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Intellectual Property Protection of Product Design

Yin Jin

Shanghai Maritime University, Haigang Road of N. 1550, Shanghai, 201306, China

Abstract: Product design will produce a series of knowledge achievements including design scheme and design process, and these knowledge achievements can be converted into legal protection of intellectual property rights under the premise of meeting the legal conditions. The protection mode of product design core results is divided into three types. The typical batch products are mainly protected by design patent. The products with high artistic creativity are mainly protected by copyright; The products in between take design patent protection as the main protection and copyright protection as the backup means. The results of the design process are mainly trading secrets protection.

Keywords: Product Design; Intellectual Property; Design Patent; Copyright; Design.

1. Introduction

The value of a designer's work lies in the design outcome, and the economic realization of this outcome depends on the intellectual property protection system [1]. Although there has been some research on intellectual property within the design field, systematic studies and targeted practice guidelines remain limited. This paper aims to address this gap by focusing on product design, undertaking a comprehensive and systematic analysis of intellectual property protection in this area. It will identify intellectual property aspects throughout the product design process and propose protection strategies. Typical cases will be analyzed to offer practical references for intellectual property practice in product design.

2. Intellectual Achievements in Product Design

Product design encompasses a wide range of mass-produced items, including everyday necessities, public goods, machinery, equipment, and vehicles. In a broader sense, product design also includes handcrafted items and jewelry. Designers in this field must take into account various factors such as production, distribution, usage, and recycling [2] to develop functional and appealing product forms or service models.

The product design process typically consists of three stages: design research, design development, and design commercialization [3].

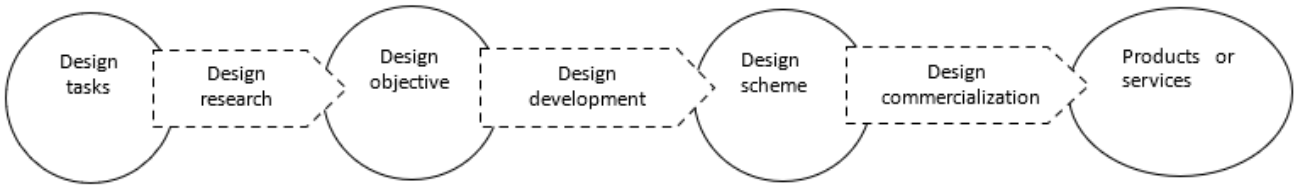


Figure 1. Product design process

2.1. Design Research Stage

The design research stage is the stage of conceptualizing design tasks. After receiving product design tasks, designers need to conduct various research and analysis. Designers will conduct research on clients - analyzing their development strategies, enterprise management, production and manufacturing, marketing, brand image, and other related situations. Conducting research on clients helps to comprehensively and accurately understand their design needs; Designers will conduct targeted market research - researching market trends, competing products, existing business models, existing technologies, existing designs, etc. Understanding the market can help find innovative directions; Designers also need to conduct research on users - to understand the needs, habits, hobbies, living environment, and other information of the target group. Understanding users can help uncover their true needs. Through various surveys and analyses, the design tasks proposed by clients will be detailed and standardized, and the design tasks will be transformed into specific design goals.

2.2. Design Development Stage

The design development stage is the conceptual visualization stage of the design objective. In this stage, designers commence the implementation of design practices aligned with the design objective and translate it into a specific scheme. Designers are required to conduct in-depth user analysis to establish a user model, which serves as an ongoing evaluation tool for the rationality of the design scheme. During conceptualization, designers generate numerous sketches that document their creative process and continue to inspire subsequent designs. Through ideation, designers identify several potential directions for design development, refine them, and formulate a preliminary plan. The preliminary scheme encompasses comprehensive modeling and technical implementation schemes and can be presented through various mediums such as renderings, engineering drawings, and prototypes.

The preliminary plan necessitates thorough designing and evaluation by comparing and screening from market perspectives, user considerations, production aspects, costs involved among others; ultimately selecting the most suitable

plan for further enhancement leading to the formation of the final plan. The final scheme includes the perfect design scheme and technical scheme, among which the design scheme focuses on the product modeling and human-computer interaction function, mainly reflected in all kinds of effect drawings, engineering drawings, models, prototypes, design manuals, etc. The technical scheme encompasses all necessary technical support required for realizing the design concept including process flowcharts, material characteristics assessment methods assembly techniques mechanical structures etc.

Additionally, the product design scheme may also encompass service modes such as product usage patterns or operational modes within a product system context. Based on intellectual property rights classification standards, the service mode aspect of product designs falls under technical schemes.

2.3. Design Commercialization Stage

The design commercialization stage is the stage when the final plan is transformed into a commodity. In this stage, designers should solve various problems in production or actual operation, such as parts assembly, material processing technology, and put forward technical solutions from the perspective of product design; In the sales link, designers may also need to put forward design plans around the product in packaging, display, advertising, publicity and other aspects. The design commercialization phase ultimately results in a product or service that is put on the market.

2.4. Design Summary Stage

After the design is completed, there is a design summary link, that is, after the product or service is put on the market, the designer should collect market feedback information, evaluate the whole design process, modify or summarize the design evaluation indicators used in the design process; In the review of the whole process of design, designers can summarize or improve the relevant design aid tools and methods in design management and design methods, such as design assistant software, design database, etc. The results of design summary will help to enhance the design ability of designers and provide methods and tools for future design objective.

3. Intellectual Property Rights in Product Design

The intellectual achievements generated in the process of product design can be transformed into intellectual property protected by law on the premise of meeting legal conditions. Table 1 shows the possible forms of transformation of knowledge achievements into intellectual property at each design stage.

Table 1. Intellectual property rights in product design

Design Process	Intellectual achievements		Intellectual Property Rights					
			Copyright	Design patent	Utility model patent	Invention patent	Trademark right	Trade secret
Design research	Analysis of Customers							■
	Market research							■
	User research							■
	Design objectives							■
Design development	User model							■
	Sketch		■					■
	Design scheme	Effect drawing	■	■				■
		Engineering drawings	■	■	■	■		■
		Models	■	■			■	■
		Prototypes	■	■			■	■
	Technical schemes				■	■		■
	Design evaluation							■
Design commercialization	Technical schemes				■	■		■
	Packaging, display		■	■			■	■
	Advertising, publicity		■				■	■
	Product or service		■	■	■	■	■	
Design summary	Design methods					■		■
	Design management					■		■
	Design assistant software		■			■		■

3.1. Design Research Stage

The knowledge achievements of the research stage primarily involve the collection, organization, and analysis of business information. On one hand, the process of gathering and arranging information reflects a limited level of innovation that generally fails to meet the creative requirements for most forms of intellectual property rights. On the other hand, information analysis falls within the abstract realm of "thought," which is not encompassed by intellectual property protection. Consequently, it becomes challenging to obtain intellectual property protection for various knowledge achievements during the design and research stage; they may only be safeguarded as trade secrets if confidentiality measures are met. These knowledge achievements provide designers with valuable insights to better comprehend design tasks, enhance customer relationships, or gain a competitive edge in client acquisition. Protecting them as trade secrets adequately fulfills practical needs since trade secret protection applies exclusively to undisclosed and non-public matters. Therefore, disclosed contents such as existing product shapes and technologies in the market, published market data, open customer and user information or any other publicly available data do not qualify

as trade secrets. Only unpublished information and analyses within these knowledge achievements fall under trade secret protection.

3.2. Design Development Stage

In this stage, the user model is a virtual figure that is summarized from the survey data, but truly reflects the needs and behaviors of the target group. Design evaluation is the evaluation of design results. They lack neither artistic creativity nor specific visual image, so they cannot form other intellectual property rights, and can only be protected as trade secrets.

The knowledge achievements in the design development stage are mainly various schemes proposed around the design objectives, including conception, preliminary scheme, and even the final implementation scheme. These schemes can be divided into two categories: design schemes and technical schemes. Design schemes focus on the visual effect of product modeling and can be protected by copyright, design patent and trademark rights. The technical solution focuses on solving technical problems and realizing practical functions, and can apply for utility model patents and invention patents.

The design scheme includes conceptual sketches, renderings, engineering drawings, models and prototypes related to the shape of the product. They show the process of design conception, showing the designer's conception direction and various possibilities of design thinking. On the one hand, they are suitable for the evidence of various intellectual property rights, used to prove the designer's independent creation and creation time and other important information closely related to the ownership of intellectual property rights. On the other hand, they record multiple preliminary design proposals unfolding around the design project and are valuable trade secrets. Among them, sketches with artistic creativity may become "artworks" and be protected by copyright. Renderings, engineering drawings, models, and prototypes can already present a design solution with a degree of integrity that can be protected in the form of Copyrights and patents. Renderings may apply for design patents; When the effect picture has a certain sense of beauty, it can also become an "artworks" protected by copyright. Engineering drawings mainly show the structure of the product, not only reflects the beauty of the shape, but also reflects the functional technology, can apply for various patents; Engineering drawings can also be protected by copyright as engineering design drawings, product design drawings and other graphic works stipulated by the copyright law. The model and prototype show the three-dimensional effect of the product, can apply for design patent; When they have a certain aesthetic feeling, they can be protected by copyright as "artworks", and models can be directly protected by copyright as "model works". When they have visual distinctiveness, they may also be registered as three-dimensional trademarks.

The technical scheme includes not only the pure technical scheme of the product in mechanical structure, material, process, assembly, use and other aspects, but also the modeling structure and service mode used to realize the actual function, which can be applied for invention or utility model patent.

The knowledge achievements in the design development stage are mainly all kinds of design ideas and preliminary schemes, which are suitable for the form of trade secret protection. The relatively complete and valuable preliminary scheme formed at this stage can be applied for various patents or protected in the form of copyright.

3.3. Design Commercialization Stage

In the production phase, designers may propose improvements to transform the final product design into a tangible product. These improvements may involve production tools, manufacturing processes, material techniques, product structures, and component shapes, resulting in relevant technical solutions. Such solutions can be protected by applying for utility model or invention patents, or by keeping them as trade secrets.

The final product released to the market serves as a composite carrier of various types of intellectual property. Technical aspects, as well as methods of use and service models related to the product, can be eligible for utility model or invention patents. The appearance design can be protected by an industrial design patent, copyright, or even as a three-dimensional trademark. Since the final product is publicly available, it cannot be protected as a trade secrets.

In the sales phase, designers may continue to develop design proposals for packaging, display, advertising, and promotional materials related to the product. Three-dimensional packaging and display designs can qualify for industrial design patent protection, while designs meeting originality criteria may also receive copyright protection. Two-dimensional advertisements and posters may be protected by copyright. As part of product brand identification, when the brand has a certain level of popularity, these designs can be protected by broad trademark rights, which prohibit brand confusion under the Anti Unfair Competition Law. Such design schemes that are not publicly available can also become trade secrets.

3.4. Design Summary Stage

Design management and design methodologies are both types of method-based innovations. In theory, they could qualify for invention patents, but there are few examples in practice. As these methodologies primarily guide innovation, they often fall into the category of abstract “ideas,” which are not patentable. Furthermore, even if patented, it would be challenging to maintain the associated economic benefits. Considering the difficulty of obtaining patents and their economic value, design management and methodologies are generally not suitable for patent protection and are better safeguarded as trade secrets.

Design assistant software developed based on design management, methodologies, and related databases can, however, be protected through software copyright or as a trade secret.

4. Intellectual Property Protection Model for Product Design

4.1. Protection Model for Core Product Design Outcomes

The core outcome of product design is the product's appearance, primarily protected through design patents and copyright. Design patents are suitable for protecting the form of products produced in large quantities, while copyright is better suited to protect highly artistic designs, such as craftwork and ornamental items.

Within the intellectual property legal framework, the patent system focuses on protecting industrial creations, while the

copyright system focuses on literary and artistic works [4]. In terms of product design, design patent standards impose relatively low artistic creativity requirements for product appearance, mandating only that the design be "distinct from existing designs." As a result, almost all industrial products can be protected by design patents. In contrast, copyright's "originality" standard sets a higher bar for artistic creativity; product forms must qualify as "artworks" to be eligible for copyright protection. Most mass-produced products do not meet this standard. For example, courts have ruled that LEGO's geometric building blocks and IKEA's Mammut children's furniture do not qualify as "artworks" and are therefore not protected by copyright. However, items like LEGO's figurine blocks and perfume bottles shaped like human figures have been recognized as "artworks" and are protected by copyright [5]. Products that are more artistically creative, or in other words, closer to visual art forms such as painting and sculpture, are more likely to be recognized as "artworks" under copyright law.

In comparison, copyright protection has the advantage of being automatically granted without formalities or examination, resulting in lower costs and longer protection. However, it is difficult for most product forms to qualify as "artworks". Furthermore, automatic acquisition of copyright does not guarantee rights, as they are not confirmed by an administrative body and often need to be determined by a court in litigation. For products with unclear artistic creativity, claiming copyright protection can carry significant risks. Design patents, on the other hand, require an application and examination process, which incurs time and monetary costs but provides more defined and exclusive rights. Additionally, product designs are generally able to qualify for design patent protection relatively easily. Design patents offer a 10-year protection period, which typically covers most products' market lifecycle.

Chinese law does not prohibit multiple intellectual property protections [6]. A product design may claim copyright protection even after obtaining a design patent, and there are cases in which products have successfully pursued copyright litigation after the expiration of their design patents.

For the appearance design of products that are clearly not protected by copyright, namely those typical industrial designs produced in bulk, which revolve around the realization of functions and the needs of users, and have a simple and less decorative appearance, such as engineering equipment, transportation vehicles, most daily necessities, electronic products, etc., the appearance design of these products is difficult to meet the requirements of copyright for artistic creativity, and can only mainly adopt the design patent protection mode.

For designs with some artistic creativity but uncertain copyright eligibility, design patents should be the primary form of protection, with copyright retained as a backup if needed. This is due to the difficulty in establishing these products as "artistic works," which lowers the likelihood of copyright protection.

For products that clearly meet copyright requirements, such as those with more decorative designs and rich visual effects, such as most handicrafts, fashion products, cultural and creative products, the appearance of these products can be mainly protected by copyright protection mode. At the same time, design patents should still be applied for as a backup protection mode to prevent situations where copyright is not recognized. In relevant disputes, first claim rights through copyright, and then switch to claiming rights through design patents when not supported.

Therefore, for all product designs, it is advisable to apply for a design patent even if copyright protection could be claimed. This builds a more robust intellectual property protection framework. Because design patents require "novelty" [7], the design should be kept confidential until the patent application is filed, after which it may be disclosed or registered as a work to secure other intellectual property rights.

If the final product design involves technical innovations, applying for invention or utility model patents is strongly recommended [8]. Technical patents offer broad protection, as a single function may correspond to multiple design forms. If a technique is patented as an invention or utility model, all design forms implementing this technique will fall within the patent's protection scope.

4.2. Protection Model for Outcomes in the Product Design Process

Other design outcomes generated during the design process are best protected primarily as trade secrets.

Within the intellectual property legal framework, trade secret protection provides the broadest coverage for various types of outcomes. As long as measures are taken to maintain confidentiality and the outcomes have commercial value, they can be legally protected as "trade secrets", even if they do not meet the requirements for copyright, patent, or trademark protection. Thus, any outcome that is not publicly disclosed can be protected as a trade secret; however, once disclosed, it can no longer be protected as such.

Since the contents of patents and trademarks must be publicly disclosed by law, patent rights and trademark rights cannot coexist with "trade secrets" for the same outcome. Copyright, however, does not require public disclosure, so it can coexist with trade secret protection.

Various design outcomes in the design process should first be protected as trade secrets. Depending on practical needs, some outcomes can later be filed for patents or trademarks, though they will lose their "trade secrets" status once disclosed. Regardless of whether they are kept confidential, the copyright for design outcomes remains unaffected and can coexist with other rights.

Design drawings and models may qualify as "graphic works" and "model works" under copyright law. These categories are intended to protect creativity in the scientific and technological fields, as these graphics and models convey a disciplined, minimalist aesthetic that reveals principles and structures of objects. Due to this, the requirements for artistic creativity are low, meaning design drawings and models can typically gain copyright protection under these categories, though only as graphics or models. That is, as "graphic works" or "model works" under copyright law, design drawings and models can prevent others from copying them directly but cannot prevent others from creating products based on the drawings or models, as physical products do not fall under the "graphic works" or "model works" categories. Only if the drawings and models qualify as "artworks" under copyright law (requiring a higher level of artistic creativity) can the corresponding products be protected as "artworks." Designers may choose to seek copyright protection for their design drawings and models as either "artistic works" or as "graphic works" and "model works," depending on the specific circumstances.

5. Summary

Each stage of product design generates various intellectual outcomes, and appropriate forms of intellectual property protection can be found within the legal framework. The core outcome of product design, the product form, has three main protection models: typical mass-produced products are primarily protected by design patents; highly artistic products are primarily protected by copyright; and products falling between these categories are mainly protected by design patents, with copyright as a backup. Other outcomes produced during the design process are primarily protected as trade secrets. A comprehensive intellectual property protection approach can fully safeguard the creative outcomes of product design.

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