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Asserting Patents to Combat Infringement via 3D Printing: It's No "Use"

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Abstract

Three-dimensional ("3D") printing technology, which enables physical objects to be "printed" as easily as words can be printed on a page, is rapidly moving from industrial settings into consumers' homes. The advent of consumer grade 3D printers fundamentally alters the traditional allocation of manufacturing infrastructure and sales activity. No longer do manufacturers need to make, sell, and ship physical products in their physical states. Rather, consumers may download digital representations of products over the Internet for printing in the comfort their own homes. For products sold in this fashion that are patented, this presents difficult hurdles to enforcement against infringers. Under existing law, the distributors of digital representations of products are not "making," "selling," or "using" the patented products or any "component" thereof. Absent proof of active inducement of infringement - i.e., at least willful blindness on the part of the distributors that their actions cause patent infringement - the distributors are not liable for the resulting infringement. While copyright law can help bridge the gap to the degree the products at issue are driven more by aesthetics than by functionality, a legislative solution appears necessary to give patentees recourse against such unauthorized distribution of their patented inventions.

KEYWORDS: Patent, Patents, 3D Printer, 3D Printing, Printer, Printing, Patent Infringement, Infringement, Copyright, Design, Patent Enforcement

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Three-dimensional ("3D") printing technology, which enables physical objects to be "printed" as easily as words can be printed on a page, is rapidly moving from industrial settings into consumers' homes. The advent of consumer-grade 3D printers fundamentally alters the traditional allocation of manufacturing infrastructure and sales activity. No longer do manufacturers need to make, sell, and ship physical products in their physical states. Rather, consumers may download digital representations of products over the Internet for printing in the comfort their own homes. For products sold in this fashion that are patented, this presents difficult hurdles to enforcement against infringers. Under existing law, the distributors of digital representations of products are not "making," "selling," or "using" the patented products or any "component" thereof. Absent proof of active inducement of

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infringement—i.e., at least willful blindness on the part of the distributors that their actions cause patent infringement—the distributors are not liable for the resulting infringement. While copyright law can help bridge the gap to the degree the products at issue are driven more by aesthetics than by functionality, a legislative solution appears necessary to give patentees recourse against such unauthorized distribution of their patented inventions.

INTRODUCTION

For centuries, objects have been designed by processes involving pencil and paper drawings or the construction of physical prototypes. Beginning in the 1980s, machines, products, and components thereof have been increasingly designed mostly—if not entirely—on computers using computer aided design ("CAD") programs.[1] CAD programs are widely used by designers, engineers, and architects today to imagine and make virtual 3D models of various objects, enabling the objects to be fully digitally developed before they are physically created.[2]

CAD programs offer many advantages over non-digital processes, such as the ability to easily change and refine a design, as well as a high degree of precision in defining all of the features and dimensions of the design.[3] While designs can certainly be created and manipulated in CAD programs from scratch, 3D scanning technology can also be used to make a CAD file that digitally captures and represents an existing object.[4] Once created, CAD files function as digital "blueprints" that can be used by manufacturers to make products to exact specifications in a factory setting.[5] Like other digital files, CAD files may be easily and

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1 *See* Michael Weinberg, *It Will Be Awesome If They Don't Screw It Up: 3D Printing, Intellectual Property, and the Fight Over the Next Great Disruptive Technology*, PUBLIC KNOWLEDGE, 1, 2–3 (Nov. 2010), http://www.publicknowledge.org/files/docs/3DPrintingPaperPublicKnowledge.pdf ("The CAD design process replaces the need to design physical prototypes out of malleable material such as clay or styrofoam.").

2 *Id.* at 2; *see also* William R. Thornewell II, *Patent Infringement Prevention and the Advancement of Technology: Application of 35 U.S.C. § 271(f) to Software and Virtual Components*, 73 FORDHAM L. REV. 2815, 2855 (2005) ("Under the current state of technology, the vast majority of the work necessary to manufacture components can be completed on computers, without actually creating a physical part. Unlike the days when parts were made by skilled artisans using hand tools, most, if not all, of the skill required to manufacture components today—either software or parts that are modeled using CAD—is employed during the computer phase. Parts can be fabricated with little effort and at remote locations.").

3 Weinberg, *supra* note 1, at 3 ("A designer uses the CAD program to create the model, which is then saved as a file. Much as a word processor is superior to a typewriter because it allows a writer to add, delete, and edit text freely, a CAD program allows a designer to manipulate a design as she sees fit.").

4 *Id.* ("Just as a flatbed scanner can create a digital file of a drawing on a piece of paper, a 3D scanner can create a digital file of a physical object.").

5 *Id.* at 2–3.

widely distributed via any digital storage medium or network, such as the Internet.[6]

Three-dimensional or "3D" printing is an emerging technology that is already having an enormous and profound impact on how products are made and sold. Just like CAD programs largely obviated the need for paper drafting and physical prototyping, 3D printing has the capability to completely bypass traditional manufacturing and distribution practices. A 3D printer essentially takes a CAD file and turns it into a physical object—"feed it a design for a wrench, and it produces a physical, working wrench."[7] Rather than starting with a block of raw material and removing, for example, all that is not a wrench, 3D printers build objects by adding small amounts of liquid or powdered material such as plastic layer by layer, from the bottom up.[8] During the layering process, heat, light, or chemicals are precisely applied to bond and strengthen the structure.[9] This layering approach enables 3D printers to construct highly intricate forms that would not be possible by simply using cutting or shaping tools on solid blocks of material.[10] Three-dimensional printers can even be used to make devices having internal moving parts, such as a functional clock or gun.[11]

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6 *Id.* at 3.

7 *Id.* at 2.

8 *Id.* at 2 ("[A] 3D printer actually builds the object up form tiny bits of material, layer by layer."); Saul Hansell, *Beam it Down from the Web, Scotty*, N.Y. TIMES (May 7, 2007), http://www.nytimes.com/2007/05/07/technology/07copy.html ("Three-dimensional printers, often called rapid prototypers, assemble objects out of an array of specks of material, just as traditional printers create images out of dots of ink or toner.").

9 Hansell, *supra* note 8 ("[Three-dimensional printers] build models in a stack of very thin layers, each created by a liquid or powdered plastic that can be hardened in small spots by precisely applied heat, light or chemicals.").

10 Weinberg, *supra* note 1, at 2 (explaining that the layering process "allows a 3D printer to create structures that would be impossible if the designer needed to find a way to insert a cutting tool into a solid block of material" and also "allows a 3D printer to form general-purpose material into a wide variety of diverse objects").

11 *Id.* ("Because they create objects by building them up layer-by-layer, 3D printers can create objects with internal, movable parts."); Jacob Aron, *First Successful Firing of a 3D-Printed Gun*, NEW SCIENTIST (July 27, 2012, 11:16 AM), http://www.newscientist.com/blogs/onepercent/2012/07/3d-printed-gun.html; Duncan Graham-Rowe, *3-D Printing for the Masses*, MIT TECHNOLOGY REVIEW (July 31, 2008), http://www.technologyreview.com/Infotech/21152/?a=f ("According to Weijmarshausen, Shapeways's use of 3-D printers takes this concept further. Objects are built in one piece

The aircraft and automotive industries have been using 3D printing for years to perform rapid prototyping, but the high cost of using this technology had kept the practice from going mainstream.[12] In July 2008, however, a company called Shapeways began providing online 3D printing services to artists, architects, designers, and hobbyists, who could submit their CAD files to be printed in just over a week and at a cost of only fifty to 150 dollars.[13] This was a big step toward bringing 3D printing technology to the masses.[14] Shapeways' website shows that it can print a virtually infinite array of objects in different materials. The following are a few impressive examples highlighted on Shapeways' website, with the CAD file shown on the left and the printed object shown on the right:

Shapeways Filigree iPhone Case[15]

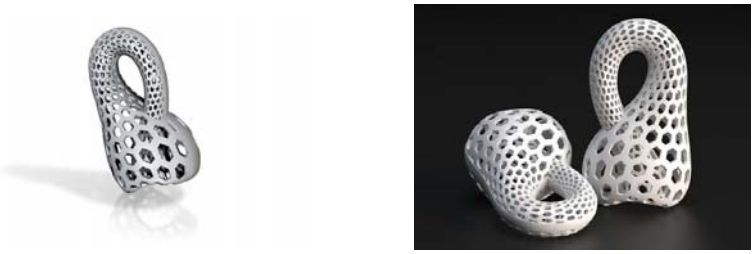
and can include moving parts. 'You can even make a working clock,' Weijmarshausen says.").

[12] Graham-Rowe, *supra* note 11 ("Rapid prototyping has been used by the aircraft and automotive industries for years, but now we're making it accessible to consumers."); Hansell, *supra* note 8 ("Three-dimensional printers have been seen in industrial design shops for about a decade. They are used to test part designs for cars, airplanes and other products before they are sent to manufacturing.").

[13] Graham-Rowe, *supra* note 11 ("Users submit their design in digital form, after which Shapeways's software checks it over to ensure that it can be made. Shapeways then passes the design to its production line of polymer printers, delivering the tangible object within 10 days of ordering, with prices typically between $50 and $150.").

[14] *Id.* ("[T]he new service, launched last week, makes this technology accessible to anyone.").

[15] *4S iPhone and CDMA iPhone Victorian Filigree Swirl*, SHAPEWAYS, http://www.shapeways.com/model/361974/iphone-4s-4-victorian-filigree-swirl-puzzle-style.html (last visited Jan. 28, 2013) (selling for fifty-five dollars in flexible plastic).



Shapeways Klein Bottle[16]

Shapeways 2-Layer Ring[17]

Some 3D printers have now come down in price to the point where they are affordable to hobbyists and general consumers. MakerBot Industries has been selling its "Thing-O-Matic" and "Replicator" 3D printers fully assembled for around $2,000, with kits for self-assembly costing around half that amount.[18]

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[16] *Klein Bottle*, SHAPEWAYS, http://www.shapeways.com/model/25918/klein_bottle.html (last visited Jan. 28, 2013) (selling for eighteen dollars and sixty-seven cents in plastic varieties or up to around eighty dollars for metal such as stainless steel, bronze, or gold).

[17] *2-Layer Twist Ring*, SHAPEWAYS, http://www.shapeways.com/model/135832/2_layer_twist_ring.html (last visited Jan. 26, 2013) (selling for forty dollars in stainless steel).

[18] Frank O'Connell, *A Machine That Gives Shape to Your Ideas*, N.Y. TIMES (Sept. 14, 2011), http://www.nytimes.com/interactive/2011/06/15/technology/personaltech/20110915-BASICS.html ("The price is $1,300 for a kit you put together yourself; a fully assembled machine costs $2,500."); *see also* Bre Pettis, *Introducing the MakerBot Replicator*, MAKERBOT (Jan. 9, 2012), http://www.makerbot.com/blog/2012/01/09/

MakerBot's Replicator Printer[19]

MakerBot's 3D printers give the ability to print products in the home "almost as easily as printing a document with an inkjet printer."[20] However, the MakerBot printers run using open source ReplicatorG software that is sufficiently CAD-like and complex that it is better suited for computer savvy hobbyists than general consumers.[21]

3D Systems, Inc., a leader in 3D printing technology for both industrial and consumer applications, offers its compact and portable "Cube" 3D printer as a strong attempt to attract more general consumers into the 3D printing fold.[22] Introduced in January 2012, the Cube includes an easy to use touch screen interface, simple "EZ Load" cartridge of printing materials,

introducing-the-makerbot-replicator; Weinberg, *supra* note 1, at 1 ("Home versions, imperfect but real, can be had for around $1,000. Every day they get better, and move closer to the mainstream."). For comparison, in 2007 it was observed that "[o]nce well over $100,000 each, such machines can now be had for $15,000," but that "[e]ven at today's prices, uses for 3-D printers are multiplying." Hansell, *supra* note 8.

19 Pettis, *supra* note 18.

20 O'Connell, *supra* note 18.

21 *See How to Print*, MAKERBOT, http://makerbot.wikidot.com/how-to-print (last visited Jan. 26, 2012); *How to Use ReplicatorG*, REPLICATORG, http://replicat.org/usage (last visited Apr. 17, 2012).

22 *See generally* 3D SYSTEMS, http://www.3dsystems.com.

aesthetically pleasing design, and immediate access to fifty free printable creations, all for $1,299.00.[23]

3D Systems' Cube Printer[24]

As pictured above, the Cube is shown along with a number of simple 3D-printed cookie cutters, but the Cube's technical capacity extends to far more complex objects. More impressive examples of the printing capabilities of the Cube include fashionable (and functional) shoes, as well as "textiles" that can be used to print 3D articles of clothing:

[23] *3D Systems Debuts First Consumer 3D Printer*, 3D SYSTEMS (Jan. 9, 2012, 8:30 AM), http://www.3dsystems.com/press-releases/3d-systems-debuts-first-consumer-3d-printer.

[24] *Cube*, CUBIFY, http://cubify.com/cube/index.aspx (last visited Jan. 28, 2012).

3D Systems' Cube-Printed Shoes[25]

3D Systems' "Mobius Textile"[26]

[25] Barry Collins, *3D Printing: Undeniably Cool, but Lacks a Killer App*, PC PRO (Jan. 12, 2012), http://www.pcpro.co.uk/blogs/2012/01/12/3d-printing-undeniably-cool-but-lacks-a-killer-app; *Freedom of Creation's Mashup Shoe*, 3D SYSTEMS BLOG (Dec. 8, 2011), http://blog.3dsystems.com/2011/12/freedom-of-creations-mashup-shoe.html. For additional examples of 3D-printed shoes from the Cube, see Chiara Atik, *Future of Fashion? 3-D Printer Produces Stylish Shoes*, LOOK ON TODAY (Apr. 6, 2012, 10:27 AM), http://thelook.today.msnbc.msn.com/_news/2012/04/06/11020541-future-of-fashion-3-d-printer-produces-stylish-shoes.

[26] *Mobius Textiles*, CUBIFY, http://3dcuboid.com/site/product_info.php?currency=EUR&cPath=3&products_id=274 (last visited Apr. 17, 2012) ("The concept of 3D printed textiles has opened a new frontier of possibilities for the production of textiles in the future. Instead of producing textiles by the meter, then cutting and sewing them together into final products, this concept has the ability to make needle and thread obsolete. This pattern is not made of rings, but mobius strips."); *see also Complex Textiles*, CUBIFY, http://cubify.com/info/tutorials/complex_textiles.aspx (last visited Jan. 26, 2012); *CNN Saturday with Randi Kaye: A 3-D Printer Created This Shoe*, CNN (Apr. 2, 2012), http://edition.cnn.com/video/#/video/tech/2012/03/31/nr-kaye-3d-printer.cnn (3D Systems' President and CEO Abe Reichental showing CNN's Randi Kaye a 3D printed textile glove); *FOC Collaborates with LCF and Within*, FREEDOM OF CREATION (June 15,

Thus, the Cube's printing capabilities already rival those of the more industrial 3D printers utilized by Shapeways, for example. For its Cube printers, 3D Systems also offers a companion Cubify online service that enables consumers to use a variety of intuitive 3D applications to design and print their own 3D products with "coloring book simplicity," circumventing the need to use complex CAD or CAD-like programs.[27] This service is also coming to mobile devices, tablets, and even Microsoft's Xbox Kinect body movement-based gaming system.[28]

While lower costs and consumer friendliness have facilitated more widespread use of 3D printing, the increasing technological capabilities have also made it more appealing. Only a few years ago 3D printing was limited to certain kinds of plastics,[29] but today 3D printers can make products out of various plastics, metals, and other materials[30]—even food-safe ceramics for dishware.[31] In February 2012, Belgian Company LayerWise announced that it had used 3D printing technology to successfully make a titanium replacement jaw for an elderly woman.[32] MakerBot's Replicator

2009), http://www.freedomofcreation.com/for/foc-collaborates-with-lcf-and-within (noting that interlocking structures made with 3D printing "could eventually have the smoothness of textiles"). For additional examples of 3D printed textiles, see *FOC Textiles in Permanent Collection at MOMA*, FREEDOM OF CREATION (Apr. 6, 2008), http://www.freedomofcreation.com/home/foc-textiles-to-permanent-collection-at-moma.

27 *3D Systems Unveils Cubify.com at CES*, 3D SYSTEMS (Jan. 5, 2012, 9:30 AM), http://www.3dsystems.com/press-releases/3d-systems-unveils-cubifycom-ces.

28 *Id.*

29 Graham-Rowe, *supra* note 11 (Objet and Stratsys, a 3D printer manufacturer, "aims to increase the range of plastic materials that can be printed, and eventually move on to metals and ceramics. But currently, these tend to require laser sintering and thus are considerably more expensive and time consuming . . . .").

30 O'Connell, *supra* note 18 ("While this machine uses plastic, other 3-D printers can create objects made of metals and other materials.").

31 Nick Bilton, *With Help from Shapeways, You Can Print Your Own Dishes*, N.Y. TIMES (May 12, 2011, 10:52 AM), http://bits.blogs.nytimes.com/2011/05/12/with-help-from-shapeways-you-can-print-your-dishes. ("Until now, 3-D printers have primarily printed in plastics or other materials that you wouldn't want to eat off of. In a release, Shapeways said it hopes customers will take advantage of the food-safe material to create 'ceramic tableware, including salt and pepper shakers, plates, mugs and more that actually can be used for eating and drinking.'").

32 Martin LaMonica, *3D Printer Produces New Jaw for Woman*, CNET (Feb. 6, 2012, 12:59 PM), http://news.cnet.com/8301-11386_3-57372095-76/3d-printer-produces-new-jaw-for-woman. Professor Dr. Jules Poukens, a member of the replacement jaw

printer, introduced in January 2012, can print a single object in two different colors, or even two different materials, at the same time.[33] 3D Systems' Cube printer can print highly accurate 3D replicas of a person's head in full color based on uploaded images of that person.[34]

As the capabilities of 3D printers continue to expand while their prices fall, companies like Shapeways will become unnecessary for providing 3D printing services to consumers. Consumers who have their own 3D printers can create or download a CAD file for the product of their choice, and with the click of a button the object can be printed. Physical products would be designed, sold, and distributed entirely on computers and over the Internet, with the end consumer printing the only physical manifestation of the product. Factories, warehouses, product transportation infrastructure, and storefronts can potentially be replaced with a directory of CAD files and a website in a number of industries.

The availability of this new and fundamentally different sales method may profoundly affect how many businesses choose to operate. Those who begin to embrace a digital distribution model early may position themselves ahead of their competitors over the next few decades. However, just like the capability for digital distribution of music and movies facilitated easy unlawful copying and downloading of those kinds of works, digital distribution of 3D objects will undoubtedly raise similar piracy challenges. Indeed, the infamous anti-copyright organization and illegal download source The Pirate Bay has already declared that digital representations of 3D objects will be the next major category of widespread consumer copying.[35]

development team, was quoted as saying that "[t]he new treatment method is a world premiere because it concerns the first patient-specific implant in replacement of the entire lower jaw." *Id*.

33 Pettis, *supra* note 18.

34 *CNN Saturday with Randi Kaye*, *supra* note 26 (3D Systems' President and CEO Abe Reichental presenting CNN's Randi Kaye with a replica of her head).

35 The Pirate Bay posted the following to its blog on January 23, 2012:

> We're always trying to foresee the future a bit here at TPB. One of the things that we really know is that we as a society will always share. Digital communication has made that a lot easier and will

Such a fundamental shift in commercial practices is also likely to shake the foundation of our patent system. The United States Constitution gives Congress the power to create a patent system, i.e., to enact legislation that "promote[s] the Progress of Science and useful Arts, by securing for limited Times to . . . Inventors the exclusive Right to their respective . . . Discoveries."[36] New technologies can raise new challenges in promoting innovation, but "[t]he nation has benefited from the adaptability of the patent system to new technologies."[37] Three-dimensional printing presents yet another instance where the patent system may need to

> continue to do so. And after the internets [sic] evolutionized data to go from analog to digital, it's time for the next step. Today most data is born digitally. It's not about the transition from analog to digital anymore. We don't talk about how to rip anything without losing quality since we make perfect 1 to 1 digital copies of things. Music, movies, books, all come from the digital sphere. But we're physical people and we need objects to touch sometimes as well!
>
> We believe that the next step in copying will be made from digital form into physical form. It will be physical objects. Or as we decided to call them: Physibles. Data objects that are able (and feasible) to become physical. We believe that things like three dimensional printers, scanners, and such are just the first step. We believe that in the nearby future you will print your spare sparts [sic] for your vehicles. You will download your sneakers within 20 years.
>
> The benefit to society is huge. No more shipping huge amount of products around the world. No more shipping the broken products back. No more child labour. We'll be able to print food for hungry people. We'll be able to share not only a recipe, but the full meal. We'll be able to *actually* copy that floppy, if we needed one.
>
> We believe that the future of sharing is about physible data. We're thinking of temporarily renaming ourselves to The Product Bay—but we had no graphical artist around to make a logo. In the future, we'll download one.

Evolution: New Category, THE PIRATE BAY (January 23, 2012), http://thepiratebay.org/blog/203.

[36] U.S. CONST. art. I, § 8, cl. 8.

[37] *In re* Schrader, 22 F.3d 290, 297 (Fed. Cir. 1994) (Newman, J., dissenting) ("The nation has benefitted from the adaptability of the patent system to new technologies, as was recognized in *Diamond v. Chakrabarty*, 447 U.S. 303, 316, 206 USPQ 193, 200, 65 L. Ed. 2d 144, 100 S. Ct. 2204 (1980) ("Mr. Justice Douglas reminded that the inventions most benefiting mankind are those which 'push back the frontiers of chemistry, physics and the like.'")"). In *Chakrabarty*, the Supreme Court interpreted 35 U.S.C. § 101 and held that a human-made microorganism useful for breaking down components of crude oil was patentable subject matter as a "manufacture" or "composition of matter" under that statute. 447 U.S. at 309–10.

adapt to avoid stifling innovation. Because a patent is nothing other than "the right to exclude others" from practicing the invention,[38] it is important that valid patents be meaningfully enforceable against infringers.[39]

This Article examines how sales transactions involving 3D printing may give rise to infringement liability for patents that cover the products being printed. Part I surveys various legal theories that could be advanced to combat 3D printing using such patents, and demonstrates that product patents are largely ineffective to ensnare infringers in an efficient manner. Part II discusses how seeking instead to protect the underlying CAD files may help to address the gap in enforceability of product patents, considering the applicability of *Beauregard* patent claims and copyright protection.

I. SURVEY OF POTENTIAL THEORIES TO COMBAT INFRINGEMENT VIA 3D PRINTING WITH PATENT RIGHTS

Patent infringement is generally defined by statute as follows:

> (a) Except as otherwise provided in this title, whoever without authority makes, uses, offers to sell, or sells any patented invention, within the United States, or imports into the United States any patented invention during the term of the patent therefor, infringes the patent.
>
> (b) Whoever actively induces infringement of a patent shall be liable as an infringer.

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38 35 U.S.C. § 154(a) (2006).

39 *Cf.* McKesson Techs. Inc. v. Epic Sys. Corp., 2011 U.S. App. LEXIS 7531 (Fed. Cir. Apr. 12, 2011) (Newman, J., dissenting) ("A patent that cannot be enforced on any theory of infringement, is not a statutory patent right. It is a cynical, and expensive, delusion to encourage innovators to develop new interactive procedures, only to find that the courts will not recognize the patent because the participants are independent entities. From the error, confusion, and unfairness of this ruling, I respectfully dissent.").

> (c) Whoever offers to sell or sells within the United States or imports into the United States a component of a patented machine, manufacture, combination, or composition, or a material or apparatus for use in practicing a patented process, constituting a material part of the invention, knowing the same to be especially made or especially adapted for use in an infringement of such patent, and not a staple article or commodity of commerce suitable for substantial noninfringing use, shall be liable as a contributory infringer.[40]

Subsection (a) defines the actions that constitute direct infringement, while subsections (b) and (c) define indirect infringement.[41] Direct infringement "has long been understood to require no more than the unauthorized use of a patented invention" by performing one of the enumerated activities under § 271(a)—making, using, selling, offering for sale, or importing the invention.[42]

Indirect infringement requires a certain state of mind, and can be thought of essentially as "aiding and abetting" direct infringement by another.[43] More specifically, active inducement of infringement under subsection (b) requires encouraging infringing activity by another with "knowledge that the induced acts constitute patent infringement,"[44] and contributory infringement under subsection (c) requires provision of material components to another for incorporation into an infringing product with knowledge "that the combination for which [the] component was especially designed was both patented and infringing."[45] Absent active inducement of infringement of *method claims* by multiple actors (which is not applicable here),[46] liability based on indirect

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40 35 U.S.C. § 271 (2006).

41 BMC Res., Inc. v. Paymentech, L.P., 498 F.3d 1373, 1378–79 (Fed. Cir. 2007).

42 Global-Tech Appliances, Inc. v. SEB S.A., 131 S. Ct. 2060, 2065 n.2 (2011).

43 *Id.* at 2067.

44 *Id.* at 2068.

45 *Id.* at 2067 (quoting Aro Mfg. Co. v. Convertible Top Replacement Co., 377 U.S. 476, 488 (1964)).

46 Akamai Techs., Inc. v. Limelight Networks, Inc., 692 F.3d 1301, 1306 (Fed. Cir. 2012) (en banc) (holding that "all the steps of a claimed method must be performed in

infringement requires a predicate finding that direct infringement occurred by a single actor's making, offering for sale, selling, or using a patented invention.[47]

In exercising their rights to exclude, patentees may seek injunctive relief, damages, or both upon a finding of infringement.[48] Where multiple parties are involved in infringing activity, it behooves patentees to target the parties most responsible for the infringement and put an end to that unauthorized activity. This is based on simple economics. If a manufacturer sells millions of directly infringing products to individual consumers, who themselves also directly infringe by using those products for their intended purposes, it is most efficient to pursue the manufacturer for the unauthorized selling of the invention rather than going after each individual customer for his or her unauthorized use. By contrast, a company may sell a single patented machine to a customer, who in turn uses that infringing machine to manufacture and sell many other products not covered by the patent. There, the majority of infringing activity is the customer's unauthorized use of the patented machine.

In the foregoing examples, both parties would be direct infringers, but the extent of one party's infringement is small by comparison, and so the economical thing to do is to target the party

order to find induced infringement, but that it is not necessary to prove that all the steps were committed by a single entity"); *see infra* note 58 and accompanying text.

47 ACCO Brands, Inc. v. ABA Locks Mfrs. Co., 501 F.3d 1307, 1314 (Fed. Cir. 2007) (quoting *Linear Tech. Corp. v. Impala Linear Corp.*, "[t]here can be no inducement or contributory infringement without an underlying act of direct infringement." 379 F.3d 1311, 1326 (Fed. Cir. 2004)); *Akamai*, 692 F.3d at 1317 ("Liability for direct infringement requires that some actor perform all of the limitations (including the steps of a process claim), either personally or vicariously."). To be clear, "[r]equiring proof that there *has been* direct infringement as a predicate for induced infringement is not the same as requiring proof that a single party would be *liable* as a direct infringer." *Id.* at 1308–09 (emphasis in original).

48 35 U.S.C. § 283 (2006) ("The several courts having jurisdiction of cases under this title may grant injunctions in accordance with the principles of equity to prevent the violation of any right secured by patent, on such terms as the court deems reasonable."); 35 U.S.C. § 284 (2006) ("Upon finding for the claimant the court shall award the claimant damages adequate to compensate for the infringement but in no event less than a reasonable royalty for the use made of the invention by the infringer, together with interest and costs as fixed by the court.").

for which the return on investment in enforcement will be the greatest—i.e., go after the big fish. This approach can maximize return not only via larger monetary recovery from the big fish,[49] but to the extent the infringer either agrees or is compelled to cease infringing activity going forward,[50] this would tend to extinguish the related infringement by the small fish. Cutting off an upstream supplier prevents further distribution to downstream customers, and preventing customers' downstream use of a machine diminishes the market for purchasing the machine in the first place. To be sure, the small fish's activity is itself actionable, since "the statute leaves no leeway to excuse infringement because the infringer only infringed a little."[51] However, it is most efficient to let the small fish go since the cost of enforcement against each individually will generally outweigh the value of any relief or recovery.[52]

While direct infringement alone offers patentees considerable flexibility for enforcement strategy, under the indirect infringement provisions of § 271(b)–(c),[53] a patentee can even enforce its rights against certain conduct (e.g., upstream commercial activity that encourages or facilitates downstream infringement) that falls short of direct infringement but is nevertheless deemed culpable and

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[49] *See* Embrex, Inc. v. Serv. Eng'g Corp., 216 F.3d 1343, 1353 (Fed. Cir. 2000) ("[T]he amount, quantum, or economic effect of wrongful conduct is central to the damages assessment.").

[50] Absent an agreement to cease infringing activity, injunctive relief is only available from the courts under certain circumstances that justify such an equitable remedy. *See* eBay Inc. v. MercExchange, L.L.C., 547 U.S. 388, 391 (2006) ("According to well-established principles of equity, a plaintiff seeking a permanent injunction must satisfy a four-factor test before a court may grant such relief. A plaintiff must demonstrate: (1) that it has suffered an irreparable injury; (2) that remedies available at law, such as monetary damages, are inadequate to compensate for that injury; (3) that, considering the balance of hardships between the plaintiff and defendant, a remedy in equity is warranted; and (4) that the public interest would not be disserved by a permanent injunction.").

[51] *Embrex*, 216 F.3d at 1353.

[52] *Cf. id.* ("[T]he statute accommodates concerns about de minimis infringement in damages calculations. . . . Although not influencing the finding of infringement itself, the amount, quantum, or economic effect of wrongful conduct is central to the damages assessment.").

[53] 35 U.S.C. § 271(b)–(c) (2006).

actionable because of the known resulting direct infringement.[54] The Supreme Court itself has noted that the essential purpose of the contributory infringement doctrine is to "provide for the protection of patent rights where enforcement against direct infringers is impracticable."[55]

Having various different activities give rise to direct infringement, as well as making liability for indirect infringement independently actionable, makes § 271 a flexible statutory scheme that enables patentees to select how they wish to most advantageously enforce their rights. Because 3D printing fundamentally alters the traditional means and allocation of manufacturing and sales activity, it is important to discern whether and how 3D printing will affect patentees' abilities to obtain economically feasible relief for patent infringement. The following sub-parts will explore various options for combating infringement via 3D printing available under the current law. These sub-parts will demonstrate that under the business model where distributors sell CAD files to consumers for printing their own products, absent proof that the distributor knows (or is willfully blind) that the products were infringing, patentees are essentially powerless to enforce their rights against such distributors.

Given the business model selected for analysis, it is expected that the inventions and patent claims implicated will be directed to the physical products as printed, and not to any method of 3D printing thereof. This is because inventors of products that are merely capable of being 3D-printed are unlikely to be in the business of 3D printing technology per se, and so are unlikely to have developed their own 3D printing systems or methods where the 3D printing technology and infrastructure already exists. Thus, for the purpose of the following sub-parts, it is assumed that the patent being asserted would include claims that cover the physical product only, and no methods for making the product or claims

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[54] *See generally* 5 DONALD S. CHISUM, CHISUM ON PATENTS § 17 (2001) (discussing contributory infringement and active inducement of infringement).

[55] Aro Mfg. Co. v. Convertible Top Replacement Co., 377 U.S. 476, 511 (1964) (quoting H.R. 5988, 80th Cong., 2d Sess. (1948); H.R. 3866, 81st Cong., 1st Sess. (1949)).

directed to an apparatus for the 3D printing of the product are included in the patent.[56]

A. Merely Printing a Patented Object Constitutes Direct Infringement Under § 271(a) by "Making" the Claimed Invention

As noted above, direct infringement is the unauthorized making, using, selling, offering for sale, or importing of the patented invention.[57] Manufacturers or consumers that print an inventory of patented products and go on to use, offer for sale, sell, or import those products plainly are direct infringers.

The mere act of printing the object, however, is also an act of direct infringement. Under § 271(a), making a patented product is a distinct act of infringement regardless of any subsequent use, sale, offer for sale, or importation.[58] While the statute does not

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[56] As noted above, the Federal Circuit's en banc decision in *Akamai* established a narrow exception, in the context of method claims, to the principle that indirect infringement liability requires direct infringement liability to exist. *Akamai*, 692 F.3d at 1306 (holding that one who induces multiple actors to perform all steps of a patented method can be liable for active inducement of infringement, even if no single actor is responsible for the performance of the entire method so as to be liable as a *direct* infringer). Direct infringement liability still can only exist where a single actor is responsible for the infringing conduct. *See id.* at 1306–07, 1317 (reaffirming *BMC Res., Inc. v. Paymentech, L.P.*, 498 F.3d 1373 (Fed. Cir. 2007) and *Muniauction, Inc. v. Thomson Corp.*, 532 F.3d 1318 (Fed. Cir. 2008) in holding that direct infringement liability requires "some actor [to] perform all of the limitations (including the steps of a process claim), either personally or vicariously").

Although vicarious liability principles are in play in the product claim context, under existing law the autonomy of the customers would appear sufficient to preclude attribution of the customers' conduct to the distributor. *See* Centillion Data Sys. v. Qwest Comms. Int'l., 631 F.3d 1279, 1287 (Fed. Cir. 2011) ("Qwest is not vicariously liable for the actions of its customers. Qwest in no way directs its customers to perform nor do its customers act as its agents. While Qwest provides software and technical assistance, it is entirely the decision of the customer whether to install and operate this software on its personal computer data processing means."); Muniauction, Inc. v. Thomson Corp., 532 F.3d 1318, 1329 (Fed. Cir. 2008) ("[M]ere arms-length cooperation will not give rise to direct infringement by any party."). Thus, the "divided infringement" scenarios at issue in *BMC* and its progeny are not relevant to the product claim analysis in this Article. In any event, as discussed below, the making of a 3D-printed product is done by a single entity—the printer.

[57] 35 U.S.C. § 271(a) (2006).

[58] *See* Sensonics, Inc. v. Aerosonic Corp., 81 F.3d 1566, 1573 (Fed. Cir. 1996) ("The patent statute grants the patentee the right to exclude others from making, using, or

define "make" or "making," the Supreme Court has stated that "[t]he right to make can scarcely be made plainer by definition, and embraces the construction of the thing invented."[59] Three-dimensional printing satisfies this broad definition of "making," since it builds an object layer by layer until completed. If the printed object is patented, it constitutes direct infringement as an unauthorized making of the invention.

Patentees can therefore meaningfully enforce patents against companies that print multiple copies of products for sale to customers, with such printing constituting direct infringement. This situation is essentially the same as any traditional manufacture and sale of products. Enforcing a patent against a mass printer of objects for sale would target the source of the infringing products, and is ideal from the patentee's perspective.

However, as discussed above, some companies will likely instead sell CAD files to allow their customers to individually print products on their own 3D printers. While the customers in that instance would be direct infringers for making the product, the customers are not the source of the infringement, and it would be economically inefficient to assert the patent against such individual infringers. It would be better from the patentee's perspective to proceed on a theory of infringement that finds the seller of the CAD files liable, but the distributors of the CAD files do not

selling the patented subject matter. 35 U.S.C. § 271. Any of these activities during the patent term is an infringement of the patent right."); *see also* CHISUM, *supra* note 54, § 16.02[3][a] (explaining the "long-standing rule that making a patented product without use or sale will constitute infringement").

[59] Bauer & Cie v. O'Donnell, 229 U.S. 1, 10 (1913). The Supreme Court revisited the meaning of "making" in *Deepsouth Packing Co v. Laitram Corp.*, in which the issue was whether the nearly complete construction of the invention in the United States, which was then exported for final assembly abroad, can be considered a directly infringing "making" of the invention. 406 U.S 518, 519, 524 (1972). The Court said no, holding that making an invention under § 271(a) requires that "the operable assembly of the whole" be constructed. *Id*. at 528. Congress subsequently added subsection (f) to § 271 to make it an infringement to export unassembled components of a patented invention to induce assembly outside the United States in a manner that would constitute infringement inside the United States. 35 U.S.C. § 271(f); *see also* CHISUM, *supra* note 54, § 16.02[3][b] (explaining the impetus and effect of subsection (f), and noting that "[t]here is no indication that Congress intended to alter the Supreme Court's construction of 'making' in *Deepsouth*, as it applies in contexts other than the exportation of unassembled components").

"make" the product.[60] The remainder of this part explores various alternative theories that might be advanced to find the CAD file distributor liable.

B. Sales of CAD Files are Not Sales of the "Patented Invention" Under § 271(a)

Perhaps the most immediate infringement theory that might come to mind for preventing CAD file distribution is the idea that sellers of CAD files are offering for sale and selling the patented invention under § 271(a).[61] While the word "sells" is not defined in the statute, the Federal Circuit has explained that "[t]he definition of sale is: 1. The transfer of property or title for a price. 2. The agreement by which such a transfer takes place."[62] The requirement under § 271(a) that the sale be of "any patented invention" implicates the particular claims of the patent, since "[i]t is a bedrock principle of patent law that the claims of a patent define the invention to which the patentee is entitled the right to exclude."[63] If a patent claims a physical product, that physical product is what must be sold or offered for sale in order to satisfy § 271(a).

As explained by the U.S. District Court for the District of Connecticut in *Ecodyne Corp. v. Croll-Reynolds Engineering Co.*, the common law traditionally reflected that "a sale . . . cannot be given of a thing which has not fully come into existence."[64] Where a contract for sale of a patented item existed, but the item was not

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[60] *See Centillion Data*, 631 F.3d at 1288 ("In order to 'make' the system under § 271(a), Qwest would need to combine all of the claim elements—this it does not do. The customer, not Qwest, completes the system by providing the 'personal computer data processing means' and installing the client software.").

[61] 35 U.S.C. § 271(a) (2006).

[62] NTP, Inc. v. Research in Motion, Ltd., 418 F.3d 1282, 1319 (Fed. Cir. 2005) (internal quotation marks omitted) ("The four elements are (1) parties competent to contract, (2) mutual assent, (3) a thing capable of being transferred, and (4) a price in money paid or promised.").

[63] Phillips v. AWH Corp., 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc) (internal quotation marks omitted) (citing Innova/Pure Water, Inc. v. Safari Water Filtration Sys., 381 F.3d 1111, 1115 (Fed. Cir. 2004)).

[64] Ecodyne Corp. v. Croll-Reynolds Eng'g Co., 491 F. Supp. 194, 197 (D. Conn. 1979) (distinguishing a contract for sale from a sale for purposes of whether a cause of action had ripened).

in fact made and delivered to the purchaser, the court explained that

> possession of the thing itself . . . is a necessary component of a "delivery," which is itself a necessary component of a sale. *When the thing in question is an apparatus and the issue is patent infringement by sale, partial delivery will not suffice; in order for there to have been a sale within the meaning of 35 U.S.C. § 271(a), the entire apparatus must have been constructed and ready for use.* Until the apparatus is constructed and ready for use, it cannot be clear whether infringement has taken place.[65]

The court explained that it would be inappropriate to deem a mere contract for sale an infringement since "the defendant may breach its contract and produce something entirely different or nothing at all," or even meet "the specifications of the contract . . . in a way which does not infringe plaintiff's patents."[66]

The Federal Circuit took a similar approach in *Lang v. Pacific Marine & Supply Co.*[67] There, the patentee filed a complaint alleging infringement by a ship hull that had not yet been fully constructed, but which was alleged to necessarily infringe if completed according to plan.[68] The Federal Circuit found there was no actual case or controversy giving rise to declaratory judgment jurisdiction—at least not yet—since § 271(a) "cannot be interpreted to cover acts other than an actual making, using or selling of the patented invention."[69] *Lang* thus requires the physical presence of the complete or "actual" patented invention to establish infringement.

Under *Ecodyne* and *Lang*, one cannot "sell" a product that does not yet physically exist in its entirety because any infringement is

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65 *Id*. (emphasis added).

66 *Id*.

67 Lang v. Pacific Marine & Supply Co., 895 F.2d 761, 765 (Fed. Cir. 1990).

68 *Id.* The accused infringer was planning to make ships in accordance with the teachings in its own patent. *Id.* at 763–64.

69 *Id.* at 765.

at that point uncertain or speculative. The sale of a CAD file for use in 3D printing would not be actionable under these cases because it is not the actual patented product being sold.

Somewhat in tension with *Lang* is the Federal Circuit's decision in *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Contractors USA, Inc.*[70] There, the accused infringer had entered into a contract to build a rig for use in offshore drilling.[71] The rig was alleged to infringe if built according to the schematics attached to the contract, but the contract also made mention of the plaintiff's patents and permitted the builder to make "alterations" as necessary "in view of court or administrative decisions . . . ."[72] Indeed, the builder did alter the rig design in the process of building it to avoid infringement based on an injunction against a third party.[73] The Federal Circuit rejected the accused infringer's argument that only the entirely constructed apparatus should be considered in order to constitute a sale, concluding that the contract to build the rig alone constituted a sale of the rig as specified in the schematics.[74] The court held that "a 'sale' is not limited to the transfer of tangible property; a sale may also be the agreement by which such a transfer takes place. In this case, there was a contract to sell a rig that included schematics."[75] Importantly, the Federal Circuit did not say that an agreement to sell schematics could alone constitute an infringing sale. Rather, the court required "a *contract to sell a rig* that included schematics."[76] In other words, the agreement must provide for

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[70] Transocean Offshore Deepwater Drilling, Inc. v. Maersk Contractors, 617 F.3d 1296, 1300 (Fed. Cir. 2010).

[71] *Transocean*, 617. F.3d at 1307.

[72] *Id*.

[73] *Id*.

[74] *Id.* at 1311. The accused infringer had relied on *Ecodyne*, discussed above, for the proposition that the entire apparatus must have been constructed and ready for use in order to be sold. *Id.* at 1310.

[75] *Id.* at 1311 (citation omitted) (citing NTP, Inc. v. Research in Motion, Ltd., 418 F.3d 1282, 1319 (Fed. Cir. 2005)). Due to the posture of the case, the ultimate disposition was not that the contract and schematic actually did establish a sale of the patented invention, but only that the patentee had raised a genuine issue of material fact sufficient to withstand summary judgment as to whether the unmodified rig shown in the schematics was infringing. *Id.* at 1311.

[76] *Id.* at 1311 (emphasis added).

"such a transfer" of a rig (i.e., "the transfer of *tangible* property") in order to be a sale under § 271(a).[77] Thus, even to the extent that *Transocean* conflicts with *Lang*,[78] *Transocean* still requires an agreement to transfer a tangible physical object. Contracts for sale of CAD drawings do not constitute an agreement to transfer any tangible property, but only an intangible digital representation of tangible property.

While an offer for sale presents a distinct basis for finding direct infringement,[79] an offer to sell CAD files for a patented product would not be an infringement for the same reasons that a sale of a CAD file is not an infringement. As explained in *Transocean*, "[t]he offer must be for a potentially infringing article," i.e., a tangible object.[80] Under these principles, selling or offering to sell a CAD file of an object cannot be deemed a sale of the patented object itself giving rise to direct infringement liability.

C. An Active Inducement Theory Under § 271(b) Can Succeed Only Against the Most Egregious Offenders

Another theory to be considered is that a distributor of CAD files for products that infringe when printed is actively inducing

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77 *Id.* (emphasis added).

78 As the earlier panel decision, *Lang* remains controlling over subsequent decisions that are in conflict with it. Newell Cos. v. Kenney Mfg. Co., 864 F.2d 757, 765 (Fed. Cir. 1988) ("This court has adopted the rule that prior decisions of a panel of the court are binding precedent on subsequent panels unless and until overturned [*en*] *banc*."); Autogenomics, Inc. v. Oxford Gene Tech. Ltd., 566 F.3d 1012, 1027 (Fed. Cir. 2009) (Newman, J., dissenting) ("[I]n the event of conflict, real or perceived, the earlier decision controls until the conflict is resolved."). In any event, the presence of a contract for sale in *Transocean* makes it distinguishable from *Lang*. In *Lang* the object being constructed was not completed such that its features were certain, whereas in *Transocean* the execution of the contract along with schematics arguably concluded the deal and solidified the features of what was to be made and delivered. *Transocean* can therefore be read as involving an "actual" sale of a rig under *Lang*. This reasoning does not distinguish *Ecodyne*, which did involve a contract for sale, but *Ecodyne*, being a district court decision, is not binding on the Federal Circuit and was permissibly rejected in *Transocean*.

79 35 U.S.C. § 271(a) (2006) (listing "offers for sale" separately from "sells"); *see also* 35 U.S.C. § 271(i) ("As used in this section, an 'offer for sale' or an 'offer to sell' by a person other than the patentee, or any designee of the patentee, is that in which the sale will occur before the expiration of the term of the patent.").

80 *Transocean*, 617 F.3d at 1309 (citing 3D Sys., Inc. v. Aarotech Labs., Inc., 160 F.3d 1373, 1379 (Fed. Cir. 1998)).

infringement. However, active inducement occurs only when one encourages another to engage in infringing activity with "knowledge that the induced acts constitute patent infringement."[81] This knowledge requirement is a significant hurdle to relief, but can at least ensnare the most egregious and deliberate infringing activity.

In *Global-Tech Appliances, Inc. v. SEB S.A.*, the Supreme Court rejected the Federal Circuit's standard that the threshold to show the requisite knowledge under § 271(b) was "deliberate indifference to a known risk" of patent infringement.[82] Instead, the Court adopted a standard of willful blindness, which consists of two basic requirements: "(1) the defendant must subjectively believe that there is a high probability that a fact [i.e., infringement] exists and (2) the defendant must take deliberate actions to avoid learning of that fact."[83] While it is not yet clear how the district courts and the Federal Circuit will apply this new standard, what is clear is that the Supreme Court intended that the threshold of proving willful blindness be higher than that for proving recklessness or negligence.[84] As the Court explained,

> Under this formulation, a willfully blind defendant is one who takes deliberate actions to avoid confirming a high probability of wrongdoing and who can almost be said to have actually known the critical facts. By contrast, a reckless defendant is one who merely knows of a substantial and unjustified risk of such wrongdoing, and a negligent

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[81] Global-Tech Appliances, Inc. v. SEB S.A., 131 S. Ct. 2060, 2068 (2011) (discussing § 271(c) before concluding that the same knowledge is needed under § 271(b)).

[82] *Id.*

[83] *Id.* at 2070. The Court later explained that

> [t]he test applied by the Federal Circuit in this case departs from the proper willful blindness standard in two important respects. First, it permits a finding of knowledge when there is merely a "known risk" that the induced acts are infringing. Second, in demanding only "deliberate indifference" to that risk, the Federal Circuit's test does not require active efforts by an inducer to avoid knowing about the infringing nature of the activities.

Id. at 2071.

[84] *Id.* at 2070 ("We think these requirements give willful blindness an appropriately limited scope that surpasses recklessness and negligence.").

> defendant is one who should have known of a similar risk but, in fact, did not . . . .[85]

Under the facts of the case, the Court concluded that the accused active inducer, Pentalpha, exhibited the requisite willful blindness.[86] Pentalpha was a Hong Kong manufacturer of home appliances that supplied deep fryers to various United States companies, and the patentee SEB alleged that Pentalpha had actively induced those companies to sell infringing products in the United States.[87] The evidence was as follows: (1) Pentalpha intentionally copied all but the cosmetic features of SEB's patented cool-touch fryer product, which Pentalpha knew was both innovative and commercially successful in the United States; (2) Pentalpha elected to copy an overseas model of SEB's fryer purchased in Hong Kong; (3) Pentalpha's CEO and President was a named inventor on several patents and was well aware that given the territorial nature of patents, foreign models are unlikely to have United States patent markings; and (4) when seeking a freedom to operate opinion from its patent attorney, Pentalpha did not inform its attorney that the product was a knockoff of an SEB fryer.[88] The Court concluded that Pentalpha's conduct reflected a concerted effort to develop plausible deniability as to its knowledge that its actions constituted patent infringement.[89]

> Taken together, this evidence was more than sufficient for a jury to find that Pentalpha subjectively believed there was a high probability that SEB's fryer was patented, that Pentalpha took deliberate steps to avoid knowing that fact, and that it therefore willfully blinded itself to the infringing nature of Sunbeam's sales.[90]

Under *Global-Tech*, any distributor of CAD files having actual knowledge or willful blindness that the file digitally represents a patented product will be found liable for active inducement of

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85 *Id.* at 2070–71 (citations omitted).
86 *Id.* at 2071.
87 *Id.* at 2063–64.
88 *Id.* at 2071.
89 *Id.*
90 *Id.* at 2072.

infringement. Proof of the requisite scienter will of course vary from case to case, but any deliberate copying, rendering, or 3D scanning of a product marked with a United States patent number should suffice. Since the resulting CAD files are distributed with the intention that they be printed, which itself constitutes a direct infringement by making the patented product, the distributor may thus be liable as an active inducer of that infringement.[91] Distributors in such situations would be the most culpable offenders under this scheme, since they knew their conduct encouraged and resulted in infringement, and it is appropriate that they be liable as such.

D. Contributory Infringement Under § 271(c) is Unlikely to Ensnare Distributors Since CAD Files are Not "Components" of a Patented Product

Another option for pursuing the distributor of CAD files is under a theory of contributory infringement. Assuming that the knowledge requirement is met,[92] contributory infringement also requires the CAD files to be a "component" of the patented product "constituting a material part of the invention."[93] This theory is not likely to be successful since the Supreme Court has taken a restrictive view of the meaning of "component."

In *Microsoft Corp. v. AT&T Corp.*,[94] the Supreme Court construed the meaning of "component" in the context of § 271(f), which makes it an infringement to export unassembled components of a patented invention to induce assembly of the invention outside the United States in a manner that would constitute infringement if within the United States.[95] In that case, AT&T's patent covered an

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91 *See supra* Part I (explaining that liability for active inducement of infringement requires an underlying act of direct infringement).

92 Aro Mfg. Co. v. Convertible Top Replacement Co., 377 U.S. 476, 488 (1964) (explaining that contributory infringers must have knowledge "that the combination for which [the] component was especially designed was both patented and infringing").

93 35 U.S.C. § 271(c) (2006).

94 550 U.S. 437 (2007).

95 35 U.S.C. § 271(f) (2006) provides:

> (1) Whoever without authority supplies or causes to be supplied in or from the United States all or a substantial portion of the components of a patented invention, where such components are

apparatus for digitally encoding and compressing recorded speech.[96] Microsoft's Windows operating system was conceded to include software code which, when installed into a computer, enables the computer to process speech within the scope of the patented apparatus.[97] Microsoft sent its software from the United States to a foreign manufacturer, either via a physical master disk or via electronic transmission, which was then copied abroad and installed onto computers made and sold abroad.[98] The question presented was whether the software sent abroad by Microsoft was a "component" of the patented invention "supplied" by Microsoft "from the United States" under § 271(f).[99]

AT&T contended that software in the abstract (i.e., the coded instructions alone, detached from a particular medium) could constitute a component of the patented invention.[100] Microsoft contended that only a physical copy of the software (i.e., the coded instructions as stored on a medium such as a CD-ROM) could be viewed as a component.[101] If software is only a component when it is a physical copy, then the master copies sent by Microsoft were

> uncombined in whole or in part, in such manner as to actively induce the combination of such components outside of the United States in a manner that would infringe the patent if such combination occurred within the United States, shall be liable as an infringer.
>
> (2) Whoever without authority supplies or causes to be supplied in or from the United States any component of a patented invention that is especially made or especially adapted for use in the invention and not a staple article or commodity of commerce suitable for substantial noninfringing use, where such component is uncombined in whole or in part, knowing that such component is so made or adapted and intending that such component will be combined outside of the United States in a manner that would infringe the patent if such combination occurred within the United States, shall be liable as an infringer.

96 *Microsoft*, 550 U.S. at 441.

97 *Id.* at 441–42. Importantly, because the patent covered an apparatus capable of performing certain functions via the software, "uninstalled Windows software does not infringe AT&T's patent any more than a computer standing alone does; instead, the patent is infringed only when a computer is loaded with Windows and is thereby rendered capable of performing as the patented speech processor." *Id.* at 442.

98 *Id.*

99 *Id.* at 441.

100 *Id.* at 447–48 ("An analogy: the notes of Beethoven's Ninth Symphony.").

101 *Id.* at 448 (providing another analogy: "Sheet music for Beethoven's Ninth").

not components under § 271(f) because those disks themselves were never copied onto computers abroad—only copies of those disks were used for the installation.[102] If, on the other hand, software in the abstract is a component, it would be immaterial that the software was loaded onto the foreign computers via copies of the master disks.[103]

The Court held that unless and until software is expressed on a computer readable medium, it is not a "component" amenable to "combination" with a computer under § 271(f).[104] The Court viewed software in the abstract as mere information and detailed instructions which "might be compared to a blueprint (or anything containing design information, e.g., a schematic, template, or prototype)," but which is not itself combinable into a device.[105] Looking at the statutory text, the Court noted that "Congress, of course, might have included within § 271(f)'s compass, for example, not only combinable 'components' of a patented invention, but also 'information, instructions, or tools from which those components readily may be generated.' It did not."[106] Microsoft was therefore found not to have infringed under § 271(f) because it did not supply from the United States any software copies that were actually installed onto computers abroad.[107]

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[102] *Id.* at 448–49.

[103] *Id.*

[104] *Id.* at 449 ("[A]ny software detached from an activating medium—remains uncombinable. It cannot be inserted into a CD-ROM drive or downloaded from the Internet; it cannot be installed or executed on a computer. Abstract software code is an idea without physical embodiment, and as such, it does not match § 271(f)'s categorization: 'components' amenable to 'combination.'").

[105] *Id.* at 449–50 ("A blueprint may contain precise instructions for the construction and combination of the components of a patented device, but it is not itself a combinable component of that device."). For this proposition, the Supreme Court cited with approval *Pellegrini v. Analog Devices, Inc.*, 375 F.3d 1113, 1117–19 (Fed. Cir. 2004), which held that transmission abroad of instructions for the production of patented computer chips was not an infringement under § 271(f). *Microsoft*, 550 U.S. at 450.

[106] *Id.* at 451.

[107] *Id.* at 456–57. To the extent this result was perceived to be an unfair "loophole" given the trivial step of simply copying a CD-ROM abroad before installation, the Court stated that "[t]he 'loophole,' in our judgment, is properly left for Congress to consider, and to close if it finds such action warranted." *Id.* at 457.

Justice Alito concurred in the result, explaining that "I agree with the Court that a component of a machine . . . must be something physical" and that "a set of instructions on how to build an infringing device, or even a template of the device, does not qualify as

Microsoft addressed the meaning of "component" in the context of § 271(f), but there is no reason that the same meaning should not apply to the same word in § 271(c).[108] A fair reading of *Microsoft* shows that the court was primarily motivated to distinguish between abstract instructions and physically combinable aspects of an invention.[109] This analysis would apply equally to the word "component" in § 271(c), particularly given the statutory construction presumption that the same words used within the same statute carry the same meaning.[110] While the presumption is rebuttable and "[c]ontext counts,"[111] both § 271(c) and § 271(f) used the word "component" in very similar ways to identify what aspects of an invention must be sold or supplied to constitute infringement.[112] If context dictated any different

a component." *Id.* at 460–61 (Alito, J., concurring). Going further than the majority opinion in his restrictive view of "component," Justice Alito believed that a portion of the disks containing the software must become physically integrated into the computer to satisfy § 271(f). *Id.* at 461–62 ("Because no physical object originating in the United States was combined with these computers, there was no violation of § 271(f). Accordingly, it is irrelevant that the Windows software was not copied onto the foreign-made computers *directly* from the master disk or from an electronic transmission that originated in the United States. To be sure, if these computers could not run Windows without inserting and keeping a CD-ROM in the appropriate drive, then the CD-ROMs might be components of the computer. But that is not the case here.").

Justice Stevens dissented, stating in his view that software should be a component under the plain meaning of the word (a constituent part, element, or ingredient) "[w]hether attached or detached from any medium." *Id.* at 464 (Stevens, J., dissenting). According to Justice Stevens, "unlike a blueprint that merely instructs a user how to do something, software actually causes infringing conduct to occur. It is more like a roller that causes a player piano to produce sound than sheet music that tells a pianist what to do." *Id.*

[108] Some might suggest that the extraterritorial effect of § 271(f) is what justified the narrow construction of "component" in *Microsoft*. The Federal Circuit has characterized *Microsoft* as a decision where "[t]he Court narrowly construed the term 'component' to exclude the 'intangible code' of an operating system because, *inter alia*, the presumption against extraterritorial application of United States law 'applies with particular force in patent law.'" TianRui Group Co. v. Int'l Trade Comm'n, 661 F.3d 1322, 1334 (Fed. Cir. 2011). Those "*inter alia*" reasons, as explained herein, also justify the same conclusion under § 271(c).

[109] *See Microsoft*, 550 U.S. at 449–52.

[110] *See* Envtl. Def. v. Duke Energy Corp., 549 U.S. 561, 574–76 (2007).

[111] *Id.* at 575–76.

[112] *Compare* 35 U.S.C. § 271(c) (2006) ("Whoever offers to sell or sells within the United States or imports into the United States a component of a patented machine, manufacture, combination, or composition . . . knowing the same to be especially made

meaning, "component" would have an even narrower meaning in § 271(c) than in § 271(f) since § 271(c) refers to a "component of a patented machine, manufacture, combination, or composition"—all physical objects—whereas § 271(f) refers more generally to a "component of a patented invention." Nevertheless, the Federal Circuit has declined to take an expansive view of "component" even in § 271(f). In *Cardiac Pacemakers, Inc. v. St. Jude Med., Inc.*, the Federal Circuit, sitting en banc, declined to read the reference to a "component" in § 271(f) as including steps of a patented method.[113]

In view of the statutory text, *Microsoft*, and *Cardiac Pacemakers*, § 271(c) compels at least the same narrow meaning of "component" as excluding mere abstract instructions. Accordingly, CAD files should not be considered "components" of subsequently printed objects and, as such, a theory of infringement by a CAD file distributor under § 271(c) is likely to fail.

E. Creating and Distributing CAD Files is Not "Using" the Patented Invention Under § 271(a)

A maker and distributor of CAD files might be also viewed as a direct infringer under the theory that these actions constitute "using" the invention under § 271(a).[114] There is no definition of

or especially adapted for use in an infringement of such patent . . . shall be liable as a contributory infringer.") *with* 35 U.S.C. § 271(f) (2006) ("Whoever without authority supplies or causes to be supplied in or from the United States any component of a patented invention . . . where such component is uncombined in whole or in part, knowing that such component is so made or adapted and intending that such component will be combined outside of the United States in a manner that would infringe the patent if such combination occurred within the United States, shall be liable as an infringer.").

[113] 576 F.3d 1348, 1364 (Fed. Cir. 2009) ("Although such patented methods do have components, as indicated, Section 271(f) further requires that those components be 'supplied.' . . . The ordinary meaning of 'supply' is to 'provide that which is required,' or 'to furnish with . . . supplies, provisions, or equipment.' These meanings imply the transfer of a physical object." (citation omitted)). While § 271(c) lacks similar "supplied" language, it specifies that the thing sold is a component of a "machine, manufacture, combination, or composition," justifying the same conclusion.

[114] Roche Prods., Inc. v. Bolar Pharm. Co., 733 F.2d 858, 861 (Fed. Cir. 1984), *superseded in part by statute*, 35 U.S.C. § 271(e), *as recognized in* Warner-Lambert Co. v. Apotex Corp., 316 F.3d 1348, 1358 (Fed. Cir. 2003) ("It is well-established, in particular, that the *use* of a patented invention, without either manufacture or sale, is actionable.").

"use" in the statute, but courts have interpreted the term broadly.[115] Use of the patented invention, even for mere personal convenience, generally constitutes infringement.[116] The Supreme Court has stated that "[t]he right to use is a comprehensive term and embraces within its meaning the right to put into service any given invention."[117] The Federal Circuit recently explained that "[t]he ordinary meaning of 'use' is to 'put into action or service.'"[118]

Because the concept of use is broad, and one can be said to "use" a patented invention in a variety of ways, "[t]he inquiry as to what constitutes a 'use' of a patented item is highly case-specific."[119] Still, "the word 'use' in section 271(a) has never been taken to its utmost possible scope," as there are limitations on what kinds of use can be deemed infringements.[120] While a person does not escape liability by using the patented product for a purpose not specifically contemplated by the patentee, the use of the product must "incorporate in some fashion the principles of the claimed invention."[121] Also, mere possession of a patented product is not an infringing use of a product absent at least some proof of "threatened or contemplated" use or sale.[122]

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115 NTP, Inc. v. Research in Motion, Ltd., 418 F.3d 1282, 1316 (Fed. Cir. 2005) ("In terms of the infringing act of 'use,' courts have interpreted the term 'use' broadly.").

116 CHISUM, *supra* note 54, § 16.03[1] ("Mere use of a patented product or process, even for purposes of personal convenience, ordinarily constitutes infringement.").

117 Bauer & Cie v. O'Donnell, 229 U.S. 1, 10–11 (1913).

118 *NTP*, 418 F.3d at 1317 (citing WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY 2523 (1993)).

119 Medical Solutions, Inc. v. C Change Surgical LLC, 541 F.3d 1136, 1141 (Fed. Cir. 2008) (citation omitted); *see also* Hughes Aircraft Co. v. United States, 29 Fed. Cl. 197, 226 (Fed. Cl. 1993) ("[T]he question of what constitutes 'use' is a mixed question of fact and law to be determined on a case-by-case basis. A device may be 'used' in many different ways, and all uses that rely on the teachings of a patent constitute infringement.").

120 Roche Prods., Inc. v. Bolar Pharm. Co., 733 F.2d 858, 861 (Fed. Cir. 1984).

121 CHISUM, *supra* note 54, § 16.02[4][c] (contrasting the use of a clothing fastener as a fastener on a pocketbook—which was deemed an infringement—with the use of a wall safe as a ship anchor—which presumably would not be an infringement).

122 CHISUM, *supra* note 54, § 16.02[4][b] (citing examples of stockpiling inventory, where possession of infringing guns in the United States "kept ready for use in case of war" constituted an infringing use, whereas goods being imported and stored in the United States prior to exportation to be sold abroad was not a use in the United States).

It has long been a defense to a claim of infringement to show that one's use of the patented invention was merely experimental—i.e., that the purpose of the use was merely to "gratify[] a philosophical taste, or curiosity, or for mere amusement."[123] This experimental use exception is "truly narrow," and cannot be extended to any testing, demonstrations, and experiments under the guise of scientific inquiry where the use has any significant commercial motivation behind it.[124] Extensions of this sentiment have led courts to conclude that using an invention in the context of a sales demonstration may constitute an infringing use,[125] while "the mere demonstration or display of an accused product, even in an obviously commercial atmosphere, is not an act of infringement for purposes of § 271(a)."[126]

In *Medical Solutions, Inc. v. C Change Surgical LLC*, the accused infringer was present at a trade show and "actively demonstrated" how to use the accused product, a device for heating and maintaining temperature for medical items such as fluids and related equipment.[127] The demonstrations "appear[ed] to fall short of practicing all of the elements of any one claim,"—for example, the demonstrations did not use the accused product with fluid in it or did not use the product to actually heat medical

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123 *Roche*, 733 F.2d at 862 (quoting Peppenhausen v. Falke, 19 F. Cas. 1048, 1049 (C.C.S.D.N.Y. 1861)).

124 *Id*. at 863 ("[T]ests, demonstrations, and experiments . . . [which] are in keeping with the legitimate business of the . . . [alleged infringer] are infringements for which experimental use is not a defense. . . . We cannot construe the experimental use rule so broadly as to allow a violation of the patent laws in the guise of scientific inquiry, when that inquiry has definite, cognizable, and not insubstantial commercial purposes." (citations and internal quotation marks omitted)); *see also* CHISUM, *supra* note 54, § 16.03[1] ("A line of authority indicates that a defendant who makes and uses a patented product or process does not infringe if the use is for purposes of research or experimentation and not for profit.").

125 *See* Mendenhall v. Cedarapids, 5 F.3d 1557, 1579 (Fed. Cir. 1993) (noting that the accused infringer "staged open houses for its customers" and "admit[ted] that at some of these events it used its mixers for demonstration purposes to make HMA" by performing the patented method).

126 Medical Solutions, Inc. v. C Change Surgical LLC, 541 F.3d 1136, 1140 (Fed. Cir. 2008) (internal quotation marks omitted). "Whether sales demonstrations or displays are 'uses' became less important after an amendment to Sections 154 and 271, which was effective January 1, 1996, added 'offer to sell' as a distinct infringing act." CHISUM, *supra* note 54, § 16.02[4][b].

127 *Medical Solutions*, 541 F.3d at 1138, 1141.

items.[128] The Federal Circuit concluded that no prima facie case was made that the patented invention was in fact used in the demonstrations, and therefore declined to decide the broader question of "whether the demonstration of a product at a trade show could ever be sufficient to establish an infringing use."[129] "That said," the court noted, "we do recognize other courts have held that demonstrations of a device are not proper evidence of 'use' because using a device means using it to perform its actual function or service, not using it as a demonstrative display."[130]

In light of the above-discussed precedent, it is clear that the making and selling of CAD files for a product, while not likely falling within the experimental use exception or constituting mere display, is also far removed from a physical product being put into service in accordance with the intended functions, as the Federal Circuit required in *Medical Solutions*. This precedent collectively suggests that the "use" theory is another avenue unlikely to prevail against CAD file distributors.[131]

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[128] *Id.* at 1141.

[129] *Id.* at 1141.

[130] *Id.* at 1141 n.4 (citing Union Asbestos & Rubber Co. v. Evans Prods. Co., 328 F.2d 949, 951 (7th Cir. 1964) and Advanced Semiconductor Materials Am., Inc. v. Applied Materials, Inc., No. 93-20853, 1995 U.S. Dist. LEXIS 22123, 1995 WL 419747, at *6 (N.D. Cal. July 10, 1995) (holding that a demonstration "hardly qualifies as using the patented process for its intended purposes").

[131] The Federal Circuit recently engaged in an expansive interpretation of "use" in *Centillion Data Sys., LLC v. Qwest Commc'ns Int'l, Inc.*, 631 F.3d. 1279 (Fed. Cir. 2011), which addressed the question of whether one of two parties on opposite sides of an electronic commerce transaction may be deemed to "use" the computers physically possessed and controlled by the other party. *Centillion* presents an interesting nuance for 3D printing because if the act of 3D printing by the consumer could somehow be attributed to the CAD file distributor, the distributor could potentially be liable as a direct infringer. However, *Centillion* fails to give such a use theory any teeth because it held that such upstream online distributors do not "use"—i.e., "put[] into service"—the customers' computers. *Id.* at 1286 ("Supplying the software for the customer to use is not the same as using the system."). In any event, even if the customer's computer is "used," the patented three-dimensional object must also be deemed "used," as discussed above. *See supra* section I.E. A broader finding of vicarious liability for the customers' actions would be necessary to find the distributors liable under *Centillion*. *See Centillion*, 631 F.3d at 1288.

F. Summary of Potential Infringement Theories

To summarize, it should be easy to prove that any printer of a patented 3D object is a direct infringer for "making" the product. However, under the likely future business model where products are distributed via CAD files to be printed by the customers, it would be highly inefficient to combat infringement in this fashion. The most egregious infringers who knowingly distribute CAD files for infringing products, or who are at least willfully blind as to the products' infringing natures, will be ensnared as active inducers of infringement. All other theories of liability discussed above are unlikely to succeed against the CAD distributors—making and selling a CAD file is not a sale of "the patented invention," the CAD file is not a "component" of the product, and the creation and distribution of the files is not a "use" of the product since it does not put the product into service.[132]

This state of the law leaves patentees virtually helpless to combat a large class of infringement of their product claims. If patent law is to continue to encourage innovation, however, Congress or the courts must eventually close this gap. Given the great weight of judicial authority precluding 3D printing infringement theories, the best solution would be a legislative one expanding the language of § 271 to account for modern commercial realities. In the meantime, patentees whose products are susceptible to 3D printing infringement would be prudent to put CAD file distributors on notice of their patents and of any alleged or likely infringement to at least plant the seed for a potential active inducement claim. This strategy only works effectively if the patentee knows the identities of the offending distributors sooner rather than later, which will not always be the case.

The following Part offers some perspectives as to other new protection and enforcement strategies that might be considered, including a shift in focus to protecting the underlying CAD files instead of the physical products.

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132 *See supra* part I, sections A–E.

II. RETHINKING HOW TO PROTECT A "PRODUCT" IN THE DIGITAL AGE

The assumption of this Article thus far has been that one would seek to combat copying of a product via patent rights, and that the patent would be one having claims directed to the product being printed. As discussed above, such claims are of limited utility under existing law because they can only be efficiently enforced against the active inducers who knowingly encourage the infringing activity.[133] However, if there were a way to secure patent claims directed to the CAD files themselves, such claims would be much more likely to be effectively enforceable since CAD distributors deal in files, not the products those files represent. As this Part discusses, while there does not appear to be a way to secure meaningful patent protection for the CAD files, copyright protection is available for both the CAD files and the 3D objects themselves, and appears to be the best option to prevent unlawful copying of the CAD files. Copyright protection, however, has its own limitations that exclude functional and utilitarian aspects of a product from protection. Thus, copyright can only close the gap to the degree that the printed products are ornamentally driven.

A. Patent Claims Directed to CAD Files are Not Feasible

Seeking patent protection for a CAD file is seeking claims that effectively cover the blueprint for a product, or a series of instructions for how to print a particular product. The law has long prohibited patents on such arrangements of "printed matter" for not satisfying the statutory definition of patent-eligible subject matter under 35 U.S.C. § 101, which encompasses "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof . . . ."[134] Essentially, the printed matter doctrine prohibits patenting mere recorded information having no necessary functional relationship to a physical structure, and which is therefore an abstract collection of information outside the scope of § 101.[135] An important exception

133 *See supra* notes 52–57 and accompanying text.

134 *See generally* CHISUM, *supra* note 54, § 1.02[4].

135 *Id.*

to the printed matter rule for software-implemented processes is the *Beauregard* claim, named for the Federal Circuit's decision in *In re Beauregard*,[136] which deemed patent-eligible "a claim to a computer readable medium (e.g., a disk, hard drive, or other data storage device) containing program instructions for a computer to perform a particular process."[137] By drafting a claim to the computer readable medium as opposed to the underlying instructions, the claim could be presented as more of a machine or manufacture and pass the § 101 hurdle.

At first glance, a *Beauregard* claim could conceivably encompass a CAD file containing the software instructions for computer-implemented printing of a 3D product. However, the Federal Circuit's recent pronouncement in *CyberSource, Inc. v. Retail Decisions, Inc.* imposed serious limitations on *Beauregard* claims that preclude this option as a viable theory. *CyberSource* held that "[r]egardless of what statutory category ('process, machine, manufacture, or composition of matter,' 35 U.S.C. § 101) a claim's language is crafted to literally invoke, we look to the underlying invention for patent-eligibility purposes."[138] On this reasoning, the Federal Circuit invalidated a claim drawn to "[a] computer readable medium containing program instructions for detecting fraud in a credit card transaction," finding that the invention was not the medium but the method for detecting fraud, which is unpatentable as an abstract idea.[139]

Abstractness has been a hot topic in patent law in the wake of the Supreme Court's decision in *Bilski v. Kappos*, which reaffirmed that § 101 prohibits the patenting of processes that are abstract ideas, but offered little guidance as to how one might determine if any given process is abstract.[140] Assuming that a set of instructions for printing a particular 3D object is not an abstract idea and is patent-eligible under § 101, the more fundamental problem with seeking to patent CAD files becomes clear: the CAD file and instructions contained therein are not the invention in this

136 53 F.3d 1583 (Fed. Cir. 1995).

137 CyberSource Corp. v. Retail Decisions, Inc., 654 F.3d 1366, 1373 (Fed. Cir. 2011).

138 *Id.* at 1374.

139 *Id.* at 1368 n.1, 1374–77.

140 130 S. Ct. 3218, 3225–31 (2010).

scenario. A patentable invention must also be novel and nonobvious under 35 U.S.C. §§ 102–103, and the CAD file itself and the instructions therein are presumably made using existing technology. A new product made in a CAD program may potentially be patentable, but the format of the CAD file itself and the method for which the file may be used to instruct a 3D printer would generally be in the prior art given the various 3D printers and services already on the market.[141] Absent a newly invented CAD file format or printing method to accompany a newly created digital product, there can be no meaningful patent protection secured for a CAD file to help combat 3D printing infringement.

B. Copyright Protection for CAD Files and 3D Products

Copyright protection is available for the broad category of subject matter known as "pictorial, graphic, and sculptural works."[142] This category encompasses sculptures and designs for useful articles, as well as mechanical drawings, blueprints, and other drawings used for the construction of objects.[143]

CAD files are essentially the same as blueprints or mechanical drawings, and satisfy the statutory requirement that such works be "fixed in any tangible medium of expression . . . from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device" since they can be digitally stored, reproduced, and communicated via computer software.[144] A 3D object represented by such a CAD file may be viewed as either a sculptural work or as a design for a "useful article," which the Copyright Act defines as "an article having an intrinsic utilitarian function that is not merely to portray the appearance of the article or to convey information."[145]

The owner of a copyright has the exclusive right to do and authorize the following activities with respect to such works: "(1)

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141 *See* 35 U.S.C. § 102 (2006) (describing the various categories of publications and activities that constitute prior art to a new patent application filing).

142 17 U.S.C. § 102(a)(5) (2006).

143 17 U.S.C. § 101 (2006); 1 MELVILLE B. NIMMER & DAVID NIMMER, NIMMER ON COPYRIGHT § 2.08[D] (2011).

144 17 U.S.C. § 102; 1 NIMMER, *supra* note 143, § 2.03[B].

145 17 U.S.C. § 101.

to reproduce the copyrighted work in copies . . . ; (2) to prepare derivative works based upon the copyrighted work; (3) to distribute copies . . . of the copyrighted work to the public . . . ."[146] One could, relying on copyright protection for a 3D object or a CAD file representation thereof, prevent unauthorized copying of those works by consumers and distributors alike, targeting whomever makes for the most efficient enforcement of the copyright. There is also some cross-protection afforded by holding the copyright to one or the other, since either would likely be considered a derivative work of the other as a mere recasting, transformation, or adaptation.[147] A CAD file distributor could thus be infringing the copyright in the CAD file by unauthorized copying and distribution, as well as infringing the copyright in the article itself by having made, copied, and distributed a derivative work of the article. In this regard, copyright law provides more flexibility than 35 U.S.C. § 271 does for patent infringement and appears better able to reach infringers who deal in CAD files as opposed to physical products.

Important limitations, however, diminish the effectiveness of copyright in preventing copying of one's product or CAD files in many cases. First, unlike patent infringement, copyright infringement requires proof of copying, and therefore coincidence, independent creation, or prior common source are all complete defenses.[148] Absent an admission of copying, the copyright holder's burden is typically satisfied by proving that the accused infringer had access to the copyrighted work and that the accused work is substantially similar to the copyrighted work.[149] Second, copyright only extends to the particular expression of ideas, not to

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146 17 U.S.C. § 106(1)–(3) (2006).

147 17 U.S.C. § 101 ("A 'derivative work' is a work based upon one or more preexisting works, such as a translation, musical arrangement, dramatization, fictionalization, motion picture version, sound recording, art reproduction, abridgment, condensation, or any other form in which a work may be recast, transformed, or adapted. A work consisting of editorial revisions, annotations, elaborations, or other modifications, which, as a whole, represent an original work of authorship, is a 'derivative work.'"); 1 NIMMER, *supra* note 143, § 3.01 (explaining that substantial copying of the prior work may constitute a derivative work).

148 4 MELVILLE B. NIMMER & DAVID NIMMER, NIMMER ON COPYRIGHT § 13.03[D] (2011).

149 *See, e.g.*, Johnson v. Gordon, 409 F.3d 12, 18 (1st Cir. 2005).

the ideas themselves.[150] Thus, an accused infringer may lawfully copy the concepts of a product or CAD file without copying the particular implementation utilized by the copyright holder. Third, as a specific extension of the idea/expression dichotomy, the scope of protection for pictorial, graphic, and sculptural works can become very narrow when utilitarian features are present because "[s]uch works shall include works of artistic craftsmanship insofar as their form but not their mechanical or utilitarian aspects are concerned . . . ."[151] Thus, copyright is likely useful protection in the context of 3D printing only to the extent that the value of a product stems from its form, not from its function. This is because ornamental features tend to be protectable as they fall more toward the expression side of the idea/expression dichotomy, and if the value of a product indeed derives from those ornamental features, the features are more likely to be copied and give rise to actionable infringement.

With regard to the 3D objects that are classified as "useful articles" rather than "sculptural works," it can be especially burdensome to prove that the design for the object "incorporates pictorial, graphic, or sculptural features that can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the article," as the Copyright Act requires.[152] This requirement has been characterized as an inquiry of "conceptual separability" determined by asking whether the design "reflects the unconstrained perspective of the artist" independent of utilitarian considerations.[153] Copyrightable designs for useful articles tend to be those that involve art being "applied" to the underlying object.[154] For example, a statuette of a dancing figure

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[150] 17 U.S.C. § 102(b) (2006) ("In no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work.").

[151] 17 U.S.C. § 101 (2006).

[152] *Id*.

[153] Brandir Int'l, Inc. v. Cascade Pac. Lumber Co., 834 F.2d 1142, 1145 (2d Cir. 1987).

[154] Daniel H. Brean, *Enough is Enough: Time to Eliminate Design Patents and Rely on More Appropriate Copyright and Trademark Protection for Product Designs*, 16 TEX. INTELL. PROP. L.J. 325, 338–42 (2008).

that formed the base of a lamp was deemed copyrightable.[155] Many objects whose forms follow their functions cannot satisfy the conceptual separability test, however, and in those instances the ability to register one's copyright in the 3D object (and therefore file an infringement suit and collect statutory damages)[156] may be hampered.[157]

Given the special hurdles to securing copyright protection in useful articles per se, it behooves the creators of such products to seek additional or alternative copyright protection in the CAD files. The threshold for registrability of CAD files appears lower due to the fact that the files are not inherently utilitarian the way that a "useful article" is. Even to the extent the CAD files include utilitarian aspects that will narrow the scope of the copyright protection, the CAD files will be original to the creators and will almost always reflect "at least some minimal degree of creativity" to obtain some copyright protection that might be enforceable.[158]

The Smithsonian institution recently undertook a massive project to digitally scan and archive its sculptural collection so that it can "lend" such objects to other institutions as high-quality 3D-printed replicas.[159] The motivation for this interest in utilizing 3D printing technology is the fact that "[t]he museum holds an

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[155] Mazer v. Stein, 347 U.S. 201, 217 (1954). Another example of a copyrightable useful article noted by the Court was that of a candlestick in the form of a woman holding an urn. *Id.* at 212 n.22.

[156] 17 U.S.C. § 411 provides that in general "no civil action for infringement of the copyright in any United States work shall be instituted until preregistration or registration of the copyright claim has been made in accordance with this title." However, a civil action may be filed if registration is applied for and refused as long as the Copyright Office is given notice so that it may become a party for purposes of the registrability issue. *Id.* Statutory damages are generally unavailable prior to the date that a copyright registration is obtained. 17 U.S.C. § 412 (2006).

[157] *See, e.g.*, *Brandir*, 834 F.2d at 1146–47 (holding that an undulating metal bike rack failed to satisfy the conceptual separability standard because "the form of the rack is influenced in significant measure by utilitarian concerns"). For further discussion on the scope and limits of copyright protection for useful articles, see Brean, *supra* note 154.

[158] Feist Publ'ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 345 (1991). The Court further explained that "[t]o be sure, the requisite level of creativity is extremely low; even a slight amount will suffice." *Id.*

[159] Alexander Pack, *The Smithsonian Utilizes Recent Strides in 3D Technology*, THE CREATORS PROJECT (Feb. 24, 2012), http://thecreatorsproject.com/blog/the-smithsonian-utilizes-recent-strides-in-3d-technology.

overwhelming 137 million pieces in their archive, but is only capable of exhibiting approximately 2% to the public at any given time."[160] The first object successfully replicated by the Smithsonian is a sculpture of Thomas Jefferson:

The Smithsonian's 3D Printed Jefferson Sculpture[161]

Three-dimensional scanning and printing of sculptural works (assuming such works are not in the public domain) is a clear example of the kind of conduct which, if unauthorized, is likely redressable by copyright law because such objects are ornamental and non-utilitarian.

Outside of the museum context, the market for copyrighted 3D-printed objects is sufficiently present that industry players are taking notice. For example, Thomas Valenty, an avid player of the tabletop *Warhammer* fantasy game, made some of his own Warhammer-style figurine designs and printed them using his MakerBot 3D printer.[162] He then posted the CAD files on a website called Thingiverse where 3D printing instructions are posted and shared among hobbyists.[163] Games Workshop, the

160 *Id.*

161 *Id.*

162 Clive Thompson, *Clive Thompson on 3-D Printing's Legal Morass*, WIRED (May 30, 2012), http://www.wired.com/design/2012/05/3-d-printing-patent-law.

163 *Id.*

maker of *Warhammer*, became aware of Valenty's designs and served Thingiverse with a takedown notice under the Digital Millennium Copyright Act ("DMCA"), asserting that Valenty's designs infringed Games Workshop's copyrights, and the files were promptly removed.[164] It is unclear whether the designs actually infringed since Valenty allegedly copied only the "style" of Warhammer figurines, not any particular figurines.[165] In any event, what is clear is that some companies like Games Workshop are already involved in policing their intellectual property rights in the 3D printing arena.

Moreover, Valenty's story reveals another aspect of copyright law that can make it more suitable to prevent 3D printing infringement than patent law. The DMCA's notice and takedown provisions enable copyright holders to effectively stop distribution of infringing works by online service providers ("OSPs") such as Thingiverse, where the OSPs did not themselves create the infringing files and may not even be aware of the contents of the files they distribute.[166] Upon proper notification by the copyright holder, OSPs that remove infringing files are not themselves liable for infringement as long as the distribution was conducted in a passive manner and without knowledge that the distributed files were infringing.[167] This "safe harbor" provision gives the OSPs a strong incentive to comply with bona fide takedown notices.

Much like the requirements for active inducement of patent infringement, relief against third parties that facilitate copyright infringement (but do not directly infringe) is generally not available without proof of intent to cause copyright infringement.[168] Under the DMCA, however, infringing distribution by OSPs can be effectively extinguished without any

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164 *Id.*

165 *Id.* Valenty's figurines may well have been better characterized as non-infringing original works inspired by Warhammer pieces than as infringing copies or derivative works of Warhammer pieces.

166 *See* 17 U.S.C. § 512 (2006).

167 *Id.*

168 *See* Metro-Goldwyn-Mayer Studios Inc. v. Grokster, Ltd., 545 U.S. 913, 919 (2005) ("[O]ne who distributes a device with the object of promoting its use to infringe copyright, as shown by clear expression or other affirmative steps taken to foster infringement, is liable for the resulting acts of infringement by third parties.").

need for proof of culpable intent, making the DMCA a powerful tool for copyright holders whose 3D products are being infringed via OSPs.

CONCLUSION

Patent infringement law in its current form is unprepared for the fundamental shift in physical product sales and distribution that will likely occur as 3D printing by consumers becomes more widespread. Those concerned about 3D printing activities infringing their patents would be prudent to take active steps that place any CAD file distributors on notice of the patents and the alleged or likely infringement. This will help to strengthen a possible claim for active inducement of infringement, which is by far the most likely theory for successfully enforcing patent rights in this context under existing law.

The first industries affected by 3D printing infringement are likely to be those who deal in consumer goods such as toys, décor, jewelry, tools, utensils, replacement parts, and simple machines with few moving parts. This is because today's consumer-grade 3D printers have more limited printing capabilities in terms of materials and processes than their industrial counterparts. That gap is quickly closing as the technology advances, however, and the industries whose products can be printed by consumers will surely increase proportionally.

It is in some ways fortunate that the state of 3D printing technology is what it is right now, since many of the industries most likely to first be affected by the gap in patent enforcement law are those whose protectable products are likely to be more aesthetically driven than functionally driven. These industries better lend themselves to relying on copyright protection over patent protection since the technological simplicity and/or lack of novelty of such products may render them ineligible subject matter for a utility patent anyway.[169] Even though copyright law imposes

[169] *See* 35 U.S.C. §§ 102, 103 (2006) (providing that an invention must be both novel and nonobvious to be patentable). Aesthetically driven products may also be covered by a design patent, which is a distinct form of intellectual property from a utility patent. *See* 35 U.S.C. § 171 (2006) ("Whoever invents any new, original and ornamental design for

severe limits on the scope of protection when utilitarian features are present, it will in some cases provide at least minimal protection against blatant copying of the objects or the CAD files.

In 2007, Cornell Professor Hod Lipson noted that he could easily imagine consumers routinely printing items like toothbrushes, forks, and shoes.[170] Even at that early date, however, researchers were already "developing ways to build parts with more complex functions. They [had] preliminary designs for batteries, sensors, and parts that can bend when electricity is applied."[171] According to Professor Lipson, "milestone for us would be to print a robot that would get up and walk out of the printer. Batteries included."[172] At the rate 3D printing technology has been developing, this milestone may not be much further into the future. Hopefully, by that time patent law will be capable of effectively combating 3D printing infringement.

an article of manufacture may obtain a patent therefor . . . ."). In fact, design patents are generally easier to secure than copyright registrations for designs for useful articles, particularly for the many instances where the design involves form being influenced by function, as opposed to art that is "applied" to an article. *See generally* Brean, *supra* note 154, at 336–42 (explaining the differences between eligible subject matter for design patents versus copyright). As discussed *supra* in the text accompnaying notes 152–57, copyright law wholly excludes any design that is not "conceptually separable" from the underlying object. There are functionality restrictions that apply to design patents as well, but the design patent functionality doctrine is more forgiving than that of copyright in that the presence of both functional and ornamental aspects will not invalidate the patent entirely but will only limit its scope to exclude the functional elements. *Richardson v. Stanley Works, Inc.*, 597 F.3d 1288, 1293–94 (Fed. Cir. 2010) ("[A] design patent, unlike a utility patent, limits protection to the ornamental design of the article. If the patented design is primarily functional rather than ornamental, the patent is invalid. However, when the design also contains ornamental aspects, it is entitled to a design patent whose scope is limited to those aspects alone and does not extend to any functional elements of the claimed article." (citations omitted). Design patents are no better suited for enforcement in the 3D printing context than utility patents, though, since 35 U.S.C. § 271 does not distinguish between the two types of patents in defining what constitutes infringement. *See* 35 U.S.C. § 271 (2006); 35 U.S.C. § 171 ("The provisions of this title relating to patents for inventions shall apply to patents for designs, except as otherwise provided."). It is the fundamentally different infringement framework of copyright law that makes it proper for independent consideration as a means to prevent infringement via 3D printing.

[170] Hansell, *supra* note 8.

[171] *Id.*

[172] *Id.*