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3D printing as a challenge for patent law in Europe

Legal and practical limits, and practical chances for rights holders

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Abstract. The costs of 3D printing have been falling for some time, and are expected to decrease even further in the near future. This development will enable a growing number of users to reproduce objects on the basis of computer-aided design (CAD) files. This will also apply to products protected by patents. After a short introduction to the technical background of 3D printing, the paper focuses on the current legal regime under German and European law, and its limitations. This part includes considerations about the ‘European Patent with Unitary Effect’ which is expected to come into force within the next few years. In its last part, the paper deals with possible alternative solutions to the new challenges, and reflects on the role of patent law in times of 3D printing.

Kurzzusammenfassung. 3D-Drucker werden immer preisgünstiger. Dies ermöglicht es einer wachsenden Gruppe von gewerblichen und privaten Nutzern, mithilfe digitaler Druckvorlagedateien (sog. CAD-Dateien, engl. computer-aided design) Objekte herzustellen. CAD-Dateien können, ähnlich wie Musikdateien, unendlich oft vervielfältigt und im Internet verbreitet werden. Es lässt sich praktisch nicht verhindern, dass Nutzer mit 3D-Druckern auch Erzeugnisse herstellen, die Gegenstand von Patenten sind. Der Aufsatz führt zunächst kurz in die technischen Grundlagen des 3D-Drucks ein und untersucht sodann die Antworten des geltenden deutschen und europäischen Rechts, einschließlich des in naher Zukunft in Kraft tretenden „Europäischen Patents mit einheitlicher Wirkung“ (Einheitspatent), auf die mit dem 3D-Druck einhergehenden Herausforderungen. Im Anschluss daran werden die Grenzen des geltenden Rechts beleuchtet. Am Ende werden Lösungen auf rechtlicher und praktischer Ebene untersucht, mit denen den Herausforderungen begegnet werden könnte. Dabei wird auch die Rolle des Patentrechts im Zeitalter des 3D-Drucks kritisch beleuchtet.

Introduction

3D printing is one of the most relevant technical developments of the recent past. The costs for the printers themselves, as well as for the materials, have fallen, so that a growing number of private users have access to 3D printing [1]. This imposes challenges to Intellectual Property Law, as does digitalization in general [2, 3]. By means of 3D printing, more and more users are able to manufacture products which are protected by IP laws [4]. In many industries, the distribution of 3D printing will change the traditional chain of production, reaching from design and manufacture of the product and its distribution until the consumption by customers [3]. Following that, many consumers will manufacture products themselves at home or have them produced by 3D printing shops or services [2]. This paper focuses on the challenges 3D printing imposes to patent law. The first part introduces the technical background of 3D printing. Afterwards, its relevance under the current patent law regime is discussed. On that basis, the limits of the current legal framework are analyzed, followed by a discussion of several possible solutions.

Technical background of 3D printing

3D printing is a general term for different processes for producing three-dimensional objects from specific materials which are applied to a platform layer by layer until they form a solid object [5]. A more precise term for it is *additive manufacturing* [4]. The template for the printing process is the so-called *Computer-aided design* (CAD) file which contains all necessary information. These files can be newly designed by users, either with the help of specific software or by 3D scanning an existing object [4]. In addition, CAD files can be downloaded from the internet, especially from specialized online platforms [6]. Not only traditional industrial materials such as metals [7], but also food or living cells can serve as material in the production [3]. A recent highlight was the production of chocolate which could be designed by customers online, according to their individual taste [8]. More complex 3D printers have been used in several industries already for decades. Meanwhile, more versatile and cheaper printers are finding their way to private households [3]. Furthermore, professional 3D printing shops and services are sprouting out of the ground, offering their services to customers.

Relevance of 3D printing for the current patent law

Overview: The three types of patents. Under the current legal framework, technical inventions can be protected by two types of patents in Germany: the traditional *national patent* under the German Patent Act (Patentgesetz, PatG) and the *European patent* on the basis of the European Patent Convention (EPC). Despite its name, the European patent only grants protection for particular states, which are chosen in the application (thus, it is often referred to as a *bundle* of national patents) [9]. In the near future, a third type of patent will be available: the European patent with unitary effect (also known as *unitary patent*). It will protect inventions in the entire territory of those EU Member States participating in the new system [10]. Its legal basis is mainly the so-called patent package, consisting of two EU regulations (the Regulation (EU) No 1257/2012 of 17 December 2012 implementing enhanced cooperation in the area of the creation of unitary patent protection (EPUE-Reg) and the Regulation (EU) No 1260/2012 of 17 December 2012 implementing enhanced cooperation in the area of the creation of unitary patent protection with regard to the applicable translation agreements (EPUET-Reg)) and the international Agreement on a Unified Patent Court (UPCA). The latter still needs to be ratified by a minimum number of Member States, which is required to set the whole system into force [11]. Although the realistic scenario of Great Britain withdrawing the EU (“Brexit”), it can be expected that the unitary patent system will come into force within the course of the next years.

National patent, using the example of the German patent. In the context of 3D printing, direct infringement falls under § 9 s. 2 no. 1 PatG which refers to objects. According to this provision, only the patent holder is allowed to use the patented invention, meaning that third parties are not allowed to manufacture a product which falls under its subject-matter, nor to put such a product into market. The indirect infringement falls under § 10 PatG. It will be presented later in the context of CAD files.

In the context of 3D printing, several acts take place. The most important ones will be examined in the following sections.

Manufacture and distribution of an object. The reproduction of a patented object which is subject-matter of a patent by means of 3D printing is a manufacture of that product in the sense of § 9 s. 2 no. 1 PatG and therefore a direct use of that patent, unless the end product differs from the original product technically to a relevant extent [4]. If it is not allowed, it indicates a direct patent infringement. However, if the production takes place in a private environment for non-commercial use, it is legal (§ 11 no. 1 PatG). This exception theoretically allows for the production of an unlimited number of specimen [6], which can be relevant in case of wear parts. Both prerequisites need to be fulfilled [1]. The private area is limited to the personal surrounding and the personal need of the acting person or related persons [12], e.g. in the home environment or during leisure activities [6]. This means that, if it serves the personal need, users can even be allowed under § 11 no. 1 PatG to have patented products manufactured by a third party [6].

The prerequisite of non-commercial use excludes uses that aim at earning something in return [6]. Generally, it is even non-commercial if the product is handed over to somebody else after a period of private use without consideration. In contrast, handing it over in return for payment is more problematic. Some scholars consider this as a commercial use [1]. However, given that after a period of private use the product is a used product, one rather needs to consider additional circumstances of the individual case [cf. also 13], e.g. whether such products are forwarded in a similar manner repeatedly [1].

However, professional printers that manufacture patented products for other persons (“manufacturing on demand”) may directly infringe patents by this behavior (cf. Düsseldorf Higher Regional Court, InstGE 7, 258 – Loom-Möbel).

Actions in relation to CAD files. On the one hand, there is the creation of a CAD file and its distribution. On the other hand, there is the download of an existing CAD file. The *creation* of a CAD file needs to be distinguished from its distribution, e.g. uploading it to an online platform or forwarding it to individual persons, e.g. by email. The creation is a mere preparatory action which is irrelevant under patent law [14]. However, the distribution may infringe patents. It is not a direct infringement in the sense of § 9 s. 2 no. 1 PatG, as this rule does not cover the spread of information, according to the general principle that patent law does not aim at preventing the exchange of information [12]. That means that also providers of online platforms do not directly infringe patents [similar 8].

However, the *distribution* of the CAD may be an *indirect* infringement under § 10(1) PatG [6]. According to § 10(1) PatG, the patent shall further have the effect that any third party shall be prohibited, in the absence of the consent of the proprietor of the patent, from supplying or offering to supply, within the territorial scope of the PatG, persons other than those entitled to exploit the patented invention with means relating to an essential element of the invention for use within the territorial scope of the PatG if the third party knows or if it is obvious from the circumstances that those means are suitable and intended for using that invention. Uploading a CAD file is an *offering to supply* [4], while forwarding it to specific recipients rather falls under the alternative term *supplying*. The most difficult issue is whether a CAD file is a means within the meaning of § 10(1) PatG. Traditionally, the term was interpreted as being limited to material things, such as descriptions or construction plans in paper form [6]. The issue arises whether the term also covers the immaterial, *digital* CAD files. The mere wording rather speaks in favor of limiting the term to material things, as it has a material connotation, especially in the context of the prerequisite of supplying it and of the official heading of § 10 PatG (“Prohibited *use* of means”). Furthermore, instead of choosing the term *use*, the legislator could have chosen the mere description that use of the patented invention is “facilitated” or “made possible”.

However, a teleological interpretation argues against limiting the scope of application to physical objects. With increasing digitalization, the classical concept of forwarding or sending construction plans etc. in printed format will be more and more replaced by the digital distribution as files. This allows for a quicker check of the plans and even the simultaneous collaboration on a draft, e.g. by using cloud computing. Even with regard to 3D printing in particular, a virtual file is much more practical and dangerous from the rights holder’s point of view, than is a hard copy whose transformation to the corresponding material object would be more complex [4]. CAD files may be forwarded to many other persons at the same time and therefore enable simultaneous mass infringements of IP rights, making it even more difficult to find every single direct infringer [12]. This makes claims (e.g. the cease and desist claim, § 139(1) s. 1 PatG) practically useless in many cases. But the rationale of § 10(1) PatG is to close protection gaps of § 9 PatG [18]. It is often easier and cheaper to trace indirect infringers [1]. Accordingly, § 10 PatG extends the protection to earlier stages, before a direct infringement actually has taken place [1]. This is also relevant for files, leaving no room for privileging their digital distribution [14], especially in times of rapidly advancing technologies [6]. Therefore, the term “means” in § 10(1) PatG should be interpreted in a contemporary understanding that covers files in general and CAD files in particular [17]. Plus, this should not be

limited to files which can control machines, as it has been discussed among scholars [see 1]. It remains to be seen whether jurisdiction will follow this understanding [12].

Also, the other prerequisites are satisfied in cases of uploading or forwarding CAD files. The file *relates to an essential element of the invention*, as the means does not need to become an element of the produced object itself, nor to have a technical function in it nor to even be capable to have such a function [12]. This interpretation is not only supported by the wording which only requires a *relation to the invention*, but also by teleological considerations again: a contemporary interpretation requires a broad understanding, actually corresponding with the term measure, as files can, following their digital nature, never be an element of nor have a technical function *in a – material – object*. Following this interpretation, a CAD file relates to an essential element of the specific invention, since it contains all parameters of the object and is the basis for the production of the latter, making it one necessary condition for the material existence of the object [6].

Moreover, the third party *knows* that the CAD file is suitable and intended for using that invention if the potential use for the manufacture of the product in question by means of 3D printing is advertised [6], e.g. by naming it accordingly. But anyhow, it is sufficient if it is *obvious from the circumstances* that those means are suitable and intended for using the invention. As a CAD file allows for the reproduction of one specific product, it is a sufficient circumstance if the product in question is patented [6].

However, if the CAD file is forwarded gratuitously and to related persons only, this may be allowed by § 11 no. 1 PatG [4]. In contrast, uploading it to the internet never falls under § 11 no. 1, as it leaves the private area [12].

The *download* of an existing CAD file from the internet, e.g. from an online platform, is a mere preparatory action for the reproduction of the product. However, if the download is followed by further dissemination of the file, this needs to be treated as the distribution of a self-made CAD file on a patented invention (see above) [disagreeing 25].

Providing an online platform for CAD files is not even an indirect infringement [disagreeing 42]. Even with the contemporary interpretation, a platform – as the mere infrastructure for the distribution of CAD files by others – is no means in the sense of § 10(1) PatG. Moreover, the platform itself does not relate to an essential element of the invention [disagreeing 25]. Also, it usually cannot be stated that the third party knows nor that it is obvious from the circumstances that the platform is suitable and intended for using that invention, except for platforms which are explicitly specialized in CAD files referring to products which fall under the subject-matter of patents and do not aim at distributing neutral CAD files.

European patent. While the EPC contains some material rules on the European patent, its specific properties follow the national laws of the different states that the European patent was granted for (Art. 2(2) EPC) [9]. Thus, the German part of a European patent is treated under German national law, making the results from above valuable also for it. However, other national laws differ from German law in some aspects, e.g. some do not have an exclusion which compares to § 11 no. 1 PatG [3], possibly leading to different results for these parts.

European patent with unitary effect (Unitary patent). According to Art. 5(3) EPUE-Reg, the scope of protection of the unitary patent and its exceptions follow the law applied to Unitary patents in the participating Member State whose *national* law is applicable to the Unitary patent as an object of property in accordance with Art. 7 EPUE-Reg. This complicated referral includes, inter alia, Art. 25 et seq. UPCA which will be implemented into national law by the Member States participating in the Unitary patent system (see Art. 84(2) UPCA) [19]. Art. 25 UPCA regulates the direct use of the patent, Art. 26 the indirect use. Art. 27 UPCA defines exceptions of patent protection. These provisions are consistent with the German §§ 9, 10 and 11 PatG [21]. For instance, Art. 27 lit. a UPCA conforms with § 11 no. 1 PatG almost wordingly. At first glance, the previous results on the German law could be directly applied to the Unitary patent. However, the new *Unitary Patent Court* (UPC) will be responsible for the Unitary patent. The UPC will be a court common to the Contracting Member States (Art. 1 UPCA), with multinational instances (cf. Art. 8 et seq. UPCA), ensuring an autonomous interpretation of the provisions independent from national legal traditions of single

Member States. Furthermore, as Art. 5(3) EPUE-Reg is an incorporating referral, Art. 25 et seq. UPCA need to be interpreted in accordance with European Union law although it stands outside EU law itself, as mere international treaty [19]. Therefore, decisions of the European Court of Justice (CJEU) that touch specific terms must be respected [19]. Thus, on the one hand, it is possible that the UPC will interpret Art. 25 et seq. UPCA as proposed above for German law. On the other hand, completely different interpretations are possible as well [cf. 21].

Limits of the current legal framework

The increasing distribution of 3D printing, especially among consumers, challenges patent law and shows its limits [3]. First, the legal framework is limited, as many inventions are not protected by patent law, either due to the high prerequisites for patentability or because of the expiry of the term of the patent (20 years, see e.g. § 16 PatG) [23]. The latter is of course no specific phenomenon of 3D printing. But as discussed above, even the use of patented invention is often irrelevant under patent law. The underlying reason is that infringing actions are split-up into several partial acts that are per se no use of the patent and therefore no infringement [12]. This is due to the complexity of the 3D printing “society” with its many participants, e.g. creators of CAD files, online platform providers or private households with 3D printers. But even the enforcement of existing legal claims (cf. § 139 PatG, resp. Art. 63(1) and Art. 68(1) UPCA) is hampered by *practical* factors [3]. First, tracing direct infringers in the digital world is difficult and expensive [24], especially given the rapid and cheap distribution of CAD files [15]. Second, many potentially relevant acts happen in the private area which is not observable [12]. Inspection proceedings in private households would be too complex, its legal possibilities limited [12]. Third, even after having traced a single infringer, the legal enforcement is difficult, especially in case of European patents, as parallel lawsuits in different states may be necessary [3].

With regard to patent law, 3D printing has a revolutionary effect: it levels the threshold between digital and material world which had been a protective factor for patents for a long time, even in times of increasing digitalization which had confronted copyright law with mass infringements for already about two decades [26].

Possible solutions

Legal solutions. In order to meet the challenges imposed by the digital world, only supranational legal solutions, e.g. on the European level, make sense at all [2].

Tightening up the exception under § 11 no. 1 PatG, resp. Art. 27 lit. a UPCA. One possible solution is the introduction of a numerical limitation to the provision in § 11 no. 1 PatG, resp. Art. 27 lit. a UPCA, following the example of § 53(1) s. 1 of the German Act on Copyright and Related Rights (Urheberrechtsgesetz, UrhG), which allows for “single copies of a work” only. This could be complemented by a temporal component in order to take into account the specifications of wear parts. The development of concrete numbers and case groups could be left to judicial decision. But tightening up the legal framework is not a sufficient answer to the already existent *practical* difficulties of § 11 no. 1 PatG, resp. Art. 27 lit. a UPCA [12]. Last, general considerations speak against such an approach [12]: especially in case of wear parts, consumers may reproduce the product in question very often. This does not change the private and non-commercial nature of this use, though. If the existent prerequisites of § 11 no. 1 PatG, resp. Art. 27 lit. a UPCA are interpreted contemporarily, the rule can sufficiently balance the interests of rights holders and the public, which is the legislator’s initial position that must be respected [12]. Thus, the provision is an example of this general objective of patent law. Patents, as industrial property rights, aim at protecting technical inventions in commercial environments, not at constraining the private, non-commercial area [1].

Retroactive flat-rate for 3D printers. Also, a retroactive flat-rate for 3D printers, as in § 54(1) UrhG, is not an appropriate solution. First, the provision proved disadvantageous already in copyright law (difficulties in defining the exact rate; only little benefit for the individual rights owners, especially in case of significant and popular works), which would also apply to patent law [12].

Second, the flat is enforced by the so-called *collecting societies*. These societies do not exist in patent law. The effort of introducing them here would be unjustifiable, given the above-mentioned disadvantages [12].

Extension of provider liability. Several scholars have discussed an extension of the liability of providers of online platforms for CAD files [27]. Specific jurisdiction on that matter is still lacking [18] but the issue compares to the liability of providers of file sharing services which has been relevant, *inter alia*, under copyright and trademark law for many years [12]. Under German law, provider liability derives from the general § 1004 of the German Civil Code (Bürgerliches Gesetzbuch, BGB) or the universal safety obligation [12]. The results of that discussion can be transferred to this context [12]. A patent infringement by a third party is a predicate offence which can form the basis of liability of the provider of the online platform where the CAD file was downloaded from [12]. Provider liability lies in an area of tension between the Directive 2004/48/EC on the enforcement of intellectual property rights (Enforcement Directive) and the Directive 2000/31/EC on certain legal aspects of information society services, in particular electronic commerce, in the Internal Market (E-Commerce Directive) [28]. While the Enforcement Directive aims at facilitating the direct enforcement of claims against intermediaries, the E-Commerce Directive privileges new business models in the internet [28]. According to that, Art. 14 et seq. of the E-Commerce Directive restricts liability of platform providers [28]. Art. 14 of the E-Commerce Directive was implemented into German law by § 10 of the German Telemedia Act (Telemediengesetz, TMG) [29]. Providers of online platforms fall under the scope of application of this provision, as they store content for others. According to § 10 s. 1 TMG, service providers shall not be responsible for the information of third parties which they store for a recipient of a service, as long as they have no knowledge of the illegal activity or the information and, as regards claims for damages, are not aware of any facts or circumstances from which the illegal activity or the information is apparent (no. 1), or upon obtaining such knowledge, have acted expeditiously to remove the information or to disable access to it (no. 2). Service providers shall not be responsible for their own information which they keep ready for use, in accordance with general legislation, and are not required to monitor the information stored by them or to search for circumstances indicating an illegal activity (§ 7(1), (2) s. 1 TMG). But, once rights holders have *made them aware* of a patent infringing file that was uploaded to their platform, providers need to remove them or to disable access to them if they want to avoid liability, as stated in the above-mentioned § 10 s. 1 no. 2 TMG [18]. Uploading infringing CAD files, as an indirect patent infringement, is sufficient on the basis of a contemporary interpretation, since § 10 s. 1 TMG requires only an “illegal activity”. § 10 s. 1 TMG follows the example of the *notice and take down* model under US law [28]. But neither the E-Commerce Directive nor the TMG provide details on the necessary form and content of such a notice to the provider – unlike the copyright-specific § 512(c) U.S. Copyright Act [30]. Furthermore, the exact relationship between provider liability and §§ 7 to 10 TMG (resp. the underlying Arts. 12 to 15 of E-Commerce Directive) is unclear, as is the question of which claims shall be covered (e.g. only claims for damages or also injunctive reliefs [31]) [28]. This should generally be decided by the national or EU legislator, as it has already been discussed for other fields of IP law [30], in order to increase legal certainty [28]. However, provider liability should not be extended [24]. In an increasingly digitalized environment, intermediaries such as online platform providers play an important role in the development of new ways of manufacture and distribution [3]. Society, as well as rights holders, may benefit from that in the future [28]. Thus, they should not be prevented. Therefore, the classical conflict of interests which underlies patent law in particular and IP law in general should not be unilaterally unbalanced to the benefit of rights owners [3].

Interim result. 3D printing overcomes traditional borders between the digital and the material world [12], which confronts patent law with problems that have been well-known to other fields of IP law, such as copyright law, for many years already [3]. Nevertheless, the current legal framework is sufficient to meet these challenges appropriately [12]. Thus, tightening the legal framework is not necessary and should be avoided [12]. Instead, a contemporary interpretation of the current provisions is recommended [18].

Practical measures for rights holders. Rights holders should take more responsibility for the enforcement of their own interests and also think outside the box of (patent) law.

Additional protection by other IP laws. Patent holders should try to have their products and construction plans protected also by other IP laws, such as trademark, design and copyright laws [3] whose differing properties may be advantageous in the individual case. For instance, if a construction plan gets protected by copyright law, the reproduction and distribution of them in the form of CAD files is prohibited to others without their permission [see also 14]. However, also for other IP laws, protection is limited by legal exceptions (e.g. the above-mentioned § 53(1) s. 1 UrhG) and by similar practical factors that hamper enforcement in times of digitalization [3].

Extra-legal measures. Rights holders should therefore use extra-legal, practical measures, ranging from technical protection measures to a radical change of perspective towards a collaboration with private users [3]. The main example for technical protection measures are digital rights management (DRM) systems, which are common in copyright law [3]. Several methods have already been developed, e.g. one which checks whether the user is entitled to produce the object before the 3D printing process starts [32]. But experience has proven technical protective measures inefficient, as most of them can be bypassed [33]. Furthermore, generally speaking, using them is, like tightening the legal framework, another attempt to fight the technical developments, which will fail in the end.

Instead, a change of perspective is the preferable answer to the challenges of 3D printing. Rights owners should embrace the technical developments and the increasing participation of third parties in the manufacture of their products as a chance. This would be a welcome development also from the costumers' point of view. *Bechtold* proposed some measures recently, of which three shall be named here, as being fruitful concepts [see 3]. First, patent holders could become more active in selling raw material for printing to customers or 3D printing shops, e.g. powder for specific products [3]. Second, they should even outsource a part of their production to professional 3D printing shops or services in the particular customer's neighborhood [2]. Third, this could be connected with even embracing the creativity of end users. They could be participated in the design of the end product which would benefit both sides and even increase customer loyalty towards particular companies [3].

Moreover, it must be mentioned that 3D printing can play a crucial role in open source hardware projects, allowing for the manufacture of hardware on the basis of freely and legally available CAD files. This may be useful in development cooperation.

In the long run, probably *flat rate* models will spread, where customers can legally download CAD files from databases run by providers who cooperate with rights holders [see e.g. 34]. If the price is moderate, users may be less incited to illegal downloads of CAD files, as this is always connected with a certain risk of "getting caught" and of accidentally downloading malware [33]. Legal suppliers may exist side by side with patent infringing suppliers [35].

Conclusion

The distribution of 3D printing is a challenge for patent law. However, this does not question the justification for its existence [35]. Rather rights owners must embrace the technical developments. An interaction of patent protection and new business models could balance the conflicting interests of rights owners and the society and lead to new cooperations [3], and is therefore a great opportunity for innovations in the future.

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