

# Innovative Research on Mobile Phone Radiator based on TRIZ Theory

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## Abstract

**In this paper, some solving methods in the theory of TRIZ, principle and solving principle and solving algorithms, the life of the ordinary mobile phone protection shell with innovation, designed to be a able to store electricity, heat, and support a mobile phone protection shell, special the phone by-products can solve both run out of battery case emergency charging problem, also can solve the mobile phone hot hot Heat problem, as well as the use of mobile phone bracket after drama or watching videos, network class, more functions and convenient, reduce unnecessary loss and health injury.**

## Keywords

**TRIZ Theory; Storage of Electrical Energy; Heat Emission; Support Mobile Phone.**

## 1. Introduction

With the development of smart phones, the main frequency of mobile phone chips is getting higher and higher, and the power is also getting higher and higher. The mobile phone will constantly generate a lot of heat in the process of running. Generally speaking, the normal temperature of mobile phone operation is between 30-50°C, more than 50°C indicates that the mobile phone has begun to heat hot, if the heat can not be dispersed in time, will cause the reduction of mobile phone frequency, at the same time, the heat source part of the strong sense of heat, will cause harm to mobile phone. Once the mobile phone gets hot, it will not only affect the user's experience, but also have a great negative impact on the performance of the mobile phone. Moreover, excessive heat will also cause a certain degree of damage to the hardware of the mobile phone, and even cause a fire when charging the mobile phone. Therefore, it is necessary to heat the mobile phone.

Since many years of development, China's mobile phone radiator industry has begun to enter the stage of brand competition, and in the trend of energy saving and environmental protection, from the previous cast iron radiator to energy saving, environmental protection, efficient, beautiful, light radiator change. Judging from the development and growth of the downstream industry, China's mobile phone radiator industry is still in the growth stage, and there is still a lot of room for improvement in the future. Therefore, this paper will carry out some innovative research and analysis on the current design and related functions of mobile phone radiator, hoping to bring some help to the market of mobile phone radiator industry in the future.

## 2. Relevant Introduction of TRIZ Theory

TRIZ Russian spelling for теория решения second изобретательских задач discusses some related problems, Russian abbreviation "ТРИЗ", Translated as "Inventing the theory of problem solving", it is pronounced in English as Teoriya Resheniya Izobreatatelskikh Zadatch, abbreviated to TRIZ. It is known as Theory of Inventive Problem Solving (TIPS). The founders of TRIZ theory are Genrich and Archishuler. In the most popular sense, innovation is the process of creatively discovering and creatively solving problems. The powerful role of TRIZ

theory lies in that it provides systematic theory and method tools for people to creatively discover and solve problems.

TRIZ theory provides a variety of scientific methods to systematically analyze problems, such as multi-screen method. For the analysis of complex problems, it includes the scientific problem analysis modeling method -- matter-field analysis method, which can help us quickly confirm the core problem and find the fundamental contradiction of the problem. According to the different characteristics of the matter-field model, there should be standard model processing methods, including model modification, transformation, addition of matter and field, etc.

Based on a large number of patent analysis, eight basic evolutionary rules are summarized and extracted by TRIZ theory. Using these evolutionary rules, we can analyze and confirm the current technical status of products, predict the future development trend, and develop competitive new products. Different inventions tend to follow common rules. TRIZ theory summarizes these common rules into 40 innovation principles, which can be used to find specific solutions to specific technical contradictions based on these innovation principles and combined with engineering practice.

ARIZ algorithm is mainly aimed at the technical system with complex problem situation and unclear contradiction and related components. It is a non-computational logical process of a series of deformation and redefinition of the initial problem to realize the gradual in-depth analysis of the problem, problem transformation, until the solution of the problem. On the one hand, the technical system evolves towards the direction of the ideal solution; on the other hand, if a technical problem has conflict to overcome, it becomes an innovation problem. The key to success with ARIZ is to refine the problem without understanding the nature of the problem until physical conflicts are identified, and the process and solution of physical conflicts are already supported by software.

TRIZ's knowledge base, based on the analysis of millions of patents in physics, chemistry, geometry and other fields, can provide a rich source of solutions for technological innovation.

### 3. Function Requirements of a Mobile Phone Heat Sink

This innovative design is a mobile phone by-product integrating mobile phone protection case, mobile phone bracket and mobile phone radiator. The product is a kind of mobile phone case style, convenient to carry and easy to install. This innovative design intends to use ABS material, because ABS material is relatively hard, ABS material has great advantages in fluidity, coloring, surface spraying and electroplating performance. Now there is a new process, called in-mold injection process, currently basically use ABS plastic material, the surface of the material is PET. The advantage of this process is that the surface of the shell can do more rich patterns, similar to the transfer process, but more delicate than the transfer pattern, more perfect in detail, strong texture, looks very tasteful.

1, storage of electric energy. The ordinary mobile phone protection shell designed to store electricity special mobile phone protection shell, its energy storage methods are divided into two kinds: the first is charging energy storage type, namely in advance for the mobile phone protection shell filled with power, in the case of mobile phone no electricity for mobile emergency in time, at the same time on the mobile phone protection shell is equipped with charging line, solve the user emergency problem, forget to carry mobile phone charge in case this kind of mobile phone protection shell Low cost, can be accepted by most mobile phone users; Second is solar energy conversion type, the solar energy into electricity and stored in the battery in the form of electricity, the mobile phone protection shell under the condition of the cell phone battery is as long as there is light or electricity in battery of mobile phone protection shell can be mobile emergency power supply, also equipped with charging line on the mobile phone protection shell, but the high cost of this kind of mobile phone protection shell, but more

optimization of mobile phone users Their sense of use experience, use more convenient, but also by the majority of mobile phone users welcome.

2, emit heat. Add the heat dissipation function of mobile phone on the basic function of ordinary mobile phone protective shell, and divide the mobile phone radiator into two corresponding styles according to the energy storage mode of mobile phone protective shell. The first is for the charging energy storage mobile phone protective shell, using a small cooling fan, the cooling fan material is going to use oil-bearing, in order to low noise, and considering the heat emitted by the mobile phone is relatively small, and the cooling fan is placed in the mobile phone easy to heat, easy to accurately emit heat, to achieve efficient cooling; Second for solar energy conversion type, adopts a new kind of heat dissipation material is graphite heat sink, for thermoelectric materials for further study at the same time, strive for in the heat coming from the mobile phone to realize the transformation of heat energy and electrical energy breakthrough, make handsets thermoelectric materials together with the combination of solar energy power supply parts to provide emergency power for mobile phones, this can not only increase the cell phones Heat dissipation ability, improve the performance of mobile phone, prevent all kinds of harm caused by mobile phone heating, but also for mobile phone protection shell battery storage part of the power supply for mobile phone to provide more sufficient space and conditions.

3, embedded adjustable mobile phone bracket. Consideration of production and cost, mobile scaffold material used and the following from the same material, at the same time, based on a lot of people use cell phones to see video, now chase play, such as cell phone in hand phone fever easily for a long time, and make his hands ache, and may be due to sitting position and other factors lead to cervical vertebra and some damage eyes. This will add an auxiliary function, normal cell phone protection shell is following with embedded stents, so then you can free hands and a phone in the best visual Angle, cell phone placed on the table, thereby reducing people caused by the use of mobile phones or damage to the eyes, the incidence of cervical spondylosis provides protection to the health of the consumer. And mobile phone protection shell with the following contact way as the semicircle Mosaic, i.e., the mobile phone support contact with the following parts, mobile phone support for semicircle (for the opening and closing of mobile phone provide operational space, and also can effectively provide placement space for cooling fan), both ends for semi-circular protruding, corresponding to the phone for the concave. This embedding method can save the expense of redundant materials, and the residual material of mobile phone case can be used to complete this part.

## **4. Carry out Innovative Design According to TRIZ Theory**

### **4.1. Energy-storage Mobile Phone Protective Case based on TRIZ Theory**

The ordinary mobile phone protective case is designed as a special mobile phone protective case that can store electric energy. When the mobile phone is out of power, it can charge the mobile phone in time to avoid delaying some important things. This innovative research mainly finds the breakthrough point of the problem through the matter-field analysis method in TRIZ theory, and deeply studies the existing problems and solutions of the innovative design through the mediation principle, pre-action principle, local property principle and multi-function principle in TRIZ theory.

(1) Matter-field analysis model. The principle is: all functions can be decomposed into two substances and a field, that is, a function consists of two substances and three components of a field. Product is a realization of function, so the function of the product can be analyzed in terms of matter-field. Thus, this innovative study finds a research scheme to solve the structural problem of using the protective shell of energy storage mobile phone as emergency power source through the problems obtained by material field analysis in TRIZ theory. Two energy

storage modes for emergency power supply function of mobile phones are studied in depth based on the technical contradiction obtained from the matter-field analysis model of TRIZ theory.

(2) Intermediary principle. Mediation principle is to use can migrate or transfer function in the middle of the object, according to this principle will know the solar type charging for mobile phone protection shell need an intermediate medium convert light energy into electrical energy, thus, using solar panels for the material of light energy into electrical energy, which can convert light energy into electrical energy stored in batteries, fundamentally solves the energy conversion The topic.

(3) Principle of prior action. To perform a desired function (whole or in part) in advance, to place objects so that they can perform the desired function immediately on the spot and in the most convenient place. Through this principle, the mobile phone without electricity, energy storage for the mobile phone protection shell, the solution of the problem of emergency power supply is in advance a solar panel installed on the mobile phone protection shell or lithium batteries, and stored in advance part of the electricity in batteries, play a role in advance of effect, which successfully solved the problem.

(4) Local property principle. The principle of local properties refers to the transition from the consistent structure of the object or the external medium (external action) to the inconsistent structure. Different parts of the object should have different functions, and each part of the object should have the most suitable conditions for its work. The ordinary mobile phone protective case is designed as a special mobile phone protective case of energy storage type. Solar panels or lithium batteries are installed on the protective case, which are assembled and connected through independent integrated circuits and voltage regulators, and meanwhile charging data lines are configured. This maximizes local functionality.

(5) Multi-function principle. This is when one object performs many different functions and therefore does not need other objects. The ordinary mobile phone protective shell can be improved to protect the mobile phone to reduce the damage of falling, but also for mobile phone charging, equivalent to an emergency charging treasure.

#### **4.2. Heat Dissipation Mobile Phone Protective Case based on TRIZ Theory**

According to TRIZ theory, the ordinary mobile phones designed to protect shell for heat dissipation of special mobile phone protection shell, and further study of thermoelectric materials, realizing the maximization of mobile phone heat absorption and sends out, through the analysis of the theory of TRIZ conflict resolution principle to find the breach of the problem, the asymmetry of TRIZ theory principle and principle of change to harm for find The implementation method to solve this innovation point.

(1) Principle of technical conflict resolution. It means that different inventions tend to follow the same rules. TRIZ theory summarizes these common rules into 40 innovation principles, aiming at specific technical contradictions, based on innovation principles, combined with engineering practice to seek specific solutions, that is, through the combination of heat dissipation device and energy storage charging device, so as to solve space problems.

(2) Asymmetry principle. It refers to the transformation of an object from a symmetric form to an asymmetric form. Mobile phone protection shell shape is a rectangle, it is symmetric device, but the phone after hot hot parts is not the whole mobile phone shell, so the cooling fan or graphite slice into and lithium battery or solar panel the size of the same size, and installed on the mobile phone protection shell, so as to solve the cooling fan or graphite piece too big cause the waste of resources, and also reduces the production of mobile phone protection shell Ben.

(3) The principle of turning harm into benefit. It is to use harmful factors (especially the harmful effect of media) to obtain beneficial effects. After the ordinary mobile phone protective shell is improved into a special cooling mobile phone protective shell, the thermoelectric materials are

further studied, and the heat emitted by the mobile phone is converted into electric energy, so as to achieve the maximum benefit of changing harm into benefit.

### 4.3. Mobile Phone Protective Case with Embedded Adjustable Bracket based on TRIZ Theory

According to TRIZ theory, the ordinary mobile phone protective case is designed as a special mobile phone protective case with an embedded adjustable bracket, and the energy storage device and heat dissipation device are combined with the assembly of this part of the device, so as to realize the integration of various functions of the mobile phone protective case. This paper mainly through TRIZ theory of combination principle, consistent principle and physical contradiction to further understand and study the problems existing in this innovation point. So as to find a concrete way to solve the problem.

(1) Combination principle. This refers to the combination of the same objects or objects that perform similar operations, but also the same or similar operations in time.

(2) The principle of consistency. That is, objects that interact with the specified object should be made of the same (or similar in nature) material. The mobile phone protective case and mobile phone bracket are made of the same material to ensure consistency and save materials. At the same time, the sunken part of mobile phone protective case is used as the placing space of mobile phone bracket.

(3) Physical contradiction. The energy storage device and heat dissipation device in the mobile phone protective case and the perfect combination of mobile phone bracket, but in the process of combination, there will be many physical contradictions: not only want to store the electric energy in the mobile phone protective case, but also want to emit heat for the mobile phone; Want to have an embedded adjustable phone stand, but also want to make the phone shell beautiful. Finally, through a deeper study of the physical contradiction principles in TRIZ theory, these physical contradictions of mobile phone protective shell are solved, and combined with the combination principle of energy storage device, heat dissipation device and mobile phone bracket assembly, to produce this multi-functional mobile phone by-product.

## 5. Conclusion

TRIZ theory is dedicated to the study of innovative design theory, has established a series of universal tools to help designers achieve satisfactory solutions as soon as possible. Advantages of TRIZ theory: Compared with traditional innovation methods, such as trial-and-error method, brainstorming method, TRIZ theory has distinct characteristics and advantages. It successfully reveal the inherent law and principle of the invention, to clarify and emphasize the contradictions existing in the system, rather than to escape conflict, the goal is to completely solve the contradiction, in the end to the ideal solution, rather than a policy of compromise or compromise, and it is based on the development of the technology evolution studies the design and development process, and is no longer a random behavior. Practice has proved that using TRIZ theory can greatly speed up the process of people's creation and invention and get high quality innovative products. So it can help us to system analysis of the problem situation, essence quickly found the problem or contradiction, which can accurately determine the problems to explore direction, breakthrough thinking obstacles, break the mindset, with new visual analysis, systematic thinking, can according to the technological evolution law to predict the future development trend, help us to develop new competitive products. So on principles in TRIZ theory and method rationally realized the energy storage device on the mobile phone protection shell, radiator and embedded adjustable bracket assembly problem, thus, to a certain extent, solve the case of an emergency cell phone battery is bring some losses, reduce



the cell phone about the dangers of hot hot on the phone itself, And reduce the health risks caused by the high Angle of mobile phone, such as watching TV series and watching videos.

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