

Design of the patent evasion and rescue manipulator based on TRIZ

Hong-liang Liu , Li-yan Chen

Changchun University of Technology, Jilin Province, China

Abstract. In this paper, the theoretical system and technical contradiction of TRIZ theory are analyzed. Combined with the patent law and patent law implementation rules, to determine the avoidance strategy. And through the goal of patent retrieval and determine the technical barriers, technical problems and solutions, according to the working mechanism and task, complete to the rescue robot manipulator mechanical structure design. The test results show that the stability and reliability of the manipulator are obviously improved.

1 Introduction

Due to the background of the global natural disasters, rescue work, showing a diversity and complexity, the development of rescue equipment proposed new requirements, the robot manipulator, which is able to detect the rescue rescue equipment instead of the natural person, the technology in nearly two years at a fast development in high speed. Study of manipulator through the biomechanics, mechanics, mechanics, electronics, material science, many areas of computer science and robotics, which belongs to the interdisciplinary field. In recent years, with the publication of relevant patents and papers, the robot has become a hot research topic in the field of international robotics.

Due to the recent emergence of robotic products, as well as a substantial increase in the amount of patent applications, in a number of areas formed a large area of technical barriers, restricting the development of the robot technology. Therefore, in the process of product design, it is needed to avoid the related patent reasonably, to find out the new technical problems and to solve the problem. But the TRIZ theory system is perfect, has the important instruction function to the risk aversion. TRIZ theory is applied to the design and improvement of robot, which can effectively improve the speed of updating and the speed of the development of the technology.

In this paper, we first analyze the whole theoretical system and technical contradiction of TRIZ theory. Patent circumvention combined with TRIZ theory, based on TRIZ patent to circumvent the robot product innovation design process, and through the goal of patent retrieval, determine the technical barriers, technical problems and solutions, to complete the design of manipulator is presented[1,2].

2 Overview of TRIZ

2.1 Overview of TRIZ theory

The core idea of TRIZ theory is mainly embodied in 3 aspects. First of all, both a simple product or a complex technology system, its core technology is to follow the objective law of development and evolution. Secondly, a variety of technical problems, contradictions and conflicts continue to be solved is to promote the driving force of this process of evolution. Then the ideal condition of the development of the technology system is to achieve as much as possible with the least resources.

TRIZ theory at the beginning of the problem solving, must first put aside all the objective conditions, through an idealized to define member end ideal solution, to define the ideal solution where the direction and position, assurance in problem solving process along the forward and the ultimate ideal solution is obtained, thus avoiding the defects of traditional methods of innovation design lack of goals, which improves the efficiency of design innovation. If the method of creative problem solving is likened to a bridge to success, then the ultimate ideal solution is the bridge pier. Ideal final result has four characteristics: to maintain the advantages of the original system, and eliminate the deficiencies of the original system; (3) did not make the system become more complex, 4 no province introduces new defects[3,4].

2.2 Contradiction and its solution

According to the TRIZ theory, the core of the invention is to solve the contradiction, and the design of the contradiction is not a creative design. Technical

contradiction is the contradiction between the two parameters, improve the system of a certain parameter, leading to the deterioration of the other parameters. As shown in the following Figure 1.

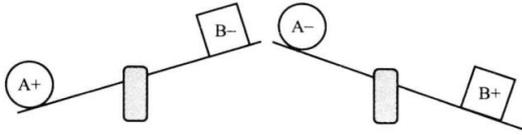


Figure 1. Technical contradiction

In order to solve the contradiction between technology and TRIZ defining the 39 technical parameters, these parameters can be broadly divided into three categories, namely: physical and geometrical parameters (including weight, length, etc.), positive parameter technology (accuracy and reliability, etc.) and negative to the parameters (energy consumption),

When a technical contradiction is identified for the specific problem, the contradiction is described in a specific term in the technical field of the problem. Then, the description of the contradiction is translated into general terms, which can be used to select the general engineering parameters from these general terms. Once a certain or several invention creation principle is selected, it is necessary to transform the invention creation principle according to the specific problem and produce a specific solution. The following Figure 2. for the whole process of the problem solving[1-3].

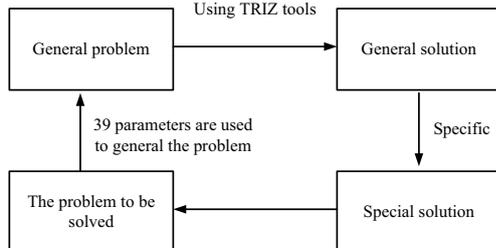


Figure 2. Problem Solution

3. Patent infringement and patent evasion

3.1 Basic knowledge of patent

Patent, also known as patent, refers to the state in accordance with the patent law granted to the applicant in a certain period of time and a certain region of its invention to create exclusive, use and dispose of the rights. At the same time, a patent document refers to the document containing the invention to create a detailed content and technical scope, but also can be used as a reference for the technical personnel to solve technical problems in this field.

A patent application to the grant of the patent right, in addition to meet with the object of the patent law in Article 2 of the protection and Patent Law Article 5 stipulated in does not violate the law, and are not in Article 25 of the patent law does not grant patent

invention of some special creativity preconditions, the most important is to have the novel, creative and practical. That solves the different technical contradiction, or uses the obvious difference in the past technical plan, has obtained the unexpected technical effect.

3.2 Patent evasion

Due to the concept of patent evasion design is derived from the patent infringement judgment procedure in the legal science, the existing patent evasion strategy is also based on the infringement judgment. At present, avoidance strategy is mainly used to remove the component design method, substitution method and the method based on the old estoppel. Here are some of the common design strategies to avoid a brief introduction. Delete method, is refers to the already effective patent on the subtraction of one or more of the necessary technical features, the transfer of its function to other system components; delete some components or auxiliary function. The legal basis of the deletion method is based on the comprehensive coverage principle and the doctrine of equivalents in the infringement judgment. It should be noted that, if all the necessary technical features in the patent right requirements of the existing patent, adding new technical features, it will fall into the scope of protection of the patent right. When using the method of deleting, it often produces new problems. At this time, we need to set up a new problem model, and solve the problem in the course of solving the problem. Alternative law refers to the use of different means (technology, methods, principles), so that the system has the same function, to achieve the same effect. The legal basis of alternative sources is also based on the principle of comprehensive coverage and the doctrine of equivalents. The use of alternative methods, it is necessary to pay attention to the need to take a different technology, methods or principles, otherwise it will be regarded as equivalent, thus falling into the scope of patent infringement. Estoppel method, namely the use of patent rights in the process to apply for a patent or follow-up procedures in the process of give up the rights of the original requirements. The legal basis of estoppel is law infringement estoppel principle based on. By this way, the need to apply for or download to avoid the patent review files, search for evidence of estoppel. If the patent has to avoid the content, then can be used directly and does not constitute infringement, otherwise, it must be turned to other strategies to avoid.

4 Application of patent evasion based on TRIZ in the design of rescue robot system

4.1 Research background

It is one of the common problems in the field of rescue at present that the huge volume of rescue equipment and limited operating range is one of the common problems. The research and development of micro rescue robot,

which has the advantages of flexible operation and wide working range, is of great significance to improve the efficiency of rescue work and reduce the loss.

Micro rescue manipulator is an important part of the rescue robot. Rescue manipulator (big arm, small arm, wrist, end clamping mechanism) by imitating the function and structure of human hand, and combined with the measurement system, and ultimately the end of the clamping mechanism to achieve accurate target location. The design and development of the rescue manipulator in the stiffness and strength to meet the requirements of the rescue work on the premise, improve the control accuracy and stability, and to achieve miniaturization and lightweight.

4.2 Functional analysis

Through the analysis of the function of the five main components of the rescue manipulator and the interaction, it is found that there may be some harmful effects or surplus function, so as to find the direction to avoid the improvement. Found the transmission device structure is too complex, affecting the accuracy of positioning, through the analysis and for end effector position positioning error may exist, and will increase the rate of vibration and fault can thus be identified it as the role of excess.

Provisions on the implementation of the patent law, the second paragraph of the twentieth paragraph provides the necessary technical features of the independent claims records to solve technical problems. To determine the role of analysis of these effects can be identified excess non essential technical features, the effect generally only in the review process or invalid program, facing the scope of protection had to shrink when, as modifying a source based on, at the same time in the product upgrading a process can also be replaced by elements or elements omitted the were removed or replaced, and the excess function replacement and also derived from new inventions create.

In the process of determining the scope of protection, the establishment of a mechanical hand function model, as shown below.

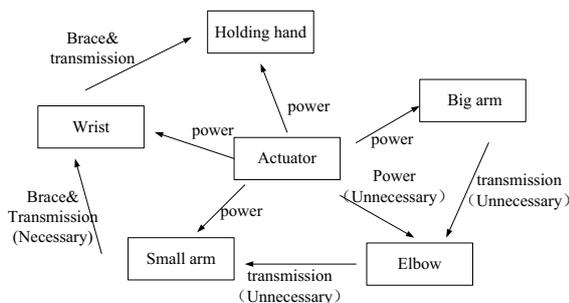


Figure 3. Mechanical hand function model

4.3 Retrieval analysis

Patent retrieval is the most commonly used method of retrieval: keyword search, IPC search and the use of it in order to get a comprehensive and accurate patent information. To the main classification number "(B25J1/00) and its classification, the following group and group of integrated retrieval. Finally, 412 patent, the patent for invention or utility model 372, according to the key words and the same or similar technical characteristics were screened to find the closest prior art, ultimately determine the " 101780673A "is the closest prior art. The patent deadline is still in the effective state.

The target document is a total of 3 rights requirements. The rotary joint is composed of a rotary joint, a connecting plate and a base, wherein the five rotary joint structures are similar, and are composed of a reducer, a flange, a motor, a box body and an encoder. Unique body design and ingenious motor, a retarding mechanism coordinating scheme of the rotary joint has light weight, simple and compact structure, convenient wiring, high strength, modular degree higher characteristic, so as to solve the general service robot arm because of weight problems and bring about the action is not flexible, inertial motion problem[3,4].

4.4 Design in the process of patent evasion

In order to avoid the patent of technical barriers, you need to increase to be solved technical parameters of the contradictory ways, selected a technology negative to the technical parameters and (31 objects produce harmful factors) positive parameters (29 manufacturing precision and 35 adaptability and the use of) to solve. In this application, increasing the pre tightening device for the manipulator to suppress negative to parameters in the vibration and improve manufacturing precision, and by increasing the end manipulator system increases a clip to function, so as to solve the existing technology in the three technical contradiction is executed.

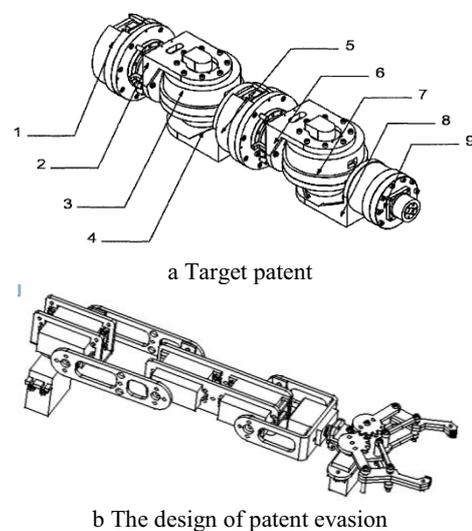


Figure 4. Design comparison

The patent after to avoid the robot by a rotary pair and swing side basal joint, with a swing side of the elbow joint, with turning pairs and the swinging side of the wrist

joint, the connection between the base joint and elbow joint arm, connecting between the elbow and wrist arm and wrist joint is connected with the clamping hands. Each joint rotation pair and swing pair, and the connecting rod drives the holding hand independent movement respectively by a stepper motor drive. The robot can move to a place where a person can't safely arrive at the time of danger. Through the mechanical arm and the chassis with the action, and through the increase of the number of gaskets with the connection, so that the device is more compact, reduce assembly clearance and vibration. As shown in the following Figure 4[4,5].

Summary

Robot technology in the past two years, the rapid development of the relevant technical documents open number multiple areas of increased year by year, in addition to the rescue, services, entertainment, rehabilitation, robot products and technology has also been widely used. Correct use of patent information technology, can reduce the technology development cycle and development costs, and based on the patent of TRIZ to avoid, can effective technical protection and patent layout, at the same time, through the technical contradictions continue to analyze and solve, can also promote the update and improvement of robot and robot technology, greatly improved the reliability and stability of the robot.

Acknowledgement

This work was financially supported by the Jilin province education department Twelfth Five-Year Scientific research project (No.[2013]153).

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