

## A Function Trimming Method for Patent Design Around

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**Abstract.** In the global businesses market, products entering into the market are facing more and more patent barriers. Therefore, patent design around is an effective way for the enterprises' product designing and technology innovation without infringing the existing patents. This paper proposes a patent design around method based on Function Trimming. This method includes the following steps: build the function model of existing patent, proper trimming of system components according to Trimming Rules, and apply TRIZ problem-solving tools to solve the trimming problem. Finally, the TRIZ-based Function Trimming method for patent design around is formed. The method is successfully applied on the Red Wine Packaging.

### Introduction

With the deepening of economic globalization, the innovation products become a core of competition among enterprises. Our country's enterprise is facing risk of infringing the existing product patent, products lacking innovations, and not occupying the initiative in the competitive market. In this fiercely competitive market, a low cost and less time-consuming way is to imitate and copy competitors' products technology to develop similar or preferable products [1]. Patents are used as a weapon to achieve competitive advantages [2]. Design around is a common intellectual property strategy (by designing a new different solution from the protection of intellectual property rights to jump out the protection of intellectual property rights) [3]. Patent design around is designed for walking around a competitive patent and develop substantial difference design in the scope of patent claims but not infringing the original patent [4]. Therefore, from the aspects of law, it has become legal behavior to bypass the scope of patent protection and to avoid patent infringement in the enterprise competition.

At present, some researchers have proposed several approaches for TRIZ-based patent design around. LIU Shangzhi [5] researched combination of patent strategy, TRIZ and QFD to innovate around design, and bicycle flywheel is successfully applied to circumvent design. LI Peng and AN Jiping [6] described the application of TRIZ theory to product development process, and summarized the general method using TRIZ to achieve patent design around. JIANG Ping [7] researched the integrated process for designing around patents through function trimming of TRIZ and patent infringement judgment, and the spiral bevel gear milling machine is analyzed to illustrate the integrated process. However, the focus of most of the above researches is the study of the application of TRIZ tools to solve the innovation problem for a new design in the latter part of patent design strategies, and not well integrate TRIZ theory into the function analysis and trimming rule on the components.

This paper proposes the method that is TRIZ-based Function Trimming for patent design around. Using patent circumvention innovation design of TRIZ theory, the functional model of one existing valid patent is analyzed to find the core technology of the patent and the breakthrough for patent design around. Then, according to the principle of Trimming, one or more system components are trimmed, the generated trimming problem is solved by TRIZ problem-solving tools. Thus Function

Trimming has been established, and designers can better achieve the re-creation and re-design of product.

### Patent Design Around Method based on TRIZ

**Process of Patent design around.** Using TRIZ for patent circumvention is effective means to walk around competitive patent solution without infringing. A successful design around must satisfy two requirements: the one is lowest limit which isn't judged infringement at the request of the law; the other one is upper limit which isn't loss of competitiveness because of high cost in the market competition at the request of the business [8].

As shown in Fig.1, the general process of TRIZ-based Function Trimming Method for patent-around innovative design mainly consist the following four steps [7]:

- Step1: Searching and analyzing the related patents to excavate the core technology of the studied product and identifying the target patent.
- Step2: Using function analysis to analyze the target patent. Obtain the thinking direction of patent-around according to the function model.
- Step3: Using patent-around strategies and TRIZ problem-solving tools to find the innovative breakthrough and forming the design concept.
- Step4: Refining and optimizing the design concept to develop a new product and utilizing patent infringement for a infringe judgment.

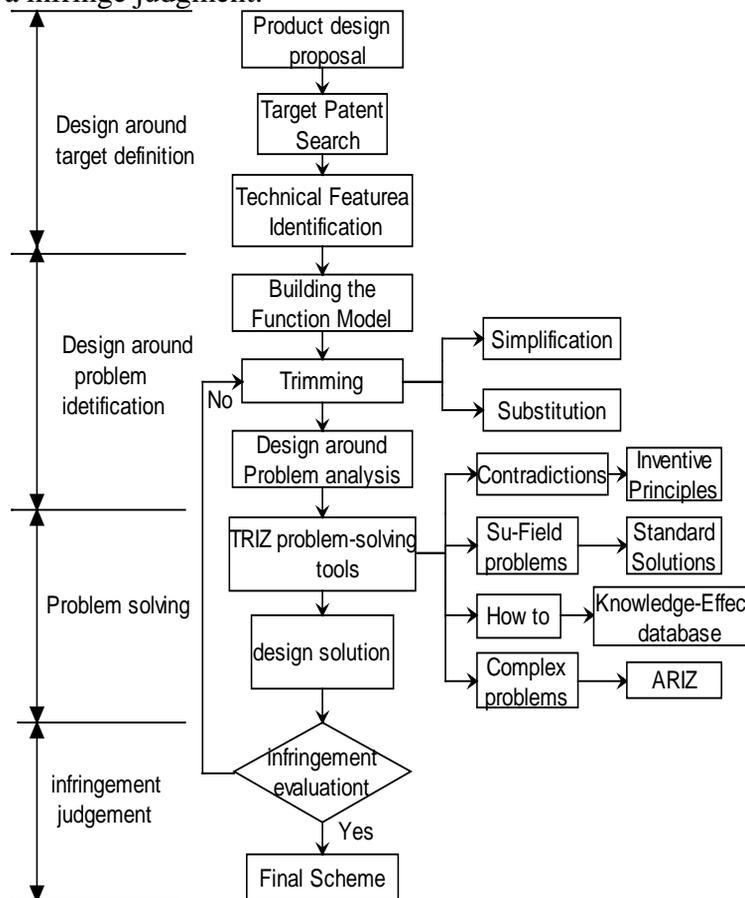


Fig.1. General process of Patent design around

Patent design around is most important means for the sustainable development of the modern enterprises and the designers. On the basis of the technical specifications and the patent claim which published in the original patent, the scope of protection and the core technology is determined. Meanwhile, the flaw in patent claim and the shortcoming in Technical Features are found out, improved and created a new product on avoiding infringement of the target patent right. This paper will focus on depth analysis of the function model of technical features, patent design method and TRIZ problem-solving tools. The main purpose of function analysis is to identify the target patent

problem and to help trimming. Patent design method is one effective way to help trimming technical features and TRIZ helps to systematically solve product design problems and develop next generation technologies and products with less risk [9]. Therefore, the design around can be conducted more quickly and efficiently.

**Building the Function Model.** Function is a abstract description the specific role of technology system. So a method based on TRIZ function modeling can analyze the target patent and establish a function model.

First, based on patent claim, Technical Features are identified. The claim is the key node in the patent. Technical Features identification mainly depend on independent claims, while the dependent claim refine and describe additional details of the Technical Features. Then, function model of Technical Features identify function relationship and function levels (Useful, Harmful, Insufficient or Excessive function) between Technical Features and other components [10]. The finally building function model of products helps designers to trim problem component in the system, and provides designers with thought of technical improvement and innovation design. The function model consists of 3 steps (function definition, classification and finishing). The flow chart of function modeling is proposed in Fig.2.

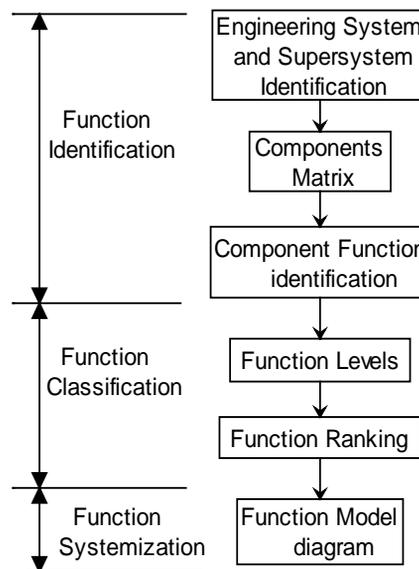


Fig.2. Flow chart of function model

The step by step of Function Model process is as follows[11]:

- Step1: All the relate component from Engineering System and Super System are identified, function relationship is analyzed and function are identified in this step.
- Step2: This step identifies the function levels and function ranking.
- Step3: Function Model diagram is built up.

It is a pre-step for Trimming to general key Trimming problem.

**Applying Trimming for Design around.** After establishing function model, the next step is to design a new product by trimming one or more patent Technical Features. In the process of patent design around, using Trimming for target patent is a very important procedure. Pivotal factors and concrete methods are described in Table 1 for trimming process.

Table.1. Trimming Rules for Trimming Technical Features

Patent around Type	Patent around strategies	The expression of around strategies	The design requirements
Simplification	Deletion	$A+B+C+D \rightarrow A+B+C1$	the all elements rule the doctrine of equivalents
	Combination	$A+B+C+D \rightarrow A+B+E$	$E \neq C+D$ the all elements rule the doctrine of equivalent

Substitution	Substitution	$A+B+C+D \rightarrow A+B+C1+D1$	$C \neq C1 \& D \neq D1$ the all elements rule the doctrine of equivalent
	Decomposition	$A+B+C+D \rightarrow A+B+C+D1+D2$	$D \neq D1+D2$ the all elements rule the doctrine of equivalent

The core of the simplification is one or more Technical Features of the target patent should be reduced (the number of Technical Features in the final plan less than the target patent). This method includes Deletion and Combination. Deletion is characteristic D of the target patent claims does not appear in the final design scheme; Combination is using TRIZ problem-solving to find a characteristic which can achieve a specific function that is realized through the interaction with a pair or more characteristics in the target patent claim. Meanwhile it can reduce one or more essential characteristics in the design scheme and avoid infringing the original patent. The new characteristic E is not sum of the original characteristics C and D, and there should be a substantial improvement in function, effect and method.

By contrast, the core of the substitution is one or more Technical Features of the target patent should be replaced (the number of Technical Features in the final plan is equal or greater than the target patent). This method includes Substitution and Decomposition. Substitution is to replace one or more characteristics in the original patent claims, while ensuring the new characteristic C1/D1 is not the equivalent of the original characteristic C/D; Decomposition is to achieve the function of certain characteristic by the interaction of several new characteristics and the combination of the new characteristics D1+D2 that is not the equivalent of the original characteristic D.

In order to implement trimming of Technical Features, the Trimming process is as Follows [10].

1. Select one function of a Technical feature from the lower function rank scores of Technical Features in the claims to be trimmed.
2. Apply Trimming rule for the selected function and identify a new function carrier to perform the initial function of the trimmed Technical feature.
3. Build the new function model.
4. Repeat steps 1 through 3 generate corresponding Trimming problems.

After trimming, a number of trimming problems are generate, TRIZ provides tools of problem analysis and solving to solve the different corresponding Trimming problems, which can lead to different TRIZ model of problem-solving for design around. For example, Corresponding tools to solve Technical Contradictions is Contradictions Matrix and the Inventive Principles. The method to solve Physical Contradictions is Separation Principles and the Inventive Principles. There are 76 Standard Solutions model to solve Su-Field problems. Knowledge-Effect database are used to solve “How to” problems. ARIZ is a wide problem-solving tool that can transform a complex inventive problem into a model of TRIZ problem-solving.

### A case example—the Red Wine Packaging

In recent years, a symbol of people enjoyment is the consumption of red wine, because people’s requirements of life quality are gradually improving. Therefore, the packaging of red wine has become a necessary market product. However, we find that there are some problems in current red wine packaging, which are the waste of packaging material due to transport packing and sales packing is not relevant, the low production efficiency and high cost of production. Now we will use the above mentioned method to design around a red wine packaging.

**Defining the Design Around Target.** Base on keyword search, Patent No. CN103318496A [13] is identified as design around target patent. After reading and analyzing content of the patent, there are two key systems, which are 1-inner buffer packing and 2-outer seal packing. As shown in Fig 3, the

structure of the inner buffer packing is the fence type, and the outer seal packing consists of 3-holding tank, 4-folded plate and 5-insert.

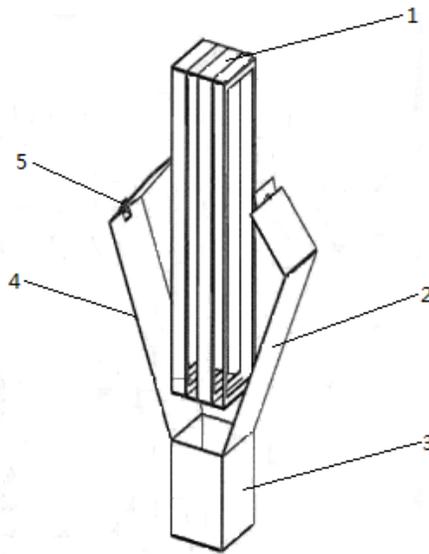


Fig.3. Model of the Red Wine Packaging

**Building the Function Model.** The main function of the Red Wine Packaging is protecting fragile bottle in the process of hauling and transportation and showing the red wine when sold to customers.

Analyzing the patent including all system components and super system components and the relationships between each other of them, establishes a function model of this Red Wine Packaging, which shown in Fig.4.

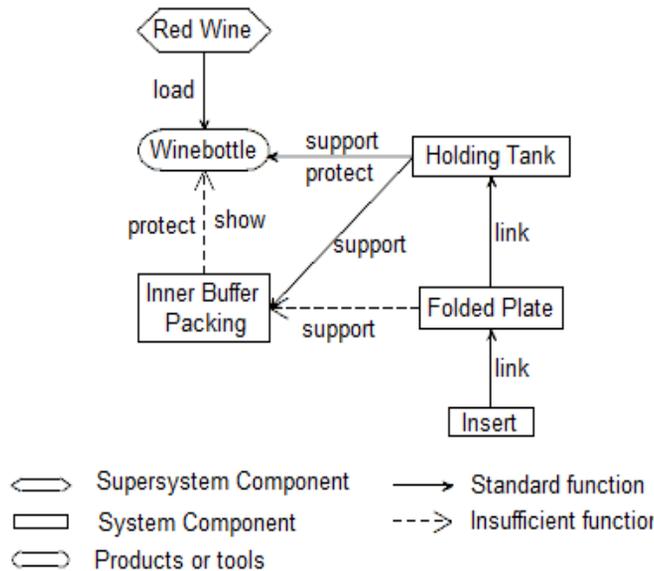


Fig.4. Function model of the Red Wine Packaging

**Analyzing and Solving Problems.** After a depth analysis of the above model, two problems of the target patent is found: a. the wine bottle is easy to be broken because protection of the inner buffer packing is insufficient. The reason is that structure strength of fence structure is poorer and toughness is not enough; b. the folded plate lack of support for the inner buffer packing. The reason is that the folded plate strength is poorer.

A designing scheme is generated when we used the TRIZ-based Function Trimming method for patent design. As shown in Fig.5 is Trimming function model.

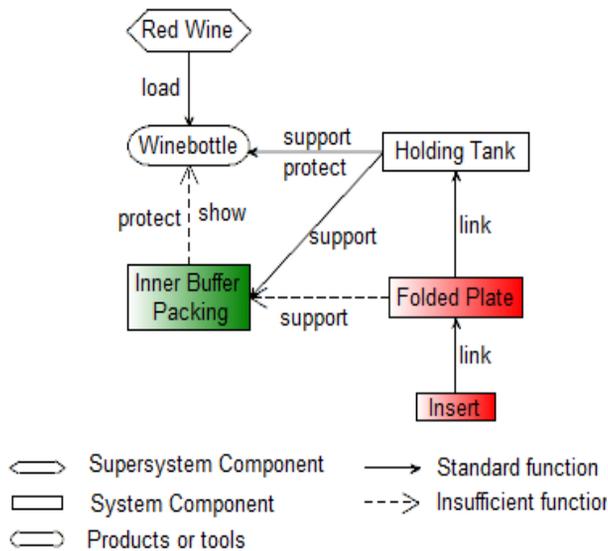


Fig.5. Trimming Function Model

According to the Fig.5, firstly, the Inner Buffer Packing can be trimmed. According to the Table.1, we choose substitution method to find out another structure that can substitute it to protect wine bottle. Trimming problem is: how to better protect bottle? This problem is translated into standard TRIZ problem and solved to use the Knowledge-Effect database. By search the database, we can find out a spiral structure of rubber that can protect the bottle by its good toughness.

Then, the Folded Plate can be trimmed, so the Insert should also be trimmed. According to the Table.1, we choose simplification method to improve the Outer Seal Packing. Trimming problem is: how to make the Holding Tank perform the function to support the Inner Buffer Packing and protect the wine bottle? We use physical contradictions to solve this problem. The physical contradictions: link and support function of Folded Plate and Insert are reserved but Holding Tank support and protect wine bottle. This contradictions can be solved by separation in spatial and separation in whole and part. Inventive Principle 5(Merging) and Principle 17(Another Dimension) are used to generate ideas. We improve the Holding Tank into a bucket structure. Shown port is opened on the barrel wall and can show the red wine in market.

**Generating the Final Plan.** Finally, a new design is produced by utilizing the design around strategies and TRIZ problem-solving tools to improve system performance of the red wine packaging. New function mold is established in Fig.5.

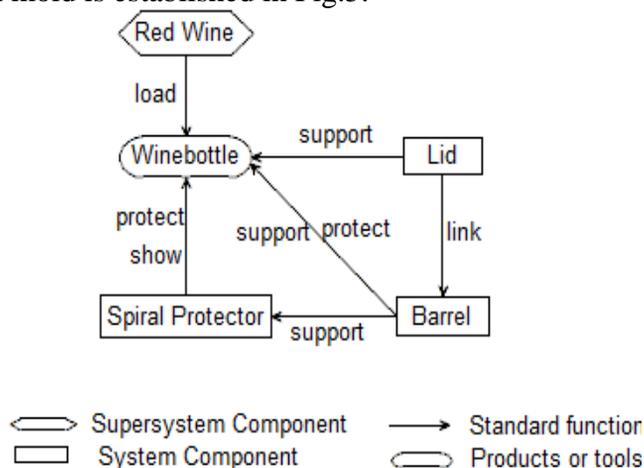


Fig.5. New Function model of the Red Wine Packaging

The final product of the red wine packaging is wooden straight-tube structures with a shown port. It consists of three components which are a barrel, lid and spiral protector. The linear spiral protector made of rubber has a stable protective effect by snapping the outer wall of bottle. The wooden barrel with a shown port on the side wall plays the role of supporting the linear spiral protector. The lid installed on the barrel is the entrance to put in and take out the bottle. As shown in Fig.6, there are three key components, which are 1-lid 2-barrel and 3-spiral protector.

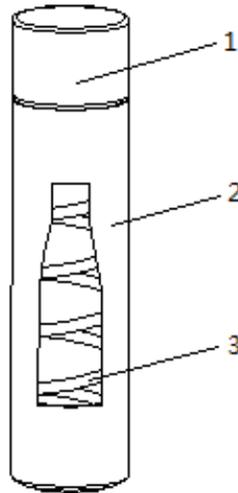


Fig.6. The final product of design around

The above packaging box differs from the traditional mode of the red wine packaging design. It not only has low cost and easy production, but also has sales display function. Design of a simple structure embodies the elegant taste of the user, and it also sets off the noble and elegant red wine.

## Conclusion

In this paper, based on the depth analysis of building function model of target patent and applying trimming principle is proposed to create a new product. According to the analysis, TRIZ-based Function Trimming is an effective way for patent design around. This method help designers greatly effectively achieve inheritance and development of patent, rather than simple literal circumvention or improper ways to plagiarism. Meanwhile, using this method enterprise can accomplish the circumvention competitive patent and enrich its patent portfolio. This method is successfully applied to improve a case study of a red wine packaging.

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