A science-fiction world transforming to reality: Is the current legal scheme of the U.S Patent Law adequate to regulate the infringement actions of Three-Dimensional Printing and protect the patent owner and his legally secured inventions?

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Table of Contents

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Chapter 1 – Introduction

The field of Three-Dimensional printing ("3D Printing"), though it is not to be considered as a new discovery as such, extends the notion of innovation in today's era, day by day. The capabilities that are being provided to the users of such technology can be perceived by many as overwhelming and even intimidating. 3D Printing has proved to be a tool used in various fields such as the medical and bio-technology field, the fashion and design industry, the agro-food industry,[1] even the astronomical field and many more. Considering the above, the most important question that may occur to the readers mind is: How can 3D Printing impact our everyday lives? The relevancy of 3D Printing lies to the fact that the action itself can transform the way that people acquire goods in ever-increasing amounts.[2] As Jeremy Rifkin indicated in his renowned work "The Third Industrial Revolution", [3] 3D Printing among other technologies, can be considered as the third industrial revolution, due to its capability of disrupting the existing economic systems on a global scale.

As it was mentioned above, 3D Printing can be used in different areas of either mass production or merely for the personal enjoyment of an individual. This disruptive technology has introduced plenty of innovative creations, some of which are worth mentioning briefly. A concrete illustration would be, a Chinese company which is currently 3D Printing ten full-sized detached, single-story houses per day.[4] It would be prudent to consider the concerns that a 3D Printed house raises, regarding the habitability and the fulfilment of prerequisites of a stable construction. A construction company named "Project Milestone", in the Netherlands, is the first one in the world to have habitable homes made by a "3D printer" building layer upon layer to create the cement walls of those houses.[5]

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[1] Elsa Malaty and Guilda Rostama, '3D printing and IP law' (WIPO magazine, February) <http://www.wipo.int/wipo_magazine/en/2017/01/article_0006.html> accessed 30 October 2018

[2] Richard D'Aveni, 'The 3-D Printing Revolution' (Harvard Business Review, 2015) <https://hbr.org/2015/05/the-3-d-printing-revolution> accessed 30 October 2018

[3] Rifkin Jeremy, *Third Industrial Revolution* (Palgrave Macmillan 2011)

[4] 'China: Firm 3D prints 10 full-sized houses in a day' BBC News (25 April 2014) <https://www.bbc.com/news/blogs-news-from-elsewhere-27156775> accessed 30 October 2018

[5] Daniel Boffey, 'Netherlands to build world's first habitable 3D printed houses' (6 June 2018 Brussels) The Guardian <https://www.theguardian.com/artanddesign/2018/jun/06/netherlands-to-build-worlds-first-habitable-3d-printed-houses> accessed on 30 October 2018; *"Another example in the construction aspect of the 3D Printing technology is the world's first 3D Printed bridge for cyclists made in the Netherlands."* Agence France-Presse 'World's first 3D-printed bridge opens to cyclists in Netherlands' (18 October 2017) The Guardian <https://www.theguardian.com/technology/2017/oct/18/world-first-3d-printed-bridge-cyclists-netherlands> accessed on 30 October 2018; *"Broken car parts are being replaced with new 3D Printed ones*

The innovation of 3D Printing is not limited however to consumer goods. The technology currently exists to print seemingly unimaginable things in the medical field, which include prosthetic devices and artificial human organs, a technique known as bio-Printing. 3D Printing human organs, [6] has received more and more attention the last years, due to its incredible potential of changing traditional medicine as we know it.

However, the medical field is certainly not the only sector that is deeply involved in 3D Printing. Companies are already engaged with several activities in order to elevate and expand their production. Specifically, a variety of different objects and in general goods have been developed in the field. Some of those objects may seem simpler than others, such as dental devises, home appliance components, or common consumer electronics, but among the more complex innovations there are 3D Printed jet engines, objects created specifically for aerospace and defence, unmanned aerial vehicles, lenses for light-emitting diodes, LEDs and many other.[7][8] [9] From these examples, it can only be assumed that as the technology itself progresses, more and more companies will follow this approach to production, especially as the variety of the different substances' increases, from the "standard plastic and photosensitive materials to new thermoplastic syntheses infused with carbon nanotubes and fibres"[10].

Like any great innovation, 3D Printing presents hidden dangers and may be subject to plenty of misuses. One of the most distinct and commonly used examples in this case, is that

without the complexity and additional costs of delivery between the car manufacturers and the engineers." Joris Peels, 'Tyr3D Printing Replacement CAR Parts in the Backside of Irelands' (14 September 2017) <https://3dprint.com/187735/tyr3d-replacement-car-parts/> accessed 30 October 2018; *"However, the industry did not hold back solely to car parts but is also experimenting with strong enough materials that can be used in the making of whole cars."* Amandine Richardot, '3D printed car: The future of the automotive industry' (*Sculpteo*, 27 December 2017) <https://www.sculpteo.com/blog/2017/12/27/3d-printed-car-the-future-of-the-automotive-industry/> accessed 30 October 2018

[6] Tabrez Y. Ebrahim, '3D Bioprinting Patentable Subject Matter Boundaries' (2017-2018) 41 Seattle U. L. Rev. 1 <https://heinonline.org/HOL/LandingPage?handle=hein.journals/sealr41&div=4&id=&page=> accessed 30 October 2018

[7] Ibid. Note 2

[8] Olivia Solon, 'It's about expanding Earth': could we build cities in space?' (21 April 2018) The Guardian <https://www.theguardian.com/science/2018/apr/21/expanding-earth-could-we-build-cities-in-space> accessed 30 October 2018 *"The start-up company also plans to develop "space-enabled materials", which can only be produced in microgravity, but they are also needed in Earth and the production machine would be none other than a classical but 'zero gravity and space-approved' 3D Printer."*

[9] D.E Smalley and others 'A photophoretic-trap volumetric display' "a paper was published in the international journal of science describing the first creation of a 'free-space volumetric display', "capable of reproducing full-colour graphics floating in the air, visible from all angles". (Nature International Journal of Science (24 January 2018) <https://www.nature.com/articles/nature25176> accessed 30 October 2018

[10] Ibid. Note 2.

of fully 3D printed guns and gun parts[11]. In a specific case, a person named Cody Wilson uploaded certain blueprints of a 3D printable pistol to his website, which later on the U.S. State Department demanded to remove immediately from the website. Cody Wilson was 'simply' accused of exporting weapons[12] without a governmental license, but the element of 'uploading' the digital version of a weapon on the internet was missing entirely and was never considered by the Court.[13] In the above case, Wilson succeeded in blurring the lines between a digital file of a gun and an actual gun.

3D Printing has existed for a respectable amount of time, however, there are issues that have not yet reached the courts as such. Nevertheless, a good amount of U.S case studies will be mentioned during the analysis in every matter that is considered correct for each subject on the study. Since the greatest amount of material on 3D Printing regarding legislation and literature was found within the U.S jurisdiction, this thesis will soundly focus on the U.S patent legal scheme. 3D Printing can be considered as originated from the U.S not only for the technological advancement itself but also regarding the different legal effects it had to the Patent Owners. It is an indisputable fact that 3D Printing patent applications have increased dramatically in the past decade. [14]

[11] Andy Greenberg, 'A LANDMARK LEGAL SHIFT OPENS PANDORA'S BOX FOR DIY GUNS' (Backchannel, WIRED 10 July 2018) <https://www.wired.com/story/a-landmark-legal-shift-opens-pandoras-box-for-diy-guns/?mbid=social_linkedin> accessed 30 October 2018

[12] International Trade in Arms Regulation (ITAR), Office of Defence Trade Controls, Bureau of Political Military Affairs, U.S. Department of State <https://www.pmddtc.state.gov/compliance/consent_agreements/pdf/SpaceSystemsLoral_DraftChargingLetter.pdf?id=ddtc_kb_article_page&sys_id=%2024d528fddbfc930044f9ff621f961987> accessed 30 October 2018

[13] "One of the most interesting points of Wilsons argumentation was that "the State Department by forbidding [him] from posting his 3D printable data, they were not only violating his rights to bear arms but his right to freely share information. (DOJ, Second Amendment Foundation Reach Settlement in Defence Distributed Lawsuit, (10 July 2018) <http://joshblackman.com/blog/2018/07/10/doj-second-amendment-foundation-reach-settlement-in-defense-distributed-lawsuit/> accessed 30 October 2018). Wilson and his organization are now developing and selling to the everyday-firearm-interested consumer-based market, a computer-controlled milling machine known as "the Ghost Runner" (Ibid. Note 13). *"This specific machine is capable, and it can provide to its owner the opportunity to produce firearm-specific parts, out of a sturdier and more enduring aluminium material."*

[14] Xin, Liu; Xiang, Yu – Potential Challenges of 3D Printing Technology on Patent Enforcement and Considerations for Countermeasures in China, p. 156, Journal of Intellectual Property Rights (2015), Volume 20, <http://nopr.niscair.res.in/bitstream/123456789/31587/1/JIPR%2020%283%29%20155-163.pdf> accessed 30 October 2018 "*for more than ten years have been experiencing an enormous rise from the year of 2003 with the astonishing amount of more than a hundred and fifty (150) applications each year." […] "A closer inspection on the suits reveals that most of them are about 3D printing devices and processes, others on peripheral technologies like software recognition, digital control and device components".*

3D Printing can present challenges in various areas. The one that is going to be analysed in this thesis is the area of intellectual property,[15] specifically patent law. It is a particularly problematic issue, that a 3D printed object could possibly be considered as an infringement on a wide range of intellectual property sub-categories such as copyright, patent law, trademark and design protection.[16] One of the most prominent issues in this area is the fact, that in order to create a 3D printed object, the printer must have specific instructions on how to actually print the object.[17] These instructions come in a digital form with plenty of different kind of formats. For the purposes of this paper we will refer to these as computer-aided design ("CAD") files.[18] A CAD file can be created in mainly two different ways. The first one is by scanning a 3D object, and the second one is by being newly designed in a digital platform by users with a help of specific software,[19] which will then be the template for the printing process to follow. So, the actions following a CAD file such as its creation, its distribution as well as its selling or offer to sell, could also be found under the umbrella of infringement of rights of the rightsholders for a specific patent, as it will be further analysed.

Another issue to be considered, is the interested parties that might depend on protection provided by patent law to protect their rights. On one side of the spectrum, there are the Patent Owners who want to protect their creations against possible violations. On the other side, users and common individuals (e.g. CAD File Holders), that make and sell or offering to sell CAD

[15] Lucas S. Osborn, 'Intellectual Property's Digital Future', (RESEARCH HANDBOOK ON DIGITAL TRANSFORMATIONS, manuscript at1, F. Xavier Olleros & Majlinda Zhegu eds., forthcoming 2016), <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2348894> 'accessed 30 October 2018; Lucas S. Osborn, 'Regulating Three-Dimensional Printing: The Converging Worlds of Bits and Atoms ' [2014]51(553) SAN DIEGO LAW
REVIEW <https://scholarship.law.campbell.edu/cgi/viewcontent.cgi?referer=https://www.google.nl/&httpsredir=1&article=1096&context=fac_sw/> accessed 30 October 2018

[16]Michael Rimock, 'An Introduction to the Intellectual Property Law Implications of 3D Printing' [2015] 13(1) Canadian Journal of Law and Technology <https://ojs.library.dal.ca/CJLT/article/viewFile/6772/5931> accessed 30 October 2018

[17] Peter Jensen-haxel, 'Comment 3D Printers, Obsolete Firearm Supply Controls, and the Right to Build Self-Defense Weapons Under Heller' [2012] 42(3) Golden Gate University Law Review <https://digitalcommons.law.ggu.edu/ggulrev/vol42/iss3/6/> accessed 30 October 2018

[18] Dibya Chakravorty, 'All you need to know about 3D file formats 8 Most Common 3D File Formats of 2018' (All3DP, 22 June 2018) <https://all3dp.com/3d-file-format-3d-files-3d-printer-3d-cad-vrml-stl-obj/> accessed 30 October 2018

[19]Robin P.G. tech and others, 'Blockchain technology and open source sensor networks' [2016] Interdisziplinäre Konferenz zur Zukunft der Wertschöpfung <http://www.openproduction.info/wp-content/uploads/2016/12/161205_Konferenzband_Zukunft-der-Wertsch%C3%B6pfung_2016_digital.pdf> accessed 30 October 2018; Constantin Blanke-roeser, '3D printing as a challenge for patent law in Europe Legal and practical limits, and practical chances for rights holders' [2016] Interdisziplinäre Konferenz zur Zukunft der Wertschöpfung <http://www.openproduction.info/wp-content/uploads/2016/12/161205_Konferenzband_Zukunft-der-Wertsch%C3%B6pfung_2016_digital.pdf> accessed 30 October 2018

files which are based on patent claims, on certain platforms to other end-users. This will include all kinds of rights taking place in one single creation which could possibly lead to a patent infringement. Another party that will be briefly mentioned is the possible 3D Printing Businesses that 3D print on demand objects that are provided by other individuals. However, this analysis would be construed under the face of protection of rights of the Patent Owner.

Summarizing the above mentioned, the creation, use and further distribution of a CAD file which is based on a patent, can be perceived as a way of circumventing the original patent claim, thus downgrading its economic and substantial value. The CAD file has a value, just because there is a patented creation of its actual object, so the seller of this is claiming its economic value without the owner's permission.[20] This is an issue that will be further analysed in this thesis.

1.1 Methodology

The following analysis will evaluate the aspects of protection that the Patent Owner might seek for his inventions through Direct and Indirect Infringement in the light of use of a CAD file and thus the 3D Printing technology. More specifically the thesis will focus on the actions of a "CAD File Holder" (e.g. the individual that illegally appropriates a CAD file which is based on a patent claim) in relation to the legal results that those actions might have to the "Patent Owner" (e.g. the individual that legally owns the patent claims of the invention). Further, it will be evaluated whether Article 35 U.S.C. §271 of the U.S Patent Act is considered adequate to cover the technology of a CAD file that governs the process of 3D Printing, while protecting the rights of the Patent Owner.

In the following second chapter of this thesis, an analysis will take place, concerning the technological aspects of the 3D Printing and mainly CAD technology but also the current U.S legal basis in which a Patent Owner can raise their possible infringement lawsuit against an infringing actor, in most cases the CAD File Holder.

Throughout the third chapter, the focus will be shifted on the elements in which a party by using, selling, offering to sell or making a CAD file can be perceived as a direct infringer

[20] Timothy R. Holbrook, 'Liability for the 'Threat of a Sale': Assessing Patent Infringement for Offering to Sell an Invention and Implications for the On-Sale Patentability Bar and Other Forms of Infringement' [2003] 43(753) Santa Clara Law Review <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1686783> accessed 30 October 2018

under 35U.S.C. §271(a). A more extensive analysis will take place on whether a CAD file should be perceived by the legislation and litigation procedures as tangible or intangible, in order to adhere to the statute of law and serve the legal interests of the Patent Owner. Furthermore, it will be questioned whether a CAD file itself can constitute a Patentable Subject Matter with the purpose of protecting the patent claims of the Patent Owner from possible infringers. Lastly, a brief mention will take place concerning the actions of 3D Printing Businesses that appropriating CAD files as service providers to certain individuals in the role of customers.

In the fourth chapter, an analysis will be construed on how a Patent Owner might consider a different approach than the section discussed in the previous chapter of Direct Infringement. Hence, a thorough analysis is done, around Indirect Infringement and its sub-categories of Active Inducement of Infringement and Contributory Infringement, under 35U.S.C. §271(b) and (c).

In the very last chapter, a summary of all the above critical views will be presented, along with certain measures that have been taken or can be established in the future in order to tackle the above issues mentioned throughout the thesis.

Chapter 2 -Three-Dimensional Printing and the US patent law system

2.1 The "Replicator" from the Star Trek series as an early 3D printer prototype?

A lot of different mentions in the sci-fi literature have been presented over the years demonstrating unique kinds of technologies somewhat comparable to the 3D printer as it is known in the current world. One of the most relevant examples, is the "Replicator"˙ a term first used in the *Star Trek series: The Next Generation.*[21] In an attempt to explain the specific fictional creation, the machine could be used to replicate certain foods by reconstituting matter and produce -whatever the person that was using it- needed, out of pure energy. However, as might be expected, it is clear enough that, for the very first part of the 21st century, technology yet hasn't reached such an advanced level in a way that it would be possible to 3D Print objects,

[21] Episode: TNG165-SinsoftheFather Star trek: the next generation, 'Replicator' (*STAR TREK*, -) <http://www.startrek.com/database_article/replicator> accessed 30 October 2018

consumables and different artefacts by 'simply' reconstituting matter using pure energy. In the non-science-fiction world, similar products have been created that constitute a comparable machine to the "Replicator". [22] [23] [24]

2.2 The technology behind 3D Printing

Most of the personal, consumer-based 3D Printers originated from the RepRap project.[25] In this project Adrian Bowyer launched an open source program to develop a 3D Printer which can reproduce itself, an event that had an immense influence on the evolution of reasonably economical consumer-based 3D Printers.

It is important at this stage of the thesis to examine a little further the technical background of 3D Printing itself, in order to have a concrete image of the type of the technology and thus further understand in what ways can this be considered connected with intellectual property law and specifically with the U.S patent system.

So, what exactly is 3D Printing? 3D Printing or alternatively called Rapid Manufacturing, Rapid Modelling Technology, or Additive Manufacturing technology,[26] is a process of producing three dimensional solid objects from a digital file (CAD file), or a scanned

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[22] Alex Hudson, 'Nestle plans to create 'Star Trek-like food replicator'' (BBCcouk, 24 June 2014) <http://www.bbc.co.uk/newsbeat/article/27996163/nestle-plans-to-create-star-trek-like-food-replicator> accessed 30 October 2018 *"An analogous example in real life would be, a technology researched by the company 'Nestlé' with the purpose of producing personal customized food to a person's nutritional needs and preferences via a 3D Printer."*;

[23] Hayley Dunning, 'Experiments underway to turn light into matter' (Imperial News, Imperial College London, 19 March 2018) <https://www.imperial.ac.uk/news/185368/experiments-underway-turn-light-into-matter/> accessed 30 October 2018 "Another distinctive example, would be a discovery from certain physicists of the Imperial College of London, on a way to create matter from light. *This would be a pure interpretation of Einstein's equation $E=mc^2$ which explains "how much energy is produced when matter is turned to energy". The relevant tested discovery from the physicists of Imperial College of London proves this exact theory but reversed, "turning photon energy into mass (i.e. $m=E/c^{2)"}$, an idea that was not applicable until very recently."*

[24] 3D Printing: Food in Space' (NASA, 23 May 2013) <https://www.nasa.gov/directorates/spacetech/home/feature_3d_food.html> accessed 30 October; Form B – Proposal Summary <https://sbir.gsfc.nasa.gov/SBIR/abstracts/12/sbir/phase1/SBIR-12-1-H12.04-9357.html?solicitationId=SBIR_12_P1,%20https://www.nasa.gov/directorates/spacetech/home/feature_3d_food.html> accessed 30 October 2018 "*Last but certainly not least, another comparable to the 'Replicator' idea, is a specific machine that was funded by NASA and was intended for developing of long-spaceflight food that was produced via a 3D printer and it was specifically made for the very distinct needs of an astronaut."*

[25] Stefan Bechtold, '3D printing and the intellectual property system'[2015] (28) Economic Research Working Paper <http://www.wipo.int/edocs/pubdocs/en/wipo_pub_econstat_wp_28.pdf> accessed 30 October 2018; Adrian Bowyer, 'RepRap' (*Repraporg*, 28 May 2018) <https://reprap.org/wiki/RepRap> accessed 4 August 2018

[26] MMM Sarcar and others, 'Computer Aided Design and Manufacturing' (1st edn, PHI Learning 2008)

object that eventually transforms this item in a digital file itself, by using specific materials. These substances, are applied to a platform layer by layer until they constitute a form and can be identified as a solid object.[27] This technology was originally used for the purpose of rapid prototyping.[28]

As mentioned previously, in order to create a 3D printed object, it is essential that the 3D Printer has specific instructions on how to proceed with the process of printing.[29] Those specific guidelines[30] that indicate to the printer what it needs to be printed come in different types of digital formats,[31] all under the generic name of a Computer Aided Design file, in-short, CAD.[32]

The impact of this digitization processes over the last century had an immediate effect not only in music, but the entertainment industry as a whole. With pronounced examples found on the infamous cases of Napster[33], Grokster[34] and the BitTorrent series of lawsuits[35]. This phenomenon can also be seen in the 3D digitization process where different types of online platforms are hosting CAD files, ready to be purchased with any currency and downloaded giving the possibility to the end-users, following the fact that they owns a 3D printer, to print a ready-to-go item without any issues˙ It is essential to examine whether this action can be considered as issue-free, from the perspective of the Patent Owner.

Although, each single area of intellectual property law is considered important to the 3D Printing technology and creations, this thesis will focus on issues of possible patent infringements in the light of the current U.S patent law, that might arise from the actions that follow the use of a CAD file.

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[27]JA Zukas and V. Zukas, 'An Introduction to 3D Printing' (1st edn, Design Publishing Inc, Sarasota FL (USA) (2015)

[28] Marc Mimler, '3D printing, the Internet and Patent Law – A History repeating?' (edn, Rivista di Diritto Industriale 2013) <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2482551> accessed 30 October 2018

[29] Ibid. Note 18

[30] 'What is 3D Printing?' (*3DPrintingcom*,) <https://3dprinting.com/what-is-3d-printing/> accessed 30 October 2018

[31] *such as: STL, OBJ, FBX, COLLADA etc.*

[32] Ibid. Note 25

[33] Case Study: A&M Records, Inc. V. Napster, Inc. August, Washington University Law, 01, 2013, <https://onlinelaw.wustl.edu/blog/case-study-am-records-inc-v-napster-inc/> accessed 30 October 2018

[34] Metro–Goldwyn-Mayer Studios Inc. V. Grokster, LTD, Legal Information Institute, Cornell University Law School, <https://www.law.cornell.edu/supct/html/04-480.ZO.html> accessed 30 October 2018

[35] Sean B. Karunaratne, 'The Case against Combating BitTorrent Piracy through Mass John Doe Copyright Infringement Lawsuits' [2012] 111(2) Michigan Law Review <https://repository.law.umich.edu/cgi/viewcontent.cgi?article=1094&context=mlr> accessed 30 October 2018

2.3 Legal basis of the CAD Technology and 3D Printing

Regulating technology is becoming extremely difficult, not only due to the requirements of neutrality in the text of a regulation or a provision of law in order to cover every new technology, but also for the considerable time frame that a text of law needs to be developed and come into force.

Under the U.S Constitution, the Congress is given the power to grant among copyrights, patent rights as well.[36] The Protection of Patent Owners under possible infringement claims in the U.S is also governed by the Patent Act (35 U.S. Code),[37] where an explicit distinction between the different types of infringements is covered. As it will be made clear in the analysis of the following chapter, a lot of different patent infringement issues arise for the purposes of those distinctions, but also between the CAD Technology itself and the 3D Printers separately.

It is considered necessary, in order to make the whole analysis more specific, that the information development will take place only from the perspective of patent infringements and no further analysis will be held on enforcement rights. Thus, it is expected that a broad understanding of the basic Patent Law Rights and the scope of patent protection are required in order to further proceed with the reading and the critical analysis of this thesis.

What 3D Printing has made utterly certain, is how much easier it is for a consumer to produce a copy of an already patented product. According to U.S Law this action will result to an infringement of this specific patent,[38] only if, the production of the copy is correlated with the functional aspects of the object[39] that make it a patentable subject matter in the first place. One of the main issues that arose from 3D Printing, is the fact that while a person is 3D Printing

[36] U.S Constitution, Article 1(8) cl.8 (granting Congress the power "[t]o promote the progress if science and the useful arts, by securing for a limited time to […] and inventors the exclusive right to their respective […] discoveries"), <https://www.archives.gov/founding-docs/constitution-transcript> accessed 30 October 2018

[37] Patent Act 15 U.S.C. §271 (2017) <https://www.uspto.gov/web/offices/pac/mpep/mpep-9015-appx-l.html> accessed 30 October 2018

[38] Lucas S. Osborn and others, 'The Case for Weaker Patents' [2016] Article 4, Vol 89(4) St John's Law Review < https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2585764 > accessed 30 October 2018

[39] Tabrez Y. Ebrahim, '3D Printing: Digital Infringement & Digital Regulation' [2016] 14(1) Northwestern Journal of Technology and Intellectual Property <https://scholarlycommons.law.northwestern.edu/cgi/viewcontent.cgi?article=1247&context=njtip> accessed 30 October 2018

an object at the privacy of his own household, no one would be able to control this action, and conclude whether this item was based originally on a patented invention.[40]

Under the infringing action of 3D Printing an object which is based on an existing patent claim, an individual can be held liable in two different instances. First, if the relevant CAD File Holder is producing a direct copy of the patented object, then he will be held liable for direct infringement under U.S.C. §271(a) by selling, offering to sell or making the patented invention. Second, if the CAD File Holder is actively inducing the infringement of a certain patented creation by a direct infringer, then he can be held liable for indirect infringement under U.S.C §271 (b)(c).[41]

It is best at this point to work with an example, to further explain the possible liability scenarios that might occur.

From the perspective of the CAD File Holder, the most plausible situation of a patent infringement for 3D Printing an object would be, that the latter would 3D Print an item directly from a CAD file, which would be already existing in a patent claim. As will be analysed later in the text, this possibly infringing CAD file might also be shared by the CAD File Holder on an internet platform, where multiple end-users can further share the file with other people and can 3D print the item or purchase copies of that digitized object.[42] This is surely not a hypothetical scenario. Daily, 3D Printing Libraries are increasingly emerging to the digital world, such as CAD file Design Communities and 3D Printing software being shared for these specific infringing behaviours to be enacted. Until recently, academic literature[43] suggested that digital files cannot constitute an infringement of an existing patent claim. However, Holbrook and Osborn[44] have challenged this assumption, by analysing the possibility that a

[40] Mark A Lemley, 'IP in a World Without Scarcity' [2015] 90(2) NYU Law Review <http://www.nyulawreview.org/issues/volume-90-number-2/ip-world-without-scarcity> accessed 30 October 2018

[41] Patent Act 15 U.S.C. § 271 (1)(b)(c) (2017) <https://www.gpo.gov/fdsys/pkg/USCODE-2011-title35/pdf/USCODE-2011-title35-partIII-chap28-sec271.pdf> accessed 30 October 2018

[42] Ibid. Note 39, p.46

[43] 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' [2010] Public Knowledge <https://www.publicknowledge.org/files/docs/3DPrintingPaperPublicKnowledge.pdf> accessed 30 October 2018 *"it is stated that contrary to a copyright infringement, downloading or holding a CAD file does not constitute any infringement liability."*; Daniel Harris Brean 'Asserting Patents to Combat Infringement via 3D Printing: It's No 'Use'' [2013] XXIII(3) Fordham Intellectual Property, Media & Entertainment Law Journal <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2088294>accessed 30 October 2018

[44] Timothy R. Holbrook and Lucas S. Osborn, 'Digital Patent Infringement in an Era of 3D Printing' [2014] 48(1319) UC Davis Law Review, p.1325 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2483550> accessed 30 October 2018

CAD file which can directly 3D Print an object, may infringe a patent claim that concerns the physical object. Thus, it is only considered as necessary that this thesis will focus mostly on the actions occurring one step before the actual 3D printing part and these are the actions around a CAD file and the way it is appropriated in different manners by a CAD File Holder.

Summarizing the above, it starts to become very clear that in comparison with a simple music file or a movie being downloaded, copied, sold or shared, with the end-user knowing of it being protected by copyright, the end-users of a CAD file downloaded from a platform might not be aware of its existing legal protection. However, even if the comparison between those two real-life examples could be marked as very similar, the essential criterion that makes the difference is the fact that a CAD file is ultimately being 3D Printed by an end-user, a key element that makes the identification of the different types of infringement very perplexing.[45]

Chapter 3 – The fundamental elements of direct infringement claims under U.S.C. §271 (a) in the light of use of a 3D Printer and a CAD file

3.1 Is "printcrime" a reality that needs to be assessed?

"[…] let me whisper in your ear. Let me tell you the thing that I decided while I spent ten years in lockup. I'm going to print more printers. Lots more printers. One for everyone. That's worth going to jail for. That's worth anything."[46] In the "Overclocked" collection of science-fiction stories, written by Cory Doctorow, the first of the micro fiction stories presented is "Printcrime". In this specific story, 3D Printing didn't only change the way that everyday goods were produced but also completely obliterated every industry that formerly was depended on patents and general Intellectual Property Rights. In this microfiction story, 3D printers are feared for their propensity of converting common people, into malignant individual mass manufacturers of illegal products.

In the above story, 3D Printing is criminalized because this new method of producing products has been established as the dominant way of manufacturing, resulting in the elimination of industries that were previously dependent on copyright or patents, or design rights etc., thus affecting the rightful owners of the Intellectual Property Rights of those goods.

[45] Ibid. Note 44, p. 1338-1339
[46] Cory Doctorow, "Printcrime" in OverClocked: Stories of the Future Present, 4. Philadelphia: Running Press, 2005

Even though this microfiction is only a science-fiction story, the essence that derives from it is not very far from the current reality. One of the issues of the story however, is that it doesn't refer specifically to the process of 3D Printing. Thus, it can be fairly easy to focus only on the socio-economical image portrayed, without having to further analyse the different ways and layers of infringement.

To answer the question of what constitutes a patent infringement in the light of use of a CAD file, it is primarily important to define how the 3D Printing Technology relates to direct and indirect infringement. As already mentioned, an individual that is 3D Printing a patented product might be considered liable either for the act of 'direct patent infringement' by producing a copy of the actual product or for an 'indirect patent infringement' by actively inducing the infringement of a patent by a direct infringer, or contributing further to the illegal action.[47]

3.2 Defining Direct Infringement in the light of the 3D Printing Technology

In order to proceed with the following analysis, it is important that we examine Direct Infringement of 35 U.S.C. §271(a), from the perspective of the Patent Owner which seeks to protect his relevant patented invention. In this circumstance, the Patent Owner is seeking action, due to another person engaging to activities by appropriating his patent claim without permission using a CAD File. The following chapter will be mostly focused to describe how the Patent Owner might choose direct infringement as his main legal basis to justify its claim against the CAD File Holder. The elements of 'selling, offering to sell and making' under 35 U.S.C. §271(a) will be further analysed in order to establish if a CAD file can be perceived as infringing in the first place under U.S law due to its intangible nature. Lastly, a reference will be made to the 3D Printing Businesses engaging in actions of appropriation of CAD files.

Under the provision of 35 U.S.C. §271(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."*[48] Generally, the right to exclude others from making,

[47] Ibid. Note 39 p.46

[48] 35 U.S.C. § 271 (a) (2017) <https://www.uspto.gov/web/offices/pac/mpep/consolidated_laws.pdf>, accessed 14 November 2018

using, selling, or offering to sell any patented invention is closely linked to the physical form of the system, and the invention in its entirety.

3.2.1 Establishing Direct Infringement with a CAD file – the lines between tangible and intangible

Identifying the individual that produced a patented object via 3D Printing can be a hard task to accomplish. On the other side of the spectrum, it can be fairly easy to identify the holder of the CAD digital file. As technology advances and progresses different types of files can have different types of identifiers from the individuals that have created them. These unique identifiers can be found to audio or video files,[49] or even plain text files that have as an identifier the digital mark of the creator. Accordingly, CAD files[50] may present specific digital identification characteristics[51] that will help the Patent Owner of a patented object to identify the CAD File Holder. In this instance and throughout the thesis, the CAD File Holder would be defined as the person that currently holds any and/or the copy of the CAD file but does not own the patent claims in which the CAD file was based upon. Under §271(a) the CAD File Holder could be held liable for direct infringement from selling the digital file or offering to sell it to an interested party.

However, a question arises in this point of the analysis that challenges the thought on whether a CAD file alone can be perceived in the same way by the law, as the tangible item that can be eventually 3D Printed,[52] in order to establish direct infringement.

Although a CAD file and a 3D Printed object at a first glace can be perceived as correlated, since the CAD file designs are used in order to 3D Print it, the main difference between the two is that a CAD file is the digital representation of the actual physical

[49] Nishit Kumar, David Auld, CSR Technology Inc (2010). *Unique identifier per chip for digital audio/video data encryption/decryption in personal video recorders*. US Patent: US8705733B2 <https://patents.google.com/patent/US8705733?oq=digital+identifiers> accessed 5 November 2018

[50] Mark L. Reynolds (2011). *Creating, verifying, managing, and using original digital files.* US Patent: US8032542B2 <https://patents.google.com/patent/US8032542> accessed 5 November 2018

[51] Peter P. Corless. Cisco Technology Inc. (2000). *Digital identifiers and digital identifier control systems for intellectual properties.* US Patent: US6885999B1 <https://patents.google.com/patent/US6885999B1/en> accessed 5 November2018

[52] This is due to the fact that U.S law requires a physical embodiment, thus an actual copy in order for the court to decide if the production of this copy can be correlated with the functional aspects of the object that make it a patentable subject matter in the first place. Ibid. Note 38, 39.

embodiment of the object. It is suggested,[53] that different types of criteria should determine the way that something is defined as tangible and intangible in patent law. Due to the fact that the transition course between the intangible CAD file and the tangible 3D Printed object is very brief, someone might suggest that if there is a sale of the CAD file, then that will equals the sale of the tangible 3D object, which would evidently infringe on the rights of the Patent Owner.[54] The different types of criteria that could be taken into account can be the *time* of the transitioning from a digital element to a 3D Printed object and the *difficulty*, in addition to the *multiple skills* that are needed for the transition. The time element would be defined as from the moment that the individual would press the button ("order" the CAD file) to the actual moment that the 3D Printer starts to produce the object. These are some of the few elements that can make the decisive factors and determine the differences between tangible and intangible objects in 3D Printing. However, these types of criteria can also hold other hurdles in deciding the tangibility of an item, since for example, the variable of complexity between different types of patterns and shapes may dramatically differ.

Thus, someone might agree that is fairly easy to demonstrate the connection between the CAD file and the 3D Printed object, since the process from the point of having the digital file in a computing device to transforming it to a 3D Printed object might be the selection of a few simple buttons. Is undeniable that this action cannot be ranked as complicated or time-consuming. Ultimately, this defines one of the main characteristics of 3D Printing· the convenience of producing an item moderately easy and at the comfort of each individual's premises. On the basis thereof, a CAD file can beyond doubt be perceived in the same way as the actual physical embodiment of the object since the process itself is just as simple as printing an image on an A4 page from a regular printer. Since, the degree in the transformation procedure itself appears to be this easy, the CAD file from a *practical perspective*, can be perceived as equivalent to the tangible object and the Patent Owner is able under §271(a) to hold the CAD File Holder liable for direct patent infringement were the latter either sells or offers to sell the CAD file.

From a *legal perspective*, traditionally in order for a creation to be considered as an infringement of a patented object, there has to be a physical materialized form of the invention.[55] Throughout the related literature most of the writers base their opinions on certain

[53] Ibid. Not 39, p.52
[54] Ibid. Note 44, p. 1356
[55]Ibid. Note 44, p.1354

court cases[56] and claim, that a digital file cannot directly infringe a patent claim which is based on a physical creation, since the law specifically requires[57] for a physical embodiment of the invention. Under this perspective, a direct infringement would entail an invention that would normally perform a certain procedure or activity,[58] and has to be consistent with the two requirements of the 'reduction to practice' principle.[59]

Conventionally, an infringing action can only be proven if the physical embodiment of the creation was correlated with the actual patent claim.[60] Nevertheless in the current digital era, not all things can be presented as tangible. One of the most prevalent examples is a software program. Regardless the fact that the Courts have assessed the matters of whether a software program or a method of doing business[61] can constitute a patent, 3D Printing has yet to be considered. In respect of software, the lines have been blurred between the tangible and the intangible, since software can now execute activities that in previous years would have been only accomplished by hardware devices.[62] Despite the fact that there is no exact equivalent to

[56] Luten v. Camp, 221 F. 424, 429 (E.D. Pa. 1915) *"stating that the matter summarizes to whether the individual has indeed infringed the patent of the patent owner. The tangibility of the creation or the relevant blueprints or the contract involved is only conditional to the plaintiff's actions of establishing whether these elements have infringed or that they have been created upon specific instructions of any of the individuals related to the contract, or otherwise were part of the contract itself concluded between the individuals."* P. 19 <https://scholarship.law.berkeley.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=4101&context=californialawreview> accessed 5 November 2018; Niks v. Marinette Paper Co., 11 F.R.D. 384, 385 (N.D.N.Y. 1951) "*providing that the mere blueprints of a physical creation cannot suffice as a patent infringement";*

[57] Eligibility Criteria: The Four Categories of Statutory Subject Matter, The United States Patent and Trademark Office an agency of the Department of Commerce [R-08.2017] <https://www.uspto.gov/web/offices/pac/mpep/s2106.html> accessed 25 January 2019

[58] Hughes Aircraft Co. v. United States ex rel. Schumer, 520 U.S. 939 (1997), 640 F.2d 1193 (Ct. Cl. 1980), <https://supreme.justia.com/cases/federal/us/520/939/> accessed 30 October 2018

[59] 'MPEP 213805 "REDUCTION TO PRACTICE" This is the Ninth Edition of the MPEP, Revision 082017, Last Revised in January 2018 MPEP Chapter Index Chapter 2100: Patentability 2138: Pre-AIA 35 USC 102(g)'(*BitLaw*) <https://www.bitlaw.com/source/mpep/2138_05.html> accessed 14 November 2018

[60] Ibid. Note 43

[61] Alice Corp. v. CLS Bank Int'l, 134 S. Ct. 2347, 2352 (2014), "*proving that a simple method of intermediated settlement is not possible to be covered by a patent even if it is generated through a computer program"* <https://www.supremecourt.gov/opinions/13pdf/13-298_7lh8.pdf> accessed 30 October 2018; Bilski v. Kappos, 561 U.S 593, 611-612 (2010), "*providing again that mere method cannot be held eligible for a patent"* <https://www.supremecourt.gov/opinions/09pdf/08-964.pdf> accessed 30 October 2018; On the contrary: DDR Holdings, LLC v. Hotels.com, LP, No. 2013-1505, 2014 WL 6845152, at *1, *12 (Fed. Cir. Dec. 5, 2014). "providing that '*systems and methods of generating a composite web page' can be covered under a patent"* <http://www.cafc.uscourts.gov/sites/default/files/opinions-orders/13-1505.Opinion.12-3-2014.1.PDF> accessed 30 October 2018

[62] Eolas Techs., Inc. v. Microsoft Corp., 399 F.3d 1325, 1339-1340 (Fed. Cir. 2005) <https://caselaw.findlaw.com/us-federal-circuit/1320506.html> accessed 14 November 2018;

compare CAD files to, a close analogy would be blueprints or even molds.[63] Nevertheless, throughout the years, many litigation procedures have established that the mere creation of certain blueprints of an already patented product cannot constitute an infringement to the patent.[64]

From a standpoint of the era of tangible industrial manufacturing, the making or using a mold or blueprints for a specific object which is covered by a patent claim, would not establish a direct infringement. Nonetheless, 3D Printing belongs in the era of digital production[65] and makes manufacturing of tangible objects a very easy task for the common individual, since each and every one can produce them in the comfort of their own homes. Hence, subconsciously promoting the idea that purchasing the actual patented invention is not an imperative action. Thus, legislators and/or the courts would have to specifically establish if CAD files can be treated as blueprints or molds.

Even though direct infringement can be considered as a possible solution to some of the Patent Owner's problems, it might not suffice on the relevant cases since there is an involvement of CAD files. As will be analyzed below, two of the main elements of §271(a) to be examined, are the "sale and the offering to sell". So, the question that arises is whether direct infringement can also be viewed from the point of holding accountable the CAD File Holder for the offer to sell or selling the CAD files alone. The only complexity in this would be, the fact that it needs to be established whether the CAD file can be identified as infringing under §271(a).[66] From the majority of the relevant literature,[67] it has been a common view that the

[63] William R. Thornewell II, 'Patent Infringement Prevention and the Advancement of Technology: Application of 35 USC § 271(f) to Software and "Virtual Components"' [2005] 73(6) Fordham Law Review 2833-2842 <https://ir.lawnet.fordham.edu/flr/vol73/iss6/8/> accessed 14 November 2018

[64] Ibid. Note. 57 Luten v. Camp, 221 F. 424, 429 (E.D. Pa. 1915) *"stating that the matter summarizes to whether the individual has indeed infringed the patent of the patent owner. The tangibility of the creation or the relevant blueprints or the contract involved is only conditional to the plaintiff's actions of establishing whether these elements have infringed or that they have been created upon specific instructions of any of the individuals related to the contract, or otherwise were part of the contract itself concluded between the individuals."* P. 19 <https://scholarship.law.berkeley.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=4101&context=californialawreview> accessed 5 November 2018

[65] Ibid. Note. 44

[66] Ibid. Note 44, p. 1334

[67] Ibid. Note 44, p. 1334, Phoebe Li and others, 'Intellectual property and 3D printing: a case study on 3D chocolate printing' [2014] 9(4) Journal of Intellectual Property Law <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2667936>accessed 5 November 2018, Daniel Harris Brean, Ibid. Note 43 'Asserting Patents to Combat Infringement via 3D Printing: It's No 'Use'' [2013] XXIII(3) Fordham Intellectual Property, Media & Entertainment Law Journal<https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2088294>accessed 5 November 2018, Nicole Syzdek, 'Five Stages of Patent Grief to Achieve 3D Printing Acceptance' [2014] 49(2) University of San Francisco

decision of the Patent Owner to proceed with a direct infringement lawsuit against the CAD file alone is not a feasible choice. Specifically, commentators state that in order for the element of §271(a) to be fulfilled, the physical product of the patent claims is what needs to be sold or offered for sale.[68] This view was discussed by the U.S District Court[69] and approached from the view point which provided that common law seeks to satisfy the elements of the Article, and the 'delivery' of an object is a requisite to the act of sale. The court commented that in order for an actual sale to take place under §271(a), the object has to be prepared in its entirety to be used and a partial delivery is not enough. For 3D Printing, since the CAD file and the actual 3D Printed object are undeniably correlated, no individual can guarantee that they will not be any changes or the machine will produce a completely different product. In another judgement of the Court,[70] it was decided that §271(a) cannot be perceived as including acts other than *"making, using or selling of the patented invention"*. Hence, a physical existence[71] of the complete or genuine patented object is needed to determine an infringement. However, as 3D Printing and CAD files are disruptive new technologies, they do require a disruptive new approach in the field of patent law.

Even if CAD files cannot be equalized as blueprints or molds, and adhere to the requirement of selling or offering to sell, they might be perceived as diagrams and schematics.[72] A later court case has established that an infringement might also occur from selling or offering to sell the already patented creation which can consist of only diagrams from electrical and

Law Review <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2423571>accessed 5 Novemver 2018; Sam Dillon, 'Infringement by Blueprint: Protecting Patent Rights in a World of Low-Cost 3D Printing' [2014] 42(3) AIPLA Quartely Journal <https://heinonline.org/HOL/LandingPage?handle=hein.journals/aiplaqj42&div=21&id=&page=> accessed 5 November 2018; Davis Doherty, 'Downloading Infringement: Patent Law as a Roadblock to the 3D Printing Revolution' [2012] 26(1) Harvard Journal of Law & Technology <http://jolt.law.harvard.edu/articles/pdf/v26/26HarvJLTech353.pdf> accessed 5 November 2018; Charles W finocchiaro, 'Personal Factory or Catalyst for Piracy? The Hype, Hysteria, and Hard Realities of Consumer 3-D Printing '[2013] 31(473) Cardozo Arts & Entertainment <https://heinonline.org/HOL/LandingPage?handle=hein.journals/caelj31&div=22&id=&page= > accessed 5 Novemver 2018

[68] Ibid. Note 43

[69] Ecodyne Corp. v. Croll-Reynolds Engineering Co., 491 F. Supp. 194 (D. Conn. 1979) <https://law.justia.com/cases/federal/district-courts/FSupp/491/194/1798931/> accessed 5 November 2018

[70] Lang v. Pacific Marine & Supply Co., 895 F.2d 761, 765 (Fed. Cir. 1990) <https://www.leagle.com/decision/19901656895f2d76111526> accessed 5 November 2018

[71] Transocean Offshore Deepwater Drilling, Inc. v. Maersk Contractors, 617 F.3d 1296, 1300 (Fed. Cir. 2010) <https://caselaw.findlaw.com/us-federal-circuit/1615660.html> accessed 5 November 2018

[72] Timothy R. Holbrook, 'Territoriality and Tangibility after Transocean' [2012] 61(1081) Emory Law Journal <http://law.emory.edu/elj/content/volume-61/issue-5/essays/territoriality-and-tangibility-after-transocean.html> accessed 30 October 2018

mechanical fields.[73] The interpretation of the latter touches the essence of whether something can be perceived as an "invention" before it is actually physically made.[74] The Supreme Court[75] confirmed the above and construed, that it is not a prerequisite for an invention to be tangibly complete in order to confirm the requirement of "sale" in §271(a).[76] Throughout the litigation procedure it can be seen that the inventor of the patent always made the creation after he had offered to sale it. The sale itself was merely based in engineering diagrams[77] and not the actual ready-to-sale product. It was acknowledged by the Court that the essential element of the "invention" is the conception of the invention and not the tangible form of the concept and idea. The Court further stated that in any case the statute does not contain an explicit "reduction of practice"[78] requirement[79] and it is a well-established fact that a creation may be patented before it is reduced to practice.[80]

A CAD file has a value, due to the reason that there is already a patent claim in place in which the CAD file was based upon. Thus, the seller of the CAD file with his actions would be claiming its economic value without the Patent Owner's authorization to do so.[81] With that said, if the CAD File Holder decides to sell or even offers to sell a CAD file, then these will be defined based on their monetary value, thus their physical form will be irrelevant in this matter.[82] The element of the monetary value should be considered, only in the case of the possible economic harm presented to the Patent Owner, if a CAD file can directly 3D Print an item. This economic-harm[83] factor can then be further used in order to define whether the above action can constitute a direct infringement by selling or offering to sell the digital file.[84]Thus, from the above reasoning and the decision of the Court[85] in Pfaff v. Wells Electronics, Inc., can be concluded, that the value of the invention can be acquired also in the case where there is no

[73] Ibid. Note 72
[74] Ibid. Note 72
[75] Pfaff v. Wells Electronics, Inc., 525 U.S. 55 (1998) <https://supreme.justia.com/cases/federal/us/525/55/> accessed 11 November 2018
[76] 35 U.S.C. § 271 (a) (2017) <https://www.uspto.gov/web/offices/pac/mpep/consolidated_laws.pdf>, accessed 11 November 2018, *"However this provision excludes a patent if it was placed as 'for sale' for more than a year before the effective filling date of a claimed invention"* 35 U.S.C. § 102 (b)
[77] Ibid. Note. 75
[78] Ibid. Note. 59
[79] 35 U.S.C. § 100,101,102(g) (2017) <https://www.uspto.gov/web/offices/pac/mpep/consolidated_laws.pdf>
[80] Ibid. Reduced to Practice
[81] Ibid. Note 19, p. 820
[82] Ibid. Note 39, p. 53
[83] Ibid. Note. 71
[84] Ibid. Note 39, p. 53
[85] Ibid. Note. 75

physical formation of the creation, but merely the intangible version of it, such as an engineering diagram· hence establishing direct infringement.

3.2.2 Does the "Making" of a CAD file constitute Direct Infringement?

Summarizing the above mentioned, the Patent Owner under §271(a), will have different options of a legal basis in order to sue for direct infringement. The first is towards the CAD File Holder that made a sale or offered to sale a CAD file. The other element under §271(a) is "making" the CAD file based on the patent claim.

Realistically, the importance of the issue of 3D Printing lies on the fact that CAD files can be effortlessly created, and individuals might not even want to produce the 3D object or sell it but rather disseminate it to the public with no additional charge. Hence, the discussion of tangible and intangible becomes more relevant, to the Patent Owner's protection of rights, since in any case, the CAD file would eliminate the profits from his patented item.[86]

One of the main arguments that the Patent Owner can present in this case, is the fact that the CAD file is specifically made in accordance with the original patented invention. Based on this, the correlation between the CAD file and the 3D Printed object in regards to the patent claim, is undeniable. The CAD file itself is made originally with the utter purpose of eventually being used to print a 3D object. On the other side of the spectrum, a CAD File Holder will dispute the above by saying, that there might be a possibility that the making of a CAD file alone, will not always result in the production of a 3D Printed product. In this sense, the CAD File Holder might support that the mere creation and the element of "making"[87] the CAD file can be restricted to its private use and not necessarily to be sold, offered for sale or eventually 3D Printed. Regardless, it is impossible to regulate the use and dissemination of these CAD files that were created for purely "personal" purposes. To make the above issue clearer, a comparable example in this situation would be the "household exception" in copyright law. Plenty of CAD files might be digitally stolen from the CAD File Holder's computer device, might be shared through a third-party or a peer-to-peer ("P2P") network. In each of these cases,

[86] Ibid. Note 44, p. 1367
[87] 35 U.S.C. § 271 (a) (2017) <https://www.uspto.gov/web/offices/pac/mpep/consolidated_laws.pdf>, accessed 29 January 2019

the CAD file might dislodge the Patent Owner's profits from his patented object.[88] Thus, it is imperative that for the avoidance of complicating matters and further understanding these situations the perception of the "household exception" as described in copyright law cannot exist in the cases regarding CAD files.

As the CAD file technology advances rapidly, CAD online sharing platforms appear, enabling the individuals, with no additional monetary impact, to simply download or further share the file.[89] It is indeed a fact[90] that P2P networks are already "aiding" for further distribution of CAD files. A real-life example of the above, is when the infamous Pirate Bay online index platform has published online the CAD file of the first printable gun.[91]

Under §271(a), the Owner of a patent claim can pursue a direct infringement claim not only in cases that the CAD File Holders have sold or offered to sell a CAD file, but also in cases that the latter merely "made" the CAD file. The action of copying a CAD file may establish the act of "making" the object.[92]

It was already established previously that under the elements of selling or offering for sale, a CAD file cannot constitute direct infringement if perceived as a blueprint or mild. The same idea is given also for the element of "making" the CAD file as it has been observed through certain U.S litigation,[93] that designs, diagrams and blueprints would not be considered as infringing the patent claim. There is a substantive volume of commitment concerning the proficiency, time and resources that one has to put into transmitting the CAD file to the actual 3D Printed invention. Hence, it can only be reasonable, that blueprints, or engineering designs, may originally not be perceived as an infringement for the element of "making" or copying the original patented invention[94] under §271(a), as previously presented through various litigation procedures for the other two elements.[95]

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[88] Ibid. Note 44, p. 1367
[89] Ibid. Note 44, p. 1364
[90] Ernesto Van der Sar, 'Pirate Bay Takes Over Distribution of Censored 3D Printable Gun' (TorrentFreak, 10th May) <https://torrentfreak.com/pirate-bay-takes-over-distribution-of-censored-3d-printable-gun-130510/>accessed 5 November 2018
[91] Ibid. Note 11
[92] Ibid. Note 44, p. 1364
[93] United States v. C.M. Lane Lifeboat Co. 118 F.2d 793 (2d Cir. 1941) <https://scholar.google.com/scholar_case?case=16363238355706441369&q=United+States+v.+C.M.+Lane+Lifeboat+Co.+118+F.2d+793+(2d+Cir.+1941)&hl=en&as_sdt=2006> accessed 5 November 2018
[94] Ibid. Note 44, p. 1365
[95] Ibid. Note 57 [Luten v. Camp]; Niks v. Marinette Paper Co.., 11 F.R.D. 384, 385 (N.D.N.Y. 1951) "*providing that the mere blueprints of a physical creation cannot suffice as a patent infringement"*

Despite of the above, it would be considerably difficult for the legislators to establish different rules and the courts to enforce them, in the case where a CAD File Holder decides to merely *make* the CAD file for purely a private use[96] and not further *offering it for sale* or *selling* it. The evidence procedure in court would almost be impossible where the CAD File Holder would have to prove that he did not use the CAD file in any other way than a purely private use which did not involve an economic harm to the Patent Owner. Even if the burden of proof falls to the Patent Owner to prove that the CAD File Holder did eventually proceed in a sale or offering to sell, then other issues might arise since the CAD files might have been digitally stolen from the CAD File Holder's hardware device and then shared through a third-party without the knowledge of the CAD File Holder.

Thus, following the above train of thought, it would be in favour of the Patent Owner's rights, that the "making" of a CAD file would be perceived as equivalent to the using, selling or offering to sell, hence establishing the CAD file design as interchangeable with the actual patented object and constituting a direct infringement.

3.3 CAD Files as a Patentable Subject Matter

In comparison with other intellectual property areas, patent law due to its nature and close relation with innovation and the latest technologies, can come across as very technical. Regardless of its technicalities, patent law progresses in a parallel matter with new technologies, thus it is also very adaptable.

Tackling an issue in the area of 3D Printing and specifically concerning the phenomenon of CAD files might be challenging. As already mentioned, there are no concrete litigation examples that would address the matter of how CAD files should be approached and treated by the Courts. In any case, the main practical question that needs to be answered is, in which ways can the Patent Owner protect his creations in advance, without running the risk that a court may not accept the views on direct infringement that were elaborated above.

The first position would be to include inside the patent claim, that the invention itself must be protected also in its intangible form, including a CAD file formation. This way the creation would be protected from the start and each individual that seeks to unlawfully use, by

[96] Ibid. Note 44, p. 1364

copying the invention to a digital form, will fall under the above description inside the patent claim. However, an issue occurs that challenges the thought of whether it is possible to patent a CAD file in the first place, since individuals might want to obtain a patent just on a CAD file even if there is no tangible object in reality.

There are two significant impediments that must be considered and may likely interfere to the procedure of patenting a CAD file as such. At one hand, the restriction on claims that are directed to abstract ideas or mere data.[97] On the other hand, the restriction to patenting on what can be perceived as mere printed matter.[98]

3.3.1 The prohibition on claims directed to mere data

The text of law provides that, all inventions that fall under the definition and scope of Article 35 U.S.C. §101[99] may be eligible to obtain a patent, subject to the conditions and the requirements of the latter Articles contained in the Title. Specifically, under §101 *"Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent".*

The Court in the case of 'Digitech' based its decision on the above definition and claimed that *"data in its ethereal, non-physical form is simply information that does not fall under any of the categories of eligible subject matter under section §101*".[100] The Court further affirmed that in this case, the device profile could not be considered as eligible for a patent claim since, it was a mere collection of *"intangible color and spatial information"*[101] whereas in all the categories that fall under §101 apart from process claims, the subject matter must be in a tangible form. This affirmation resulted from the case 'In re Nuijten' [102] in which a signal with embedded data was not considered as eligible for a patent regardless of the fact that the

[97] Digitech Image Tech's V. Electronics for Imaging, 758 F.3d, 2014 at 1349 <HTTP://WWW.USPTOTALK.COM/CASES/DIGITAL_IMAGE_V_ELECTRONICS_FOR_IMAGING.PDF> accessed 26 November 2018

[98] Gulack, 703 F.2d, 1983 at 1386 <http://digital-law-online.info/cases/217PQ401.htm> accessed 26 November 2018

[99] 35 U.S.C. § 100,101,102(g) (2017) <https://www.uspto.gov/web/offices/pac/mpep/consolidated_laws.pdf>

[100] Ibid. Note 97 at 1350

[101] Ibid. Note 97 at 1348

[102] In re Nuijten, 500 F.3d 1346, 1351-1352 (2007), <https://casetext.com/case/in-re-nuijten> accessed 29 November 2018

signal itself eventually was generating tangible effects.[103] The Court in 'Digitech' further adopted the definitions that were given in 'In re Nuijten' were they asserted that under §101 the definition that accompanied the term 'manufacture' attributed to the term 'articles' that occur from the manufacturing procedure, while the word 'article' was defined as a specific substance or commodity.[104] Nevertheless, the above definitions were closer to the industrial era rather the technological one, in which a CAD file justifiably lies to. For this reason, in the same case a new approach was considered in defining the word manufacture[105] from an alternative dictionary definition[106] to the one the Supreme Court was utilizing. This alternative definition presented that 'art' and 'processes' must be perceived in more general terms[107] that will not dispute the definition which was originally provided by the Supreme Court.[108]

A broader approach was further suggested by a scholar[109] who claimed that "manufactures" do not have to necessarily fall under the tangibility requirement. It is explained[110] that 'manufactured' may be defined as containing "all-man made articles" excluding any machines or compositions of matter. Through this perspective, §101 can be interpreted very generally as to include every product possible, except the ones that are not made specifically by human beings, but are generated "naturally". In a last instance, the scholar equates everything 'not made by mankind' with the 'printed matter' of a product,[111] further

[103] Daniel Harris brean, 'Patenting Physibles: A Fresh Perspective for Claiming 3D-Printable Products' [2015] 55(4) Santa Clara Law Review p. 851 <https://digitalcommons.law.scu.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=2811&context=lawreview> accessed 6 December 2018

[104] Damien Howard, 'A Discussion on the Patentability of Signals: Examining In re Nuijten' [2009] 8(1) Northwestern Journal of Technology and Intellectual Property <https://scholarlycommons.law.northwestern.edu/cgi/viewcontent.cgi?article=1100&context=njtip> accessed 29 November 2018;

[105] Ibid. Note 103 [in re Nuijten], at 1360-1361,

[106] A dictionary of the English language. Abstracted from the folio ed., by the author. To which is prefixed, an English grammar. To this ed. are added, a history of the English language [&c.]. Defining 'Manufacture' as: *"[a]ny thing made by art"*, while 'art' was defined as: *"[t]he power of doing something not taught by nature and instinct"; "[a] science"; "[a] trade"; "[a]rtfulness, skill, dexterity"* <https://books.google.nl/books?id=bXsCAAAAQAAJ&printsec=frontcover&dq=A+Dictionary+of+the+English+Language+(3d+ed.1768)&hl=nl&sa=X&ved=0ahUKEwiEk7WWr_neAhVHb1AKHVT3DmAQ6AEIMDAA#v=onepage&q&f=false> accessed 29 November 2018

[107] Ibid. Note 102, at 1362

[108] Diamond v. Chakrabarty, 447 U.S. 303 (1980) <https://supreme.justia.com/cases/federal/us/447/303/> accessed 29 November 2018

[109] Ibid. Note. 103, p. 851 <https://digitalcommons.law.scu.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=2811&context=lawreview> accessed 6 December 2018

[110] Donald S Chisum, *Chisum On Patents §102* (edn. 2014), through Ibid. Note 103, p.851

[111] Ibid. Note 103, p.851, "*Chisum further explains that the 'novelty' and 'utility' of the 'printed matter' rest other than in the structure of the entity. Thus, the patentability of any man-made structural entity should depend on the requirements of novelty, utility and non-obviousness."*

stating that the patentability of any structural entity designed and made by the human kind should be interpreted on the statutory requirements presented in patent law such as novelty etc. and not the tangibility or its absence of the object.

From the above, we can only conclude that a CAD file will fall under this definition. This is due to the fact that even though the CAD file may be perceived by some as 'mere data' due to its digital formation, it nonetheless depicts the equivalent 3D Printable item, and required a reasonable effort from a human being to be created (made by mankind). The statute of law allows for a foundation on which a CAD printable file can be considered as patentable manufactures.[112] Thus, in this instance it is of no importance whether a CAD file is perceived as a tangible or an intangible object as long as the CAD file is considered as printable.

3.3.2 The prohibition on claims directed to abstract ideas

The second element in which there is a hindrance in patenting CAD files might be that the claim is directed to an abstract idea. Nevertheless, the statute of law under §101 is not the only reason that certain claims are not patentable due to abstractness. As mentioned previously in Chapter 2.3, Congress has the authority to grant patent rights in order to promote innovation,[113] among other elements. Abstract ideas cannot constitute a patentable subject matter[114] because these "are the basic tools of scientific and technological work" [115] and if patented they will severely hinder innovation.[116] In comparison to the above mentioned cases of 'Digitech' and 'In re Nuijten', which they involved merely data that were unlinked to anything physical, a CAD file constitutes an appropriate tool for use and manufacturing and cannot be considered as an abstraction of an item but the precise illustration of it.[117] A more recent opinion by the Commission, on the in 're Certain Digital Models'[118] the ITC reaffirmed

[112] Ibid. Note 103
[113] O'Reilly v. Morse, 56 U.S. 62 (1853), at 113 <https://supreme.justia.com/cases/federal/us/56/62/> accessed 29 November 2018
[114] Diamond v. Diehr, 450 U.S. 175 (1981), at 185 <https://supreme.justia.com/cases/federal/us/450/175/> accessed 29 November 2018;
[115] Gottschalk v. Benson, 409 U.S. 63 (1972), at 67 <https://supreme.justia.com/cases/federal/us/409/63/> accessed 29 November 2018
[116] Ibid. Note. 61 Bilski V. Kappos, 561 U.S. 593, 649 (2010) <https://www.supremecourt.gov/opinions/09pdf/08-964.pdf> accessed 29 November 2018
[117] Ibid. Note 103
[118] In Re Certain Digital Models, Inv. No. 337-TA-833, USITC (2014) (Commission Opinion) <https://www.usitc.gov/intellectual_property/int_prop_publications.htm> accessed 29 November 2018

the previously mentioned by providing that digital datasets that represented data of patients individual dental treatments, constitute "articles" and fall under the definition of 19 U.S.C. §1337, were they could be prevented from being imported in the U.S if they infringe a patent.[119] In conclusion, the Commission decided that the data sets in question did constitute "true articles of international commerce" and settled, that by not including both tangible and intangible forms of the dental devices under the definition of "Articles" would be incoherent with the statute of law.[120]

Hence, the question on whether CAD files constitute 'manufactures', the Court[121] has emphasized and indirectly proved that §101 should be interpreted in an "open" and non-explicit manner and represent correctly the essence of patent law.[122] In another case,[123] the Court reiterated the above statement by providing that, notwithstanding the terms of §101 and the word context of the draft patent claim, the essence of the issue of a patentable subject matter lies to the fundamental invention itself, hence the 3D printed object deriving from the CAD file.

3.3.3 The restriction on patenting mere 'printed matter'

Due to the digital nature of a CAD file, it is fairly easy for it to be perceived as a non-patentable printed-matter. It has been presented[124] that the simple composition of information, characters or mere words does not prove the requirement of inventiveness as provided in the statute, and thus is not entitled to be protected under patent law. The underlying idea of the printed matter doctrine is undeniably associated with the restriction on patenting mere data or abstract ideas.[125] The previously mentioned scholar[126] stressed in his work, that plenty of times

[119] Ibid. Note 102 at 34
[120] Ibid. Note 102 at 53-55
[121] In re Alappat, 33 F.3d Fed. Circ. (1994), at 1526,1553 <http://digital-law-online.info/cases/31PQ2D1545.htm> accessed 30 November 2018
[122] Ibid. Note. 103, p. 853
[123] CyberSource Corp V. Retail Decisions, Inc., 654 F.3d Fed. Cir. (2001), at 1366,1375 <https://caselaw.findlaw.com/us-federal-circuit/1577625.html> accessed at 30 November 2018
[124] In re Russell, 48 F.2d 668, C.C.P.A. (1931) <https://www.courtlistener.com/opinion/1569096/in-re-russell/> accessed at 30 November 2018
[125] Ibid. Note. 103; Samuel J. Jr. Sutton, 'The Mental Steps Doctrine: A Critical Analysis in the Light of Prater and Wei' [1969-1970] 13(3) Patent, Trademark and Copyright Journal of Research and Education <https://heinonline.org/HOL/Page?handle=hein.journals/idea13&id=460&collection=journals&index=> accessed 2 December 2018
[126] Ibid. Note. 110 Chisum §1.02(4)(e)

human intervention is required through the patent claim procedure, when this involves characters or a printed matter. Therefore, it involves a mental element which can only be detected in a human being. Under the above reasoning, the Court[127] established an exception in which information is being processed not by a mind but a machine, hence a computer. It is supported that a CAD file does fall under this exception since in its nature a CAD file is processed by a computer, in order to be properly read by a human being.[128] With that reasoning the CAD file cannot not 'infringe' the printed matter doctrine.

Summarizing the above analysis, one might conclude that the issue does not lie as such on whether the CAD file should be perceived as tangible or intangible. The Court confirmed that something might be perceived as an "invention" before it is actually physically made, even if it is being 'sold or offered for sale' under §271. Regardless, a CAD file can be perceived as 'making' the invention since as already established, it requires a considerable amount of expertise and time to be digitally created by a human being.

The elements included in §101 which define what can be a patentable subject matter, need to be interpreted in a broad sense to include all man-made creations. Incorporating the CAD file inside the patent claim of the invention might be the best approach of a Patent Owner in dealing with possible digital infringements. Indeed, the statute of law does not include any language that could regulate the digital part of the 3D Printed object, hence the CAD file. Nevertheless, the present technological evolution might create a custom in which Patent Owners will feel obliged and socially compelled to include inside their patent claims the CAD file design, so to avoid possible missuses of their inventions in the future. Notwithstanding the fact that those claims would constitute patentable subject matter, it has to be considered that these claims will not shield the Patent Owner's patents that have been issued earlier in time.[129]

3.4 3D Printing Businesses under the framework of Direct Infringement

As it was extensively discussed, the Patent Owner under §271(a), will have the options of pursuing the direct infringement approach through the elements of "selling, offering to sell or making" the CAD file. Regardless, a more reasonable and easier approach for the Patent

[127] In re Lowry, 32 F.3d Fed. Cir. (1994) at 1579, 1583 <https://law.resource.org/pub/us/case/reporter/F3/032/32.F3d.1579.93-1558.html> accessed 2 December 2018
[128] Ibid. Note. 103, p. 854
[129] Ibid. Note 44, p. 1355

Owner to consider would be to engage in a direct infringement claim against the relevant 3D Printing Business (intermediary) that 3D Prints items on demand of the individual that requests them. [130] In this instance, the 3D Printing Business would be considered as the CAD File Holder, since they will be the entity appropriating the patent without prior approval of the Patent Owner.

Direct infringement against an individual might not be the most suitable way to approach the subject. The Patent Owner would most likely not be very keen in pursuing a long litigation procedure that could result in bad customer relations, by engaging in the direct infringement claims against the individual using the CAD file and eventually a 3D Printer. The Patent Owner may have another way in approaching the subject under §271(a).

It is thus reasonable to also consider engaging with a direct infringement claim against the intermediary that would be responsible in 3D Printing the relevant CAD file provided from the individual.[131] In this specific case, an intermediary might represent a certain 3D Printing Service dedicated to this action and committed to 3D Printing on demand. One of the key concerns to be addressed in this point, is that the Patent Owner could consider to sue for direct infringement, the 3D Printing Business that 3D Prints the already protected object. The reasoning behind this is that the Patent Owner can raise the argument that since the re-produce of his patent claim and evidently the 'producer' of the 3D Printed invention is the 3D Printing Business, so to say the intermediary, then the latter shall be held liable for a direct infringement and not the individual that requested the object. This is due to the fact that at the time of the given action the 3D Printing Business would be the CAD File Holder and not the individual that made the request. Indeed, in this case, an intermediary would be far more facile to accuse of. The 3D Printing Business would be the 'front face' in all actions, by knowingly engaging to the demands of the customers without considering the possible legal implications. Thus, those 3D Printing Businesses would be simply easier to identify by the Patent Owner and held liable for direct infringement under §271(a).

[130] Ibid. Note 39, p.48
[131] Ibid. Note 39, p.51

Chapter 4 – How the patent owner might be protected under an indirect infringement claim U.S.C. §271 (b), (c) towards a CAD digital file?

4.1 What if the spaceship was protected under a certain patent?

"[…] "To show you the start of it, here's a construction machine I've built. […] this constructor is both efficient and flexible. I feed magnetronic plastics—the stuff they make houses and ships of nowadays—into this moving arm. It makes drawings in the air following drawings it scans with photo-cells. But plastic comes out of the end of the drawing arm and hardens as it comes. This thing will start at one end of a ship or a house and build it complete to the other end, following drawings only."[132]

In the science fiction story of Murray Leinster's "Things Pass By" one of the men involved in the plotline tries to build a spaceship by layering a certain type of plastic called 'magnetronic', injected through a moving-drawing arm. Even though at the time these types of actions might have been perceived only as products of fantasy-based storylines, the models that have been presented in the late half of the 21st century have exceeded the fantasy element and conceived it into an everyday reality. Yet, what would have happened if the spaceship that the man in Murray's story was trying to make, was already protected under patent law and the Patent Owner wanted to protect his original invention by forbidding the making of it? In this specific case the man that was trying to build the spaceship was the same man that built the machine-arm itself that eventually would produce the starship.

As it was analysed earlier, under §271(a)[133], the Patent Owner would have been able to proceed with a direct infringement against the CAD File Holder that engaged in actions through a CAD file. Based on the above story, the man did not only create the spaceship but also the machine thereof. In that sense, the man would have been using the equivalent to a 3D Printer –machine-arm- to 3D Print an already patented invention without the permission of the Patent Owner and thus directly infringe the already patented object.

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[132] Leinster Murray *"Things Pass By"*, older version of Eric Frank Russel story <http://www.isfdb.org/cgi-bin/title.cgi?41311> accessed at 5 November 2018, published In Thrilling Wonder Stories, Summer 1945 <http://www.isfdb.org/cgi-bin/pl.cgi?61764+c> accessed 5 November 2018. Reprinted in Fantastic Story Magazine, Winter 1955 <http://www.isfdb.org/cgi-bin/pl.cgi?244869+c> accessed 5 November 2018, currently available at the Internet Archive <https://archive.org/stream/Fantastic_Story_Magazine_v08n01_1955-Winter/Fantastic_Story_Magazine_v08n01_1955-Winter_djvu.txt> accessed 25 August 2018

[133] 35 U.S.C. § 271 (a) (2017) <https://www.uspto.gov/web/offices/pac/mpep/consolidated_laws.pdf>, accessed 5 November 2018

The Patent Owner under the claim of indirect infringement could either sue the individual that uses the 3D Printer and produces 3D Printing items or sue the CAD File Holder directly for the making thereof. But as it has been analysed previously, the challenges that would be presented in this specific case are plenty. Another party that can be held liable in this situation would be the 3D Printing Business that is responsible for printing the preferred 3D Printed design of a customer, on demand. This 3D Printing Business, would be held liable for direct infringement, by the Patent Owner, since the business is producing/making the 3D Printed object and not the individual that has requested the item. The 3D Printing Business would be easier to identify and eventually be accused for direct infringement by the Patent Owner, since they can be considered as the 'front face' of all 3D Printing actions under §271(a). It is important to mention, that in the moment that this thesis was being written, 3D Printing cannot be perceived as a fully automated process. That is due to the fact that as it was analysed in a previous chapter, different types of elements contribute to the procedure of 3D Printing an object. The elements of difficulty, the multiple skills required as well as the time needed for ordering a CAD file to transition to a 3D object, amount to the human element which is essential for the whole process to transpire.

However, in the above-mentioned case, one might consider the other side of the spectrum, where the Patent Owner would sue the individual that is requesting from the 3D Printing Business to 3D Print a CAD file which is based on a patent claim. Under §271(b),(c),[134] an individual or a third party may be held liable for indirect infringement, for the actions of other parties that are directly infringing the protected patent.[135] The reasoning behind indirect infringement lies to the protection of the Patent Owner when there is a complexity of suing infringements due to either their immense amount, their scattered character, their position as a customer of the Patent Owner or their incapability of indemnify the later.[136] Under the Patent Act there are two different frameworks of indirect infringement

[134] *"(b) Whoever actively induces infringement of a patent shall be liable as an infringer. (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 non infringing use, shall be liable as a contributory infringer."* U.S Government Publishing Office, <https://www.gpo.gov/fdsys/pkg/USCODE-2011-title35/pdf/USCODE-2011-title35-partIII-chap28-sec271.pdf> accessed 18 August 2018

[135] Ibid. Note 44, p. 1333

[136] Timothy R. Holbrook, 'The Intent Element of Induced Infringement' [2006] 22(3) Santa Clara High Technology Law
Journal <https://digitalcommons.law.scu.edu/cgi/viewcontent.cgi?referer=https://www.google.nl/&httpsredir=1&article=1407&context=chtlj> accessed 5 November 2018; Michael N Rader, 'Toward a Coherent Law of

that can be exercised by the Patent Owner. The first one, under §271(b), is Active Inducement of Infringement and the second one, under §271(c), is Contributory Infringement.[137]

4.1.1 Indirect Infringement by the 3D Printer Manufacturer

Relating to 3D Printing technology, and with respect to the active inducement of infringement, it can be reasoned that the manufacturer which produces the 3D Printer, is the source of the possible indirect infringement, since it is the actual machine that generates and forms that 3D Printed object.[138] From this scope the Patent Owners would have to engage in very complex litigation procedures with the factory producers of those 3D Printers, in which ultimately would result in an impasse due to the lack of the required knowledge from the side of the 3D Printer producer. Under §271(b), (c), it is a prerequisite that the indirect infringer had knowledge about the existence of the relevant patented invention. In this situation, the producers of those 3D Printers are just manufacturing a generic machine, in which a specifically made CAD file would be eventually the actual element in which the 3D Printing procedure would be based upon. In that sense, the 3D Printer would entail just the means to an end, and thus the 3D Printer producers would not be held liable for an active inducement liability under indirect infringement of §271(b).

4.2 Active Inducement of Infringement, in the context of 3D Printing Technology

Based on the statute of law[139] in order for an individual to be considered as an indirect infringer has to either actively induce the infringement of a patent, or contribute to the infringement. With the objective of establishing the framework of active inducement the Patent

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Inducement to Infringe: Why the Federal Circuit Should Adopt the Hewlett-Packard Standard for Intent Under 271 (b), 10 Fed Cir BJ 299 (2001)' [2002] 10(3) The Federal Circuit Bar Journal <https://heinonline.org/HOL/LandingPage?handle=hein.journals/fedcb10&div=20&id=&page=> accessed 5 November 2018

[137] Ibid. Note 134, Timothy R. Holbrook, 'The Intent Element of Induced Infringement' [2006] 22(3) Santa Clara High Technology Law

[138] Ben Depoorter, 'Intellectual Property Infringements & 3D Printing Decentralized Piracy' [2014] 1483(65) Hastings Law Journal <https://repository.uchastings.edu/faculty_scholarship/1011/> accessed 5 November 2018

[139] Patent Act 15 U.S.C. §271 (b) (2017) <https://www.uspto.gov/web/offices/pac/mpep/mpep-9015-appx-l.html> accessed 30 October 2018

Owner has to prove that he meets certain requirements. The first element is that the infringing action has to involve direct infringement. The second requirement, is that the infringing individual has a definite intention of inducing a third party to proceed with the infringing action. The third element, is that there is an affirmative act by the inducer.[140]

Taking this into consideration, in the field of the 3D Printing technology, it appears to be quite challenging for the Patent Owner to implement his patent limitations under the framework of active inducement. Throughout certain litigation procedures it appears that,[141] it is an absolute requirement that the Patent Owner must demonstrate the existence of direct infringement. To put everything into context, in the case of 3D Printing, under the previous mentioned elements, that Patent Owner would have to present either by direct or circumstantial proof that the infringing individual granted access to a specific CAD file, from which a third party ultimately downloaded and 3D Printed.[142] Circumstantial evidence may be sufficient for the Patent Owner to constitute an infringement claim, nevertheless the latter must prove that the active inducer had also knowledge about the existence of the patent claim.[143] However, as already discussed in the previous chapter, identifying the individual who directly infringed the patented object by having a CAD file in his possession (e.g. from an online sharing platform) might present various challenges due to the internet's anonymous nature.

As mentioned previously direct or circumstantial evidence[144] may be sufficient for the Patent Owner to constitute an infringement claim, yet the Patent Owner would have to provide proof that the active inducer had knowledge about the existence of the patented object. Notwithstanding the above, the courts have disputed in an immense amount of cases the correct approach as to how to identify the element of 'satisfactorily enough circumstantial evidence', especially in the case of software related procedures,[145] which could be the closest element to associate with a CAD file. Correspondingly, in a CAD file procedure the courts most likely

[140] Ibid. Note 44, p. 1335
[141] Limelight Networks, Inc. v. Aka-mai Techs., Inc., U.S. 134 S.Ct. 2111, 2119, 2120, 189 L.Ed.2d 52 (2014), <https://caselaw.findlaw.com/us-federal-circuit/1718368.html> accessed 5 November 2018; Aro Mfg. Co v. Convertible Top Replacement Co., 365 U.S. 336, 341-342 (1961) <https://caselaw.findlaw.com/us-supreme-court/365/336.html> accessed 5 November 2018
[142] Ibid. Note 44, p. 1336
[143] Ibid. Note 39, p. 57
[144] Linear Tech. Corp v. Impala Linear Corp., 379 U.S F. 3d 1311, 1326-1327 (Fed. Circ.) (2004) <https://openjurist.org/379/f3d/1311/linear-technology-corporation-v-impala-linear-corporation> accessed 5 November 2018, Moleculon Research Corp. v. CBS, Inc., 793 F.2d 1261 (Fed. Cir.) (1986) <https://openjurist.org/793/f2d/1261/moleculon-research-corporation-v-cbs-inc> accessed 5 November 2018
[145] Ibid. Note 44, p. 1337

would need, based on a case by case scenario, to examine whether the circumstantial evidence are sufficient to assess the direct infringement.

In a second manner, the supply of direct or circumstantial evidence to the court would not be enough unless the Patent Owner also provides proof that the active inducer had the knowledge that the object was patented. This intention by the active inducer demands an actual knowledge of the existence of the patent claim or willful blindness.[146] Nevertheless, willful blindness can be very challenging to present in 3D Printing activities. Under this scope, the Patent Owner would have to prove that the active inducer was knowingly and with intent inducing the direct individual to engage in this 3D Printing actions by further informing the infringer that the intended 3D Printing creation is based on a patent claim.[147]

To summarize, against the backdrop of 3D Printing technology, there are two different schemes where active inducement can take place. The first one, as already mentioned, is when an individual may create or acquire a CAD file and further disseminate it to another individual. The latter would then proceed in the action of 3D Printing the object into a physical embodiment of the CAD file, infringing this way the already patented object that it was based upon. The second scheme, is the instance in which there is an online CAD file sharing platform, where the patented object would be further downloaded and disseminated by other end-users and ultimately 3D Printed. As examined already, in the second scheme presented, the active inducer would have to have an explicit intention of disseminating the CAD file in order for it to essentially be 3D Printed.[148] However, under this requirement it is an essential element that the object is indeed 3D Printed.[149] This element itself presents an immense challenge since the Patent Owner would be very difficult to identify whether the actual 3D Printing has been concluded, even more so, from an online CAD file sharing platform or a P2P network. As for the explicit intent element, even though it is a requirement in order to sue for an active inducement infringement based on §271(b), it might not be very distinct just yet how this requirement can be interpreted under the online CAD file sharing platform.[150] It is suggested,[151]

[146] Yvonne Lee, 'Global-Tech Appliances, Inc v SEB, SA: Discovering Wilfully Blind Territory in Induced Patent Infringement' [2012] 27(4) Berkeley Technology Law Journal <https://scholarship.law.berkeley.edu/cgi/viewcontent.cgi?article=1935&context=btlj> accessed 5 November 2018
[147] Ibid. Note 39, p. 59
[148] Ibid. Note 44, p. 1343-1344
[149] Ibid. Note 39, p. 58
[150] Ibid. Note 39, p. 61
[151] Ibid. Note 39, p. 61

that the Patent Owner would have to identify a series of proofs in order to establish the necessary intent element from the active inducer.

4.3 Contributory Infringement, in the context of a CAD file

Under the framework of §271, are counted more than one forms of indirect infringement. In the previous sub-chapter, active inducement of §271(b), was analysed in the light of several scenarios. In section §271(c), another form of indirect infringement called Contributory Infringement, is going to be assessed. This section is the most prevalent form of indirect infringement.[152]

Under contributory infringement the Patent Owner might constitute an individual liable if certain requirements are met. The individual may (i) sell, offer to sell, or import in the U.S established area (ii) a certain component of a patented machine, (iii) knowing that this component is specifically made or adapted for use in an infringement of such patented invention (and not a staple article or commodity of commerce suitable for substantial non-infringing use), (iv) that will result in the act of direct infringement.[153]

In contrast with the form of active inducement previously mentioned, contributory infringement does not require that the infringer had an ulterior intent to induce infringement. Nonetheless, there is a need of the knowledge requirement of the infringer that there was an already a patent claim and as the section §271(c) requires, the related component must be specifically made or adapted for use, for the infringement of that patent.[154] These two provisions §271(b), (c), might be perceived as very similar. However, even though they might be associated with one another, they are very different for the above reasons. In the case of §271(c) because the individual which 'contributes' to the infringement is cognizant about the fact that an already patented invention covers the infringing object, and that the component of that object has non-infringing uses, the intent of this individual is assumed and expected.[155]

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[152] Hewlett-Packard Co. v. Bausch & Lomb, Inc., 746 F. Supp. 1413 (N.D. Cal. 1990) <https://openjurist.org/909/f2d/1464/hewlett-packard-company-v-bausch-and-lomb-incorporated> accessed 5 November 2018

[153] Patent Act 15 U.S.C. §271(c) (2017) <https://www.uspto.gov/web/offices/pac/mpep/mpep-9015-appx-l.html> accessed 30 October 2018

[154] Patent Act 15 U.S.C. §271 (c) (2017) <https://www.uspto.gov/web/offices/pac/mpep/mpep-9015-appx-l.html> accessed 30 October 2018 and Ibid. Note 39, p. 62

[155] Ibid. Note 44, p. 1345

4.3.1 Interpretation of the terms: selling, offering to sell or importing under the framework of Contributory Infringement

The main wording presented under §271(c), is that the Patent Owner may contemplate on suing an individual for indirect infringement, if the latter engages in the actions of selling, offering to sell or importing a certain component of a patented machine […].[156] The individual that initiates these actions, and to whom an indirect patent infringement may be presented upon, is defined as the CAD File Holder.[157] Even though, it can be supported that the above mentioned wording, can be quite vague and very widely defined, the U.S Federal Circuit has limited the scope of the word "offer" by specifically defining it in the general context of contract law.[158] Accordingly, the definition of "offer" is interpreted from the court as: an individual must be willing to engage into a specific negotiation or contract, and that the other party comprehends that his agreement to this, is aimed and intended and will result in conclusion of the negotiation or contract.[159] Nevertheless, it has been suggested,[160] that the defined term of "offering" is not interpreted in the context of patent law, and thus the courts would have to further define this wording outside of its scope and focus on contracting law.

Furthermore, and in addition to the defined term of the "offer", the Federal Circuit has also defined the term "sale". By the courts interpretation, the term "sale" suggests the existence of a transaction, but it does not include whatsoever the definitions of a gift, or a donation or of a free transferring.[161] As a result to this definition, in the context of the CAD file, the Patent Owner would be able to proceed in suing for an infringement claim, only if the specific CAD file is related to an economic trading of any short resulting to a sale (or an offering to sell). This commercial trading would have to be between, the CAD File Holder to a possible

[156] Patent Act 15 U.S.C. §271(c) (2017) <https://www.uspto.gov/web/offices/pac/mpep/mpep-9015-appx-l.html> accessed 30 October 2018
[157] Ibid. Note 39, p. 62
[158] Timothy R. Holbrook, 'Liability for the Threat of a Sale: Assessing Patent Infringement for Offering to Sell an Invention and Implications for the On-Sale Patent Ability Bar and Other Forms of Infringement' [2003] 43(3) Santa Clara Law Review <https://digitalcommons.law.scu.edu/lawreview/vol43/iss3/3/> accessed 5 November 2018, Lucas S Osborn, 'The Leaky Common Law: An "Offer to Sell" as a Policy Tool in Patent Law and Beyond' [2013] 53(1) Santa Clara Law Review <https://digitalcommons.law.scu.edu/cgi/viewcontent.cgi?article=2744&context=lawreview> accessed 5 November 2018
[159] Ibid. Note 39, p. 62
[160] Ibid. Note. 157 Lucas S Osborn, 'The Leaky Common Law: An "Offer to Sell" as a Policy Tool in Patent Law and Beyond' [2013] 53(1) Santa Clara Law Review
[161] Ibid. Note 39, p.62

disseminator/end-user.[162] The challenge presented in the above analyses is quite clear. In the case that the CAD File Holder decides in further disseminating or merely hosting the CAD files in an online CAD file sharing platform and gives access to end-users to freely download those files, then the definition of "sale" given by the court would have no substance. Thus, the Patent Owner might find the situation of accusing and holding an individual liable for contributory infringement quite difficult if the above scenario takes place.[163]

4.3.2 The perception of a CAD file as a component of a patented invention

Throughout the thesis it has been a common pattern that the law and subsequently the courts lack to specifically categorize and define what constitutes a CAD file. As it was previously mentioned, under section §271(c), the second requirement to establish a contributory 'indirect' infringement is that a component of a patented machine is being sold, or offered to sale, or imported into the U.S. territory. Under this scope, the CAD file must be perceived as a 'component of a patented machine' in order for the Patent Owner's claim of contributory infringement to have a substance. It has been supported by relevant literature,[164] that a CAD file as such can only be perceived as a predecessor of the physical embodiment of the 3D Printed creation. Thus, it might be a challenging idea for the Patent Owner to try to sue for contributory infringement by supporting the argument, that a CAD file is directly correlated with the definition of a 'component'.

A component is commonly considered as a segment of a bigger machine, arranged out of numerous parts, structured to operate as a whole.[165] It can be reasoned, that since the actual CAD file is not included in the final product of a 3D Printed object, then it cannot be considered as a component of the "bigger machine". From the above definition of what constitutes a component, is distinct that in order for a part to be considered a component, it has to be included in the production of the final operative system of the object.

Against this background, there have been numerous cases as will be discussed below, where different kinds of components can have a digital character. Undeniably, a CAD file is

[162] Ibid. Note 39, p.62
[163] Ibid. Note 44, p. 1347
[164] Ibid. Note 44, p. 1347 – 1348, Note. 39, p. 63
[165] Ibid. Note 44, p. 1347-1348

the digital "embodiment" of the intended 3D Printed creation. Thus, a CAD file can be directly correlated with a software code, since it is a design made in this algorithmic environment. Specific litigation has contributed to this argument by supporting the idea that certain digital elements can constitute what is presented in the statute of law as a "component".[166] Specifically, the Court held that the software in itself cannot be considered as a "component" per se, however it is assessed that the software code embedded in a "medium"[167] can be perceived as such. In the CAD file context, since the digital file is considered as a mean (such as the software) provided in a medium to ultimately 3D Print the object then, the CAD file can be considered as a "component" in that sense.[168] Other industries have supported this idea by recognizing that many elements from icons on computer monitors[169] to suppositional chemical structures[170] and Very-large scale integration designs (VLSI)[171] can be perceived as components to their bigger structures. Hence, contributory infringement may be supported and established to court if the CAD file is perceived and recognized as a digital "component".

Chapter 5 – Conclusion

5.1 Venus Equilateral and the era of duplication

"Treasure? Of what use could treasure be in this day and age? With the Channing-Franks Matter Reproducer, gold or any rare element could be synthesized by merely introducing the proper heterodynamic signal…. A treasure trove was ridiculous. Of absolutely no value".[172] George O. Smith as early as the 1940's has imagined an 'era of duplication' where the mass-produced manufacturing devices have displaced the entire intergalactic manufacturing industry. Even though the entire interstellar mass-manufacturing industry might

[166] Microsoft Corp. v. AT&T Corp., 550 U.S. 437 (2007) <https://supreme.justia.com/cases/federal/us/550/437/> accessed 5 November 2018
[167] Ibid. Note 44, p. 1350
[168] Ibid. Note 39, p. 64
[169] MPEP § 1504.01(a)(I)(A) [R-08.2017] *"The USPTO considers designs for computer generated icons embodied in articles of manufacture to be statutory subject matter eligible for design patent protection under 35 U.S.C. 171."* <https://www.uspto.gov/web/offices/pac/mpep/s1504.html> accessed 2 February 2019
[170] High throughput Discovery, Battery High Throughput Workflow, Wildcat Discovery Technologies <http://www.wildcatdiscovery.com/fileadmin/user_upload/wildcat_high_throughput_worflow.pdf> accessed 5 February 2019
[171]For example: Anand Raghunathan, Sujit Dey, Ganesh Lakshminarayana, Niraj K. Jha. (1998) *Constrained register sharing technique for low power VLSI design*. US Patent: US6195786B1 <https://patents.google.com/patent/US6195786> accessed 5 February 2019
[172] George O. Smith, The Complete Venus Equilateral (Del Rey 1980)

not be in danger as of yet, from the above analysis one might conclude that the 3D Printing industry is starting to become a very prominent issue for the respective Patent Owner and his interplanetary future inventions.

With that said I hope this thesis will intrigue the reader, to further examine the reverberations of such a disruptive technology and prompt the later to use not only the 3D Printing science, but every contemporary- experimental or not- technology, with an always open and critical mind.

Even though the field of 3D Printing it is not to be considered as a new discovery as such, it has still a broad spectrum of issues that are yet to be considered from a patent law perspective. Under the U.S Patent Act, there are different options, that the Patent Owner can claim his legally obtained patent rights over his creation. Nevertheless, the U.S litigation "repository" related to 3D Printing issues as such is very limited, hence failing to assist in the expansion of protection that a Patent Owner might seek.

U.S patent law in its present fashion and manner and due to its historical background mainly regulates tangible objects and 3D Printing through the use of CAD files, challenges the idea of tangible and intangible in its very essence. As already analysed, with the press of a simple button an individual can create instantly an object just from owning the relevant CAD files. Since the tangible and intangible are so closely correlated in this process, it can only be considered a sensible procedure, to produce new statutes of law and amend the current ones to fit such a particular technology. The U.S Patent Act provides different procedures which the Patent Owner may follow to enforce his rights such as direct and indirect infringement but the outcomes of either such a choice might produce very ambiguous and uncertain results. Due to the fact that CAD files are a digital representation, hence the predecessor of an actual object, it is yet uncertain if patent claims can be formulated to protect them. The U.S Supreme Court has made a "dent" in the current absence of sufficient litigation and attempted to clarify the scope and feasibility of having a patentable software program, which is considered the most closely related element to a CAD file.[173] However, even though many cases following the court's decision have proved why certain software claims cannot meet the patentability conditions, the area of patentability of a CAD file software is yet to be clarified.[174] Another distinct area that

[173] Ibid. Note 72

[174] Jim Singer, 'Patent-eligibility after Alice: a summary of decisions that found software inventions eligible for patenting' (IP Spotlight, 25th November) <https://ipspotlight.com/2014/11/25/patent-eligibility-after-alice-a-summary-of-decisions-that-found-software-inventions-eligible-for-patenting/> accessed 5 November 2018

has to be defined, is the entity which the Patent Owner would hold accountable for and enforce upon his patent rights. The choices are plenty and unclear since the Patent Owner could form an infringement claim either against the CAD File Holder or a 3D Printing Business entity. Nevertheless, under the existing U.S patent law an infringement claim of such nature might not count to the benefit of the Patent Owner. Thus, it is deemed as necessary to develop a new regulation to frame the needs of CAD files and thus 3D Printing or reforming the current Patent Act to protect the owner's rights.

Different methods of regulating 3D Printing have been proposed and discussed all of which amount to the conclusion that none of the current statutes of law suffices to protect the Patent Owner's rights. Some of the suggested actions include, the amendment to the Patent Statute to contain an exception to infringement for the actions concerning the use of CAD files and 3D Printing,[175] or the creation of a notice-and-takedown rule similar to the Digital Millennium Copyright Act ("DMCA").[176] It is further proposed that the Congress may act, by amending the DMCA to also include the Patent Act. Thus, the proposed DMCPA would assist in the enforcement of the amended notice-and-takedown regulation and will aim at the CAD file sharing platforms holding them liable for contributory infringement.

A consideration that the Congress would have to make is the range of the 3D Printing Technology. 3D Printing cannot be limited only to the borders of the U.S territory. The application of the notice-and-takedown rule would not be able to address the international character of the technology since it would not be applicable beyond the U.S borders and the transborder flow of 3D Printing data. Certain legislative propositions to address the above issue included, the Stop Online Piracy Act ("SOPA") and the Preventing Real Online Threats to Economic Creativity and Theft of Intellectual Property Act of 2011 ("PIPA"). However, even though these legislations regulated the entrance of digital copyrighted works via electronic transmission from around the world they did not issue anything concerning the patentable subject matter.[177] Another legislative proposal called Online Protection and Enforcement of

[175] Deven R. Desai, Gerard N. Magliocca 'Patents, Meet Napster: 3D Printing and the Digitization of Things' [2014] 102(1691) The Georgetown Law Journal 1713 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2338067> accessed 5 November 2018

[176] The Digital Millennium Copyright Act of 1998, U.S. Copyright Office Summary <https://www.copyright.gov/legislation/dmca.pdf> accessed 5 February 2019

[177] Michael A carrier, 'SOPA, PIPA, ACTA, TPP: An Alphabet Soup of Innovation-Stifling Copyright Legislation and Agreements' [2013] 11(2) North western Journal of Technology and Intellectual Property 21, 22, <https://scholarlycommons.law.northwestern.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1179&context=njtip> accessed 5 November 2018

Digital Trade Act ("OPEN"), allowed the United States International Trade Commission ("ITC") to have jurisdiction across digital importation into the U.S to further protect the rights of the Patent Owners while preserving the existing "freedom" of information to the internet. Although none of the above legislation proposals passed, OPEN's main principles can be further used to regulate the infringement of patents in 3D Printing technology. Under the above legislation the Patent Owner would be able to enforce his rights against infringers of his patented creation and further establish the findings of future cases such as the 'In re Certain Digital Models'.[178]

In conclusion, the current U.S legal framework is not considered adequate enough to establish the precise guideline that will regulate sufficiently CAD files and the 3D Printing technology. Nevertheless, the basis in which a new proposed regulation might be based upon is undeniably already in place as patent law has always been very adaptable to new technologies and well constituted. Accordingly, it would be a more reasonable concept to depend entirely on the proceeding case law, in which there will be case-by-case scenarios to approach these issues and define the direction in which the courts will have to deal with the disruptive technologies called CAD files and 3D Printing.

[178] In re Certain Digital Models, Digital Data, & Treatment Plans for Use in Making Incremental Dental Positioning Adjustment Appliances, the Appliances Made Therefrom, and Methods of Making the Same, Inv. No. 337-TA-833, USITC Pub. 2013-18437, (2014) (Final) <http://www.itcblog.com/images/Digital-Models-Commission-Opinion-lowres-10Apr14.pdf> accessed 5 November 2018
"The case provided clarification concerning whether by importing digital data articles could establish a patent infringement and if it is possible for the patent owner to have patent protection for digital representations of physical products."

Abbreviations

3D – Three-Dimensional Printing

CAD – Computer Aided Design

DMCA – Digital Millennium Copyrights Act

DMCPA – Digital Millennium Copyright and Patent Act

ITC – United States International Trade Commission

OPEN – Online Protection and Enforcement of Digital Trade Act

P2P- Peer-two-Peer

PIPA – Preventing Real Online Treats to Economic creative and theft of Intellectual Property Act of 2011

SOPA – Stop Online Piracy Act

TRIPS – Agreement on Trade-Related Aspects of Intellectual Property Rights

U.S – United States of America

U.S.C – United States Code regarding Patent Law

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