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The Analysis of 2002 Chinese Inventive Patent Based on TRIZ

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Abstract: A large part of the strength and power of TRIZ exists because the methodology was constructed on the foundations provided by the analysis of a substantial number of patents, and the patents were researched primarily based on mechanical inventions from twenty or more years ago. However, nowadays, the product is much less 'mechanical' and much more 'electronic' or 'field-based', it is evident that some of the classical TRIZ tools can not providing users with as much assistance as they could. So a large scale of patent analysis was initiated in recent years, with the aim of acquiring substantial quantities of new data to add to the TRIZ database. The paper introduces the form and some findings in the research of 2002 Chinese mechanical inventive patents.

Keywords: *patent analysis, TRIZ, Inventive Principles, Level of Invention, Standard Solutions*

1. Introduction

TRIZ is the Theory of Inventive Problem Solving that put forward by G.S.Altshuler, a former Soviet Union scholar, and his followers, based on their research of 2500 thousands of patents. After the development of several decades, TRIZ has evolved to a strongly methodology that can solve the innovative problems or inventive problems, provides the deviser with a complete set of process model, tools and method in the conceptual design phase of the innovative design and improved design [1,2]. A large part of the strength and power of TRIZ exists because the methodology was built on a considerable database of research and the systematic analysis of a significant proportion of the world's most successful patents.

Around 1985, however, this analysis was for the most part halted and the research focus was shifted to other important areas, and the patent that G.S.Altshuler analyzed was primarily based on mechanical inventions from twenty or more years ago. However, In using some of the TRIZ tools on today's problems – in nowadays, millions of new patent emergence once a year with the rapid development of the technology, and the patent has become much more electrical and software based in its outlook – it is evident that the classical TRIZ tools are not providing users with as much assistance as they could [3].

So a large program of patent analysis was instigated in recent years with the aim of extending TRIZ to accommodate the changes brought about by the rapid development of the economy and technology, a great deal of new patents have been analyzed and added to the TRIZ knowledge base.

Studying TRIZ has initiated and gained some fruits in China, but not widely popularized in the commercial interests, not being applied to solve the innovation of products [2]. Facing the emergence of the great quantity of new patents, how to percipience the development and transformation of the technology, and how to mine the technology belonging to ourselves? Especially, since China has entered the WTO, we have facing more rigorous restriction of the intellectual property. So the researching of the independence of intellectual property becomes more important. Therefore, make use of the current patent fully and reasonable, at the same time, using the advanced design methodology(TRIZ) analyze the patent, discover the key technology of the patent and find out the Inventive Principle of the products. So we can forecast the future progress of the technology, enrich and perfect the theory of TRIZ, with

the important significance aim of guiding the innovation design of the product.

Based on the theory of Inventive Problem Solving (TRIZ), this paper analyzes some mechanical patent authorized by The State Intellectual Property Office of China in 2002, and the patent was analyzed in three main areas of focus: Inventive Principle, Level of Invention, Inventive Standards, and points out the importance of maintaining an active program of patent analysis in the end.

2. The statistic of Chinese inventive patent in 2002

In 2002, 21476 inventive patents had been granted by The State Intellectual Property Office of China. 27.3% of all, 5854 patents, were granted to Chinese, and the others 73.7%, 15622 patents were granted to overseas people. The amount of patents granted to Chinese in 2002 is nearly equal to that in 2001, while at the same time, which granted to overseas increased about 43%, as shown in figure 1. So, in 2002, there is a big gap between the amount of inventive patents be granted to Chinese and that of overseas.

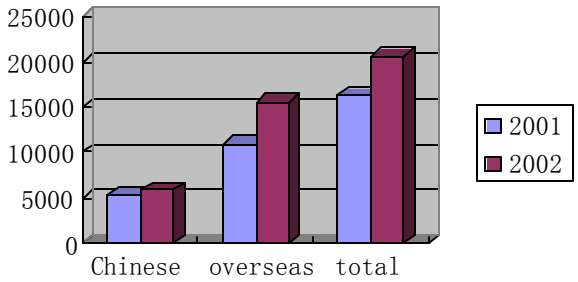

Figure1: The Contrast of The Patents Granted to Chinese and Overseas In 2001 and 2002

All of these patents came down to every parts of technology and reflected the development of the new technologies. The amount of patent application and authorization of Chinese and foreigner can reflects the innovative capability and technical level of a nation, or region and corporation.

3. Patent research

The research was conducted by 30 mechanical engineering undergraduates at our university, the students can select random a set of patents from the Chinese inventive patent databases, the only criteria being that the patents should describe an essentially mechanical-based system and that the patents should have been granted in 2002, each student was tasked with identifying six patents for analysis – and hence the total data for analysis comprised over 180 different inventions.

The patent research has been adopted the following basic process: First, the patent is given at least a cursory evaluation in order to ascertain its potential contribution to the TRIZ database. As a result of the research we can know that there is a considerable proportion that have little of value to contribute to understanding of the inventive process. Then, for those patents we consider worthy of further analysis, we conduct a detailed examination of the invention disclosure looking to acquire potential data in three main areas of focus: Inventive Principle, Level of Invention, Inventive Standards. A summary of the overall process is illustrated in Figure 2.

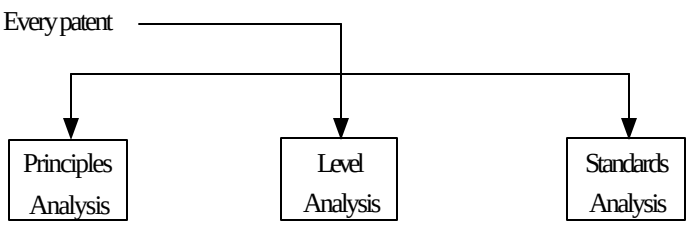

Figure2: Summary of Patent Analysis Process

3.1 Inventive Principle

Inventive Principle, namely the theory of technical contradiction solving, was summarized by G.S.Altshuler and his followers, based on their research of a great deal of patents, in all 40 items. These principles are not just restrained from applying in a certain field, they synthesized the theory of physical, chemical and all kinds of engineering fields, it can be applicable for the inventive creation in different fields [1].

Practice has proved that these principles play important roles in guiding the deviser's inventive design, and the applied frequency in solving problem is different, as shown in figure 3, arrows show the direction of frequency increasing [6].

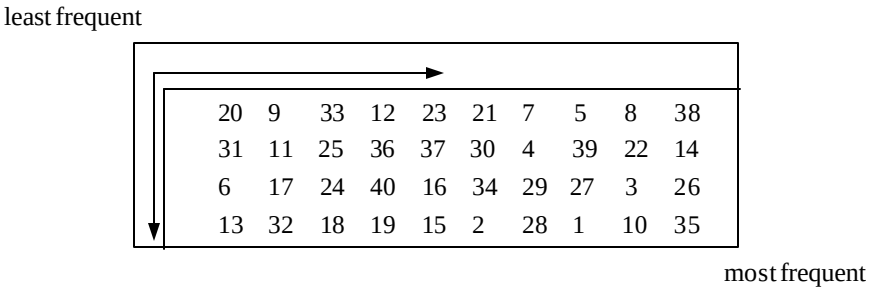

Figure 3. The Applied Frequency of Inventive Principle
(the reference to the contradiction matrix)

Principle 35, Parameter Changes is applied the most frequently, and Principle 10, Preliminary Action, Principle 26,Copying, Principle 3, Local Quality to a lesser extent. Principle 20, Continuity of Useful Action is rarely utilized.

In the research, the student was required to identify what aspects of a design the inventor was seeking to improve, what parameters these aspects conflicted with, and how the inventor overcame the conflict. And, what Inventive Principles the inventor have used. In broad terms, these elements can be extracted from the background, summary and claims sections of the invention disclosure text.

For all the 180 inventions of the research, have utilized the Inventive Principles definitely, statistics of the applied number of Inventive Principle is presented in figure 4.

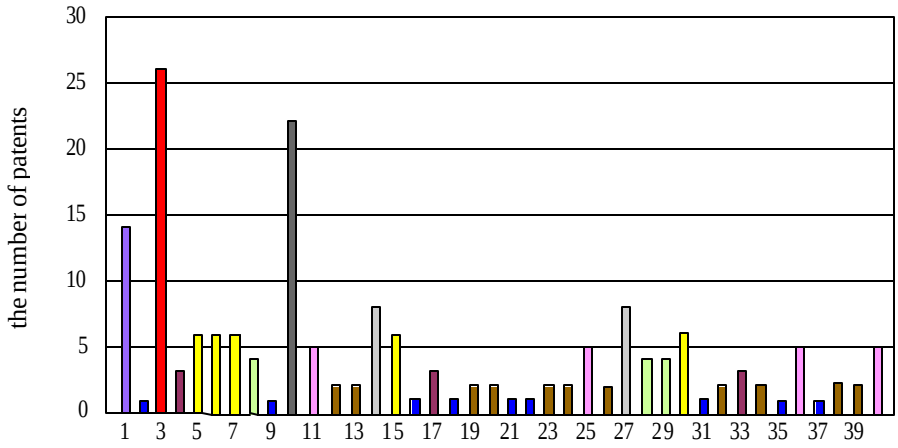

Figure 4. Statistics of The Applied Number of Inventive Principle

Though the frequency list（as shown in figure 3）is the frequency that the principles appear in the matrix, but the inventive principles are finally based on the research of a great deal of patents, and also the frequency list is. So we compare the results of our analysis to the frequency list, in order to verify the list. The patent that G.S.Altshuler analyzed was primarily based on mechanical inventions from twenty or more years ago, while the research here is of a significantly smaller size than the original analysis, it is nevertheless sufficient to allow some statistical comparison to be made [4].

As shown in figure 4, Principle 3, Local Quality was applied the most frequently, and Principle 10, Preliminary Action, to a lesser extent. Conversely, While the Figure 3 suggests Principle 35, Parameter Changes relatively frequently, the research suggest it has lesser been utilized, and the Figure 3 suggests Principle 20, Continuity of Useful Action relatively rarely, the research suggest the same result. By the statistical comparison, the applied frequency of Inventive Principle, which the inventors have used in their inventive products accords with figure 3 basically.

Usually, more than one Principle have been utilized in some patents, this suggests that the inventor seeking to improve some aspects of the patent, probably caused more than one technical parameter contradiction, consequently used more than one Principle in solving the contradictions [5].

These Principles only indicate the probably direction of solving the problem, namely, using the Principles can get rid of a lot of unfeasible way, therefore can guide the deviser to solve the problem rapidly. If the deviser can use the Principles constantly and expertly, so that he can improve his creative capability greatly and solve problem rapidly.

3.2 Level of Invention

The classification of patent into the five levels defined by G.S.Altshuler and the associated distribution between the five categories is well known across the TRIZ community, and the products evolve from low-level to high-level [1,3]. According to the classification of patent defined by G.S.Altshuler, we classify the patents in our research, and make a contrast to the classical TRIZ. We have envisaged that some changes to the classical patent distribution of the different levels have occurred during our research. The result of the research is presented in figure 5.

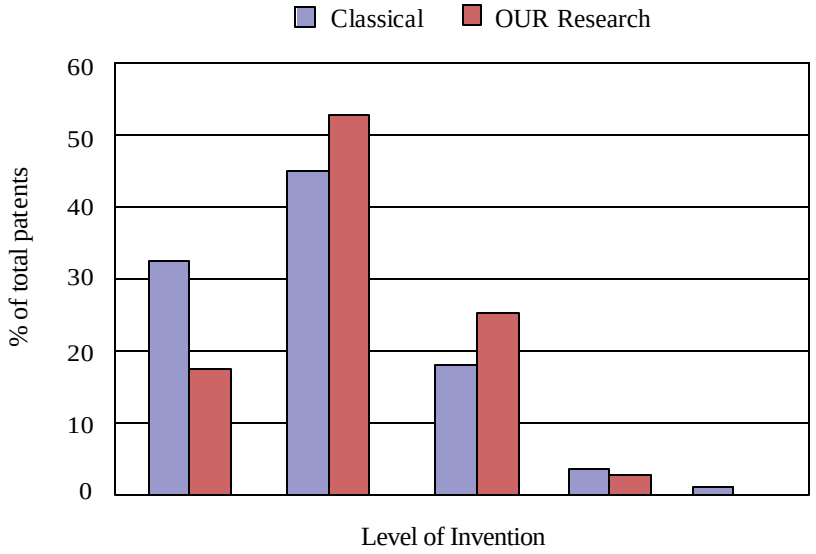

Figure 5: Comparison Between Classical and Updated Data on Level of Invention

The main shift we observe relative to the data from 'classical' TRIZ finding is one way from level 1 towards a greater proportion of level 2 and level 3 inventions. While we cannot be certain, this evidence suggests that inventors are progressively more likely to look outside the horizons of their organizations. This is probably due in no small part to the massive increase in the availability and accessibility of patent data in recent times, and the growing awareness that intellectual property represents an important competitor as far as potential investors is concerned.

The apparent decline in Level 1 inventions shows that many companies now probably do not use patents for some reasons: On the one hand, in fast moving consumer products industries, a product may be obsolete before the patent can be processed. Companies rely on trade secrets and speed for competitive advantage. On the other hand, the cost of applying for and maintaining a patent may not be justified in business terms, even thought the invention is interesting in TRIZ terms. Many companies are patenting only higher level inventions, to save money.

The increase in the number of level 3 inventions suggests that organizations are becoming increasingly aware of the possibilities of exploiting their intellectual capital in other sectors, can also be due to the increasing availability of data [3].

The small reduction in the number of Level 4 inventions relative to classical TRIZ findings seems to be unreasonable, we think this evidence that companies increasingly seek to build extensive patent 'fence' around their higher-level inventions before their competitors are able to do the same, so we cannot acquire enough data of higher-level inventions.

There is not a piece of Level 5 invention in the research.

An aspect of patents is the relationship and level of influence between different Levels of Invention. There was a definite link between Level 4/5 inventions and the subsequent creation of many Level 3, 2 and 1 inventions, high-level inventions are based on a great deal of low-level inventions. As have insufficient data from the research, we cannot establish any long term patterns regarding the dynamics of how quickly high level patents spawn lower level patents. We will continue to pursue such study, with the aim of acquiring more correlative data.

3.3 Standard Solutions

The Standard Solutions may be used as templates to which problems may be matched: They provide a concise description of the generic situation and generally include a statement of high-level constraints or restrictions. G.S. Altshuller and his followers had compiled standard Solutions of TRIZ for many years, in all 76 solutions. They are classified as 5 large categories. Standard Solutions are independent of other TRIZ toolkit. The 76 Standard Solutions with the S-Field model are useful for Level 3 inventive problems [1].

Analyzing Chinese inventive patents based on Standard Solutions, we can know that the patents according with the idea of Standard Solutions primarily remain with Classes 1 ('Improving the system with no or little change') and 4 ('Detection and measurement'). Of all the 180 patents, 30% (54 pieces) belong to Class 1, 4% (8 pieces) belong to Class 4, 8% belong to other class, and the others cannot come down to any Standard Solutions.

Owing to the form of Class 1 Standard Solutions is simple relatively, we have hypothesized that the Class 1 is applicable to the early evolution stages of a system, and so our research has tried to establish whether there is a valid correlation. The result of the research is presented in table 1, it clearly shows the Class 1 Standards generally being deployed to generate the lower level patents found during the initial growth periods of the S-curve.

This conclusion is not inconsistent with the viewpoint that Standard Solutions are useful for level three inventive problems, which discussed above. Because, on the one hand, the development of the patents has not used Standard Solutions method consciously, on the other hand, Class 1 Standards change the system least, primarily concerned with adding substances and fields to systems. To confirm a system evolution stage require some experience element for the scope of patents analysis, a precise conclusion should base on large numbers of data analysis.

Tab 1: Correlation Between Use of Class 1 Standard Solutions And Evolutionary State

Evolution Stage	% of Solutions	Average Level of Invention
Conception/Birth	1	1.7
Infancy	67	1.5
Growth	28	1.5
Maturity	4	1.3
Retirement	0	

In addition, during the research, we took notice of the overlap between the Standard Solutions and the Inventive Principles, like Principle 24 – Intermediary, Principle 5 – Merging, and Principle 1 – Segmentation, which are all concerned with adding substances or fields to systems. Some patents featuring these Principles usually also possible utilize Standard Solutions, and the average Level of invention is significantly higher. This suggests that higher-level solutions emerge from using combinations of Principles and Standards.

As far as Class 4 Standard Solutions are concerned, we have observed that many patents are the method for detection or measurement. Measurement problems can occur at any time during the lifecycle of a system. Solving these problems can apply Class 4 Standard Solutions.

4. Conclusions

The program of research use different parts of the TRIZ problem solving toolkit, has gained some contributive data to the TRIZ knowledge base. As creative invention, patent itself contains innovative value of the technique. We can find out the intrinsic technology of patent and the evolutive direction of the technology by way of analyzing a great deal of patents, then can forecast the future development of the technology, guide the innovative decision-making of the technology [7]. The result of the patent analysis is also the attribution to the enterprise, it can diminish the power of easing the transfer of best practice between different industries, enhance the start point of the R&D of the enterprise, help enterprise to make their strategical decision-making.

Owning to the analyzed patent was essentially mechanical-based system, and was conducted by manual work. Hence, the total data for analysis is insufficient, and the rate of the data processing is slow. With the development of the information technology, the query of patent becomes so convenience relatively. Almost all the patent database of the world can be consulted on the Internet, and there are large numbers of free database [8]. In recent years, using of analysis software of computer network information has been so helpful to analyze patent, for instance, some expert software for the patent searching and data mining.

We are increasing the research from other parts of patent other than mechanical field, even the patent of overseas, continuing to update the TRIZ database, and preparing to develop the software of patent analysis base on TRIZ.

Acknowledgement

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