

Research on the Patents Layout Strategy by Applying TRIZ Theory

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Abstract: Patents are important weapons for enterprises to participate the competition in market, while patents layout can help enterprises increase competition. Considering a set of completed innovative approach from strategy to tactics provided by TRIZ theory, therefore, integrating the TRIZ theory into the whole patent layout process is proposed in this paper, and the innovative tools and resource of TRIZ are applied into the patent digging process. The basic function model and auxiliary function model are established by functional analysis of TRIZ during patent analysis process, the technical evolution theory and resource analysis of TRIZ is used to expand the innovative materials for patent applications during the patents digging process, the configuration between the claims of independent right and dependent right of patent can be sorted out by TRIZ tools during the patents application process. In this way, a set of methods and models of patent layout for enterprises can be established.

Key words: patent layout; TRIZ; patent strategy; function analysis **JEL code:** O34

1. Introduction

Patents, which are known as one kind of intellectual property right, are important weapons for enterprises to participate the competition in market. However, if the quality of patent is poor, or the number of applying patents is insufficient, or the loopholes are existed in the application processes, the opportunity of patent design around can be left for the competitors.

The patent layout is an overall layout planning behavior of the enterprise according to the applied patent's technology field, number, location, scope and occasion, in order to form an effective permutations and combinations of the fine patent layout behavior. Reasonable patent layout can lead enterprises to make suitable development strategies, classify and protect enterprises innovations by different patent forms, to establish the enterprises technology protection network, to avoid clutter invalid patent applying, therefore, it's necessary for enterprises to do patent layout according to the conditions of the enterprises can utilize patent layout to design around for competitors' patent technology, and establish its own technology protection network. The methods of patent layout are attracted by many scholars. Vincenzo Denicolò et al. (2012) proposed a dynamic

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model of a patent portfolio race in industry by the Markov perfect equilibrium. Holger Ernst et al. (1998) explored two types of patent portfolios for strategic R&D planning. Knut Blind (2009) analyzed the strategic motives for patenting influence the characteristics of companies' patent portfolios. Holger Ernst et al. (2009) provided a more accurate assessment of a firm's patent portfolio. Fengjin Zhu et al. (2010) investigated patent layout affected by the technical evolution law of TRIZ. Shunxin Xie et al. (2012) designed the patent layout planning process based on the five models, and the steps of the patent layout were discussed. Liyan Yu et al. (2009) analyzed China patent layout in all knowledge fields by using of factor and cluster analysis method, focused on the differences in different patent applications fields. TRIZ was proposed theoretical system, by the former Soviet scholars Genrich S. Altshuller (1961), with a complete set of world-class innovative approach, which contains breakthrough thinking inertia methods, techniques, forecasting tools and a systematic approach to solve problems.

Aiming to the specific patented technology, this paper focused on how to dig and deploy high quality patents, then, for improvement the overall value of the patents of the enterprises, a patent strategy designed is proposed to achieve the desired patent layout for the enterprises. Considering the characteristics of TRIZ theory, the main idea of this paper is to integrate the innovative tool and resource of TRIZ into the whole patent layout process, which mainly contains that the basic function model and auxiliary function model are established by functional analysis of TRIZ during patent analysis process, the technical evolution theory and resource analysis of TRIZ is used to expand the innovative materials for patent applications during the patents digging process, the configuration between the claims of independent right and dependent right of patent can be sorted out by TRIZ tools during the patents application process. In this way, a set of methods and models of patent layout for enterprises can be established.

2. Patent Layout Strategy by TRIZ

2.1 The Main Strategy of Patent Layout

The core patent is the key node in technology development process, and cannot be bypassed to circumvent the key technology. In other words, the core patents marks a new era of technology, which has a wide market prospects on the technological stage. The network is built around the core patent's technology system or sub-system to form a series of better technical effect patents or patent base achieved by different means with the same functionality. Currently, the common models of the patent layouts are roadblocks patent layout model, wall patent layout model, carpet patent layout model, fence-style patent layout model, and so on. Considering the function of layout patents, the authors divided such patent layout models into two categories, one is defensive layout, and the other is adversarial layout.

The best patent layout is to achieve defensive patent and adversarial patent in ones, which not only contains the core patent, but also the tight protection network by around the core patents. Actually, the defense patent layout is to prevent other competitors to design around, and the adversarial patent layout is to find opportunities to patent design around, and, the defense patent layout and the adversarial patent layout are coexisted in the enterprise. Therefore, the optimal solution of patent layout is to achieve by digging the core patents, then, around the core patents to form the patent network by digging the perimeter patents.

According to the condition of ownership of the core patent, the strategy of patent layout is proposed as following.

Firstly, when the core patents are rest in enterprise itself, the enterprise is in order to prevent other enterprises

to patent design around or beyond, the defensive patent layout should be taken. And the enterprise can use the wall patent layout model or carpet patent layout model around the core patent according to its economic strength.

Secondly, when the core patents are rest in competitors', the enterprise has to compete with competitors; the adversarial patent layout should be taken. The applications for adversarial patent layout have two cases; one case is the competitors, which have been around the core patent with wall-style patent portfolio or carpet patent portfolio, and the enterprise can use a new breakthrough innovation to form a new patent layout network to look forward the opportunities to break through the patent technology. The other case is the competitors just has the core patent without forming adversarial patents, and the enterprise should increase adversarial technology around the core patent technology to form the adversarial patent layout.

2.2 Digging the Core Patents by TRIZ

Altshuller (1961) pointed out that the evolution of technical system is not random, while to follow a certain objective laws and the technical system is also facing natural selection, which is similar to evolutionary of the biological systems.

As mentioned above, the core patents, which are the key nodes in technology development process, should exist in somewhere of technical evolutional route. The purpose of digging the core patents by TRIZ is to find the current core patent (if the ownership of the core patents belongs to the competitors) and form the next steps' core patents (if the ownership of the core patents belongs to the enterprise). A lot of technical evolution laws and routes are provided by TRIZ theory to predict the further core technologies. The product evolutionary state sequence of the core patent in different evolutionary directions can be analyzed by choosing of different technology evolutionary laws and routes of TRIZ. For the core patents, the corrected position in the technology evolutionary routes can be located; the core patents can be valuated, and to form several potential core patents by TRIZ evolution law and the new ideas for different current products can be got to form design concepts, then, through targeted R & D investment to dig the core patents, in this way, the core patents layout ahead can be achieved.

2.3 Digging the Peripheral Patents by TRIZ

TRIZ theory provides a variety of problem-analyzing and problem-solving methods, which can inspire the problem comprehensively to help analyze a system or subsystem, and the ideal solution of these technical problems can be found in this way.

The purpose of digging the peripheral patent by TRIZ is to form the enterprise patent layout network. According to the enterprise's needs, more peripheral patents around core patents can be dug by TRIZ tools. For example, the specific conflict parameters are abstracted by using of the conflict matrix of TRIZ to locate the conflict in specific problem. The all different technical solution programs, which are inspired by TRIZ inventive principles, are dug to apply more peripheral patents around the core patent, other optimization design methods can be also used to get technical tips, and the wall patents layout strategy can use to make the patent network, by applying peripheral patents according to all technical solution programs, which inspired by TRIZ tools.

3. The Patent Layout Process by TRIZ

The patent layout process includes the patent information analysis, the core patent layout, the patent network layout, and the patent application layout.

3.1 The Patent Information Analysis by Using of TRIZ

The patent information analysis by TRIZ mainly consists of two parts; one part is to make the patent overall

strategy, by the product maturity technology predicted by TRIZ technology forecasting software. The other part is to draw the patent claims map by using of function analysis of TRIZ, in this way, to make sure the mainly technical questions and solved methods for the core and peripheral patents. The patent information analysis by TRIZ also can provide patent intelligence, to imply the patent landmines and the directions for the patent design around.

(1) Making the patent layout strategy based on the product technology maturity prediction

According to TRIZ theory, the product evolution law meets S development curve, included infancy, growth, maturity and exit. The direction of the R & D can be got by a corrected valuation predicted by using of TRIZ product technology maturity prediction, then, to develop a reasonable patent layout strategy for the special products.

For example, products as in infancy, should increase investment, apply the core patent by using of TRIZ technology evolution method, and the core patent can be protected; Products as in growth, should around the core patents to form a large number of peripheral protective patents. Products as in maturity, should be appearance design, and apply utility model patents. Products as in exit, should functional cut, streamline innovate and breakthrough innovate.

The model of TMMS (technology maturity mapping system) in TRIZ is used to analyze the product technology maturity. The invention number, grade and SCP (symptom curing patents) are chosen as the patent analysis parameters. The first step is to index the patent data by choosing an index path according to the keywords and parity words in technical fields. The second step is to screen the indexed patent data by view the abstract of patents to keep the related patents by removing unsuitable technical themes and directions. The third step is to grade and classify the related patents, the invention is divided by TRIZ theory into five grades according to different creativity and value, then, the technology development process and technology inheritance relationship can be sorted, and the first appeared technologies are the highest grades, as core patents, and subsequent patents, which are rich or remedy the core patents, are lower grades, as the peripheral patents. The forth step is to statistics the patents to generate the graphs. The relationship between the invention number and time, the relationship between invention grades and time, the relationship between SCP and time, can be shown as graphs by using of invention tool software. The fifth step is to predict the product maturity. Comparing with the product performance standard curve, to make a judgment for the technology stage, which belongs to its infancy, growth, maturity and exit.

(2) Drawing the patent claim map by functional analysis tool in TRIZ

Functional analysis is an important theory and analysis tool in TRIZ. The functional model of a product, which is established by TRIZ functional analysis tool, can analyze as one function with all sub-functions by decomposing as the smallest function elements. It's note that all the different sub-function or function elements can be resolved by functional analysis. And all the solutions for certain sub-function or function element should be into patent layout scope and form new patents. The existing patent technical solutions should be marked in patent claim maps as patent mines, then, to dig other new solutions or solutions for making up the deficiencies of existing solutions.

There are three steps in drawing the patent claim map, the steps are as following.

The first step is to index and screen patent data. The patents, which are indexed and screened by the product technology maturity prediction, are mainly analyzed to draw the first appeared core patents. The second step is to establish the core patent's function structure model, which includes all sub-function and function elements, by TRIZ function analysis. The third step is to establish the patent module of function element or auxiliary function.

The auxiliary functions, which are based on the core patents, are analyzed to establish the detailed technical function graph.

For illustrating the drawing process of the patent claim map, one of nail clipper patents is used. The first step is to index nail clippers related patent, and analyze of existing patent claims, to find the basic and auxiliary functions, the core function of nail clippers is the cutting nails function, and nail auxiliary functions includes collecting splashed nail, nail clippers positioning, folding portable, removable head, and others, as shown in Figure 1.



Figure 1 The Core Auxiliary Functional of a Nail Clipper

The second step is to establish the core function model tree of nail clippers, as shown in Figure 2.



Figure 2 The Core Functional Model Tree

The third step is to establish the patent module of function element or auxiliary function. The auxiliary function "collecting splashed nail" is chosen. According to analyzing the existing patent technology, the mainly resolutions can be got, then to list the claims of all the solutions for one special auxiliary function as the claim map, as shown in Figure 3. In this way, each auxiliary function can establish a claim map, and the patent module of the total auxiliary functions can be established, then, the functional morphological matrix, which can be



referred for enterprises to invest in R&D, can be got based on the patent module of the total auxiliary functions.

Figure 3 One of Auxiliary Functional Analysis

3.2 Patent Layout for Core Patents by TRIZ

The technology prediction tools in TRIZ for technology system evolution law and route are used for core patents layout to result different new concepts, which can form the core patents by patent digging and enterprises product development after evaluation, for the future products. The patent layout design by TRIZ process mainly contains two steps; one of steps is to make sure the product maturity forecast based on TRIZ technology evaluation law, the other step is the key features of claims of the core patent identified based on function model and auxiliary function model, then to produce new product design concepts by choosing different technology evaluation law and route.



Figure 4 The Evolution Searching Process

(1) Fey and Rivin et al. (1994) describes the technology evolution law is as nine items. According to the different stage of the technology evolution process, the suitable evolution law should be chosen.

(2) According to the laws and routes of technology evolutionary in TRIZ, the technical direction of the core patent can be forecast. Considering a number of the technology evolution routes provided by evolution laws, therefore, the potential evolution route is searched basing on the analysis of existing technologies, as shown in Figure 4. The evolution searching process is based on the core patent functional model, using patent function principle to extract the basic functions, select the technical evolution route 2-2, and locate the core patent state

correctly. Meanwhile, summarizing and predicting the evolution paths for the main technical problems, in this way, to generate new concepts into next evolutionary step circle, then, around the new concepts to develop the new products, then to develop and apply the new core patents.

3.3 The Patent Network Layout Design by TRIZ

Once the core patents were determined, the enterprises need actively expand peripheral patents in order to defense and compete. This expanding process includes design around the existing patents and improving the existing technology. The main work of the patent network layout based on TRIZ is to use the different tools of TRIZ theory around the core patents and dig more techniques with the same functionality or improved technical problems, then, find the ideal solution.

(1) Patent design around the existing core patents by TRIZ

Patent design around is a kind of innovation design to bypass the existing patent with different technical programs, which can form a patent network by applying patents. In this paper, the process of the patent design around is based on TRIZ functional analysis. First, to choose the interesting function element by analyzing each function element of the functional model, this can be got by indexing the information analysis. Second, the standard engineering parameters are abstracted by the related invention method of TRIZ. The conflict solution theory of TRIZ gives 39 standard engineering parameters; we can use these 39 standard engineering parameters to describe the important parameters, which have to be changed to achieve the same function. The hint may be got in virtue of invention theory of TRIZ, therefore, to get a new solution with different technique to achieve the same function. It's important for abstracting the parameters by TRIZ standard parameters to be indexed and analyzed in different technical field, and the similar problem solution in different field can be transferred. Third, the function elements inspired by hints, are originated in the indexing results from other field patents or the analysis results by using of TRIZ software. Forth, the new function elements can form the new technical programs, which can apply patents according to the legal rules of patent infringement combination. In this way, the patent design around can be got, and all the results of patent design around can form the patent network layout.

(2) Improved design for the existing core patent by TRIZ

The improved design means the product differentiation according to customer needs. Considering the ability of TRIZ theory for finding and solving problem, we hope to provide a kind of method to help enterprises break through the inertia of thinking to dig more patents and improve competition and satisfy customer's needs.

When some customers need the defects to be improved, or performance enhancements, then, the substance field analysis, which utilizes the standard problem of substance field to find the problem in all functions, can be used, meantime, to get the solutions by TRIZ 76 standard solutions, which is an important analyzing tool of TRIZ, also can be used. The substance field analysis for function elements should be done based on the functional analysis of TRIZ. In this way, to form new product patents by the performance enhancements and improvement.

When some customers need products with a variety of additional features, the resource analysis of TRIZ can be used. For example, some customers want to nail clippers with magnifying function, some customers want to glasses with alarm function. The solution of additional functions can be dug by resource analysis of TRIZ, while each solution for additional functions may apply patents, in this way, the all kind of integrated innovations and new technique can be got.

When some customers want products by cutting function, the function cutting tools of TRIZ can be used. For example, children cell phone just need to call some important relatives, and elderly cell phone just need phone

function with big words in keypad. In this way, the function cutting tools of TRIZ can be used to disruptive innovation. The technical solutions may apply patents to occupy the market share.

The essence of the patent network layout design is to dig more patent material, to apply more high quality patents, and allow enterprises to take the initiative in competition. If the enteritis's match the TRIZ methods with patents kinds, the enteritis can dig patents and establish the patent network from the beginning to the patent strategy standing height by TRIZ theory. According to the patent law, patents are classified as invention patents, utility model patents, and appearance design patents. Different patent types have different creative requirements. For the core patent, it should be carried out from every view; meanwhile, the patent module should be regarded as key object for patent design around by patent information analysis, during digging patent process. And to make sure the design to bypass the existing technical solutions to resolve the problem from the different view, then to dig the patent technology, and obtain the ideal solution for each technical problem. Finally, the patents network is achieved by applying for patents around the core patent.

3.4 The Patent Application Layout Design by TRIZ

The application for the innovation patents is an important part of intellectual property protection, and the patent application layout design should be included two steps, as following:

(1) First, the innovation results should be sorted and classified according to the innovation levels, and patent layout should be also regarded corresponding to different intellectual property. Altshuller (1961) proposed five level original solutions include conventional solutions, system changing solutions, cross-industry solutions, interdisciplinary solutions, and the new science-based solutions. In this paper, according to the Altshuller's five level solutions, proposed the corresponding different patent application strategy.

For conventional solutions, as they have authorization conditions for utility models and appearance design, then, each small problem solution program should be applied as a peripheral patent, or timely disclosure the technical, and making it into the public domain; For system changing solutions, it should be applied invention patent or utility model patent according to the difference of authorization conditions; For cross-industry solutions, it should be applied invention patents, meanwhile, the core components of the new system or production methods of the new system should apply patents. In this way, the new patent group can be formed around the new system; for interdisciplinary solutions, it should be applied for invention patents, which have a relatively wide protection scope. And this kind of solutions should be regarded as core patents, which should be carried out patent design around and patent layout, to form multi-level patent groups, from product to method, from mechanism to equipment, then to system, from core components to products, from appearance patents to invention patents; For the new science-based solutions, it should also be applied invention patent, as same as the interdisciplinary solution, while this kind of solution should focus on the applied research and product development, meanwhile, the applied patent should cover from the core patent and component to the applied products.

(2) The second, according to the characteristics of the patent law, based on patent claim written rules; the independent claim should cover the all necessary technical characteristics for the technical problem. Considering the functional model of TRIZ clearly shown all of the essential technical features, the production's configuration and function can be understudied by using of TRIZ function model. The innovation results for applying patent can be configured by function model, the independent and dependent claim should match smoothly.

4. Conclusion

TRIZ theory can not only assist enterprises to innovate, but also play an important role in making enterprise patent strategy, patent design around, and patent layout.

In this paper, the innovative tool and resource of TRIZ applied into patent layout strategy is proposed, and the patent layout design process by TRIZ is introduced. And a set of methods and models of patent digging and layout for enterprise is achieved. However, considering TRIZ theory is as huge and integrity, different TRIZ tools for patents design around or patent layout should be some different impact. Therefore, the systematic process needs to continue to refine to form a complete systematic theoretical approach for guiding enterprises patent layout and innovation.

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