Optimal Design of Hair Dryer Based on TRIZ Theory

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Abstract

Based on the technical contradiction and innovation principle of TRIZ theory, combined with the design example of hair dryer, the optimization design of the functional structure of hair dryer is made to improve its shortcomings. Split the hair dryer and define the functions of its components. The experimental data are obtained through the analysis of function evaluation and value coefficient, and then get the functional structure that needs to be improved. Combined with the innovation principle of the TRIZ theory, select an innovation way of improving the functional structure that can be used. According to the theoretical results, a more optimized design of hair dryer was designed. The case of optimization design of hair dryer shows that TRIZ theory can effectively solve the functional conflicts and structural contradictions of products.

Keywords

TRIZ, technical contradiction, innovation principle,optimization design.

1. Introduction

TRIZ theory originates from the research of patent invention by experts in the former Soviet Union. It summarizes the basic principles followed by invention and creation, and integrates multi-disciplinary knowledge. It puts forward a set of basic principles of innovation research[1]. In recent years, TRIZ theory has become a very effective auxiliary tool for innovative design[2-4]. TRIZ theory holds that the mark of product innovation is to solve or remove contradictions in design and produce new competitive solutions[5-7]. The core of invention problem is to discover and solve contradictions. The design that has not overcome contradictions is not innovative design. The process of product evolution is the process of constantly solving contradictions existing in products[8-10]. After one contradiction is resolved, the product evolution process is at a standstill. after another contradiction is resolved, the product moves to a new state. Designers constantly discover and resolve conflicts in the design process, which is the driving force for the evolution of design towards idealization[11].

In this paper, we use the method of TRIZ theory to carry out innovative design of electric hair drier. This paper analyzes the existing problems of the product, summarizes these problems, finds out the corresponding standard problems, and then calculates the standard solution, obtains the corresponding solution, solves the problems encountered, and completes the product innovation process.

2. Classification and Analysis of Product Components

2.1 Split various parts of hair dryer.

Fig.1 Explosion diagram of dismantling and blowing of blower

2.2 Function definition function cards.

Through the analysis of each part, it is judged that the main parts needed to realize the function are drawn the function definition worksheet, and some function cards are obtained(Tab.1).

Tab.1 Function definitions of parts of hair dryer

Number	Spare parts	Functional definition	Cost (RMB)
1	Front cylinder	Concentrated wind power and convenient use	8
2	Shell	Protect parts, seal body and beautiful shape	18
3	Handle	Easy to take, support structure, beautiful shape	13
4	Filter net	Protect human body and protect parts	3
5	Screw	Fixed connection	0.15
6	Selector switch	Adjust temperature and control wind force	1
7	Electric machinery	Driving fans and providing power	11
8	Electric hot wire	Generate heat and heat into the air	7
9	Electric wire support	Supporting electric heating wire	9.2
10	Fan	Generate wind	7
11	Mica sleeve	Isolation of heat and fixed wire	4
12	Connector	Connection structure	8
13	Plug	Through current and forming loop	8
14	Wire	Connection power	4

2.3 Functional system diagram.

Combining with the related knowledge of functional arrangement, this paper analyzes and clarifies the intrinsic relations among the various functions. After discussing and compiling the functional system diagram according to the functional logic system (Fig.2), unnecessary functions are found and eliminated, the functional areas of value improvement are grasped, and the grades of the improved objects are defined.

2.4 Function evaluation.

As one of the important links of product development and design, function evaluation is indispensable. This process is to find out the low-value functional areas by evaluating the level of function value, and help us to define the specific functional areas that need to be improved.F1: hair dryer; F2: heating; F3:

protection of safety; F4: appearance; F5: wind intensity. The following ABCDE five steps are to strictly abide by the whole evaluation process of functional evaluation steps:

A. Seeking function importance coefficient

In order to obtain more objective data, it was decided to adopt the compulsory decision method (0,1 scoring method). The following are the final conclusions drawn from a number of synthesis, as shown in Tab.2.

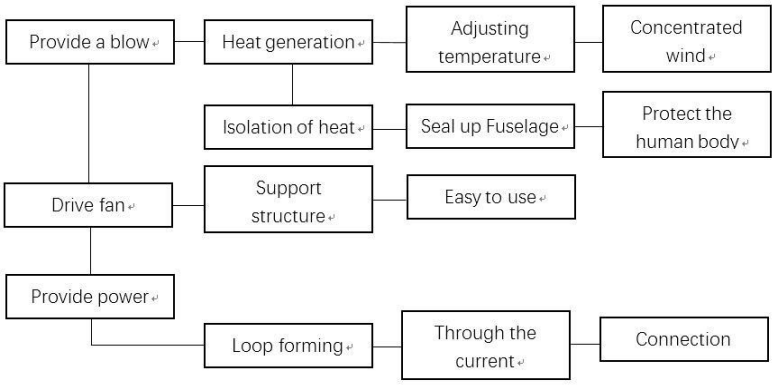

Fig. 2 Functional diagram of blower

Tab.2 Evaluation table of blower function coefficient

Function name	One to one comparison result					Function score	Function evaluation coefficient
	F_1	F_2	F_3	F_4	F_5		
F_1		1	0	1	1	(3)4	0.27
F_2	0		0	1	0	(1)2	0.13
F_3	1	1		1	1	(4)5	0.33
F_4	0	0	0		0	(0)1	0.07
F_5	0	1	0	1		(2)3	0.2
Total						15	1

B. Finding cost coefficient

When a component undertakes only one function, the function cost coefficient is usually calculated by the realistic cost of the component; if multiple components undertakes one function, the function cost coefficient is calculated by the actual cost of each component; if one component undertakes multiple functions, the function weight should be considered first. Cost allocation is made to the extent and then the functional cost coefficient is calculated. Based on the above calculation principles, the final conclusion is obtained after repeated accounting, as shown in Tab.3.

Tab. 3 Calculation data of cost coefficient of hair dryer

Constituent elements		Functional area				
Name	Cost	F1	F2	F3	F4	F5
A	43.6	10	10	12	10.6	1
B	4304	15	14.4	4		10
C	12	8	4			
Real cost	C	C1	C2	C3	C4	C5
	99	33	28.4	16	10.6	11
Cost coefficient		0.33	0.29	0.16	0.11	0.11

C. Seeking value coefficient

According to the calculation method of value coefficient, the result of Tab.4 is obtained.

Tab. 4 Data sheet for calculation

Functional area	Value coefficient	Current cost	Cost coefficient	Value coefficient
F1	0.27	33	0.33	0.82
F2	0.13	28.4	0.29	0.45
F3	0.33	16	0.16	2.06
F4	0.07	10.6	0.11	0.64
F5	0.20	11	0.11	1.82
Total	1	99	1	

D. Analysis based on value coefficient

Theoretically, the closer the value coefficient is to prove that the proportion of components in function is equal to that in cost in the same period, so it can not be used as a key improvement object. When the value coefficient is less than 1 and much less than 1, it shows that the parts are not very important in function, but they occupy a larger cost, and should be listed as the key research object of value engineering. When the value coefficient is greater than 1 and much larger than 1, it shows that the parts are more important in function and have lower occupancy cost, which is the goal of value engineering. Through the above judgment method, F2 and F3 are determined as the key analysis objects of value engineering. According to the experience analysis, the final key analysis object is F2.

3. Product improvement

TRIZ innovation theory is undoubtedly efficient as one of the means to solve the problems found. It quantifies the problems found, systematizes the methods to solve the problems, and greatly reduces the time to solve the problems. The following is the practical application of TRIZ innovation method to the design of hair dryer. As shown in Fig.3 and Fig.4.

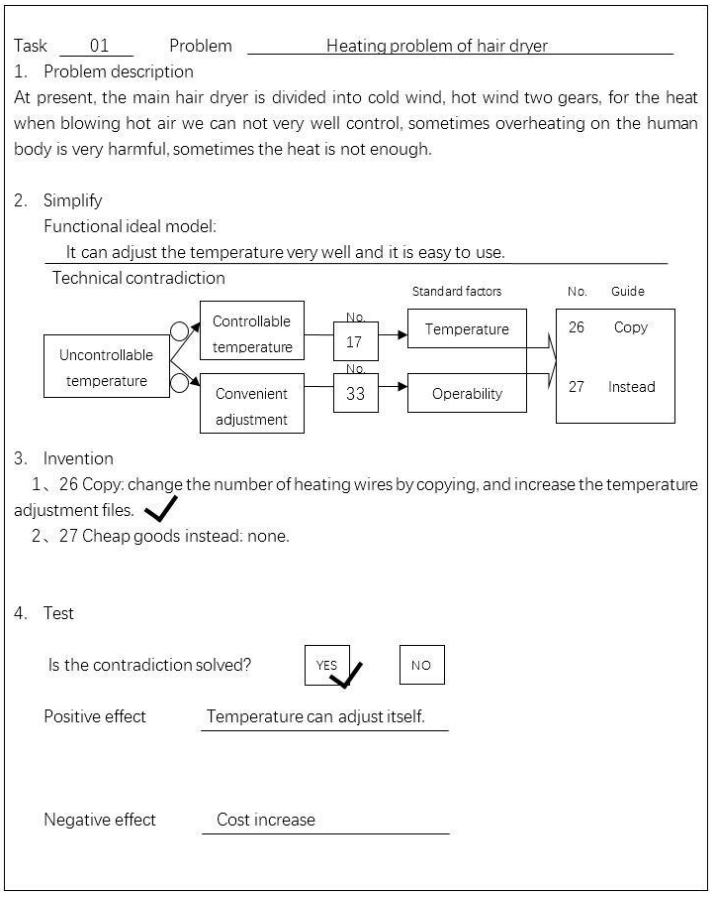

Fig.3

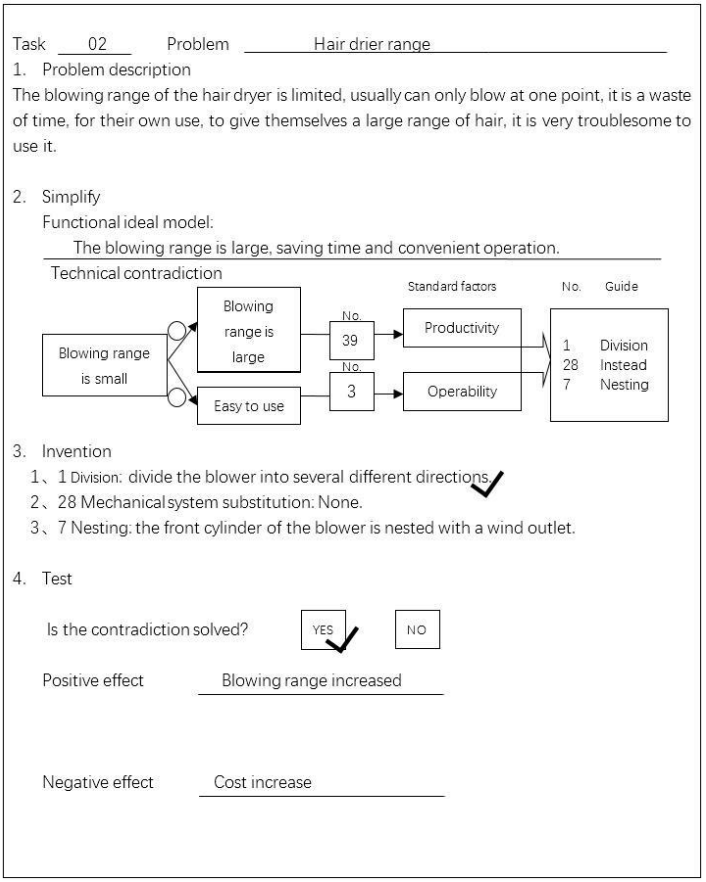

Fig.4

After the analysis and research in the early stage of design, the following improvements are obtained.

A. The scheme changes the front cylinder mode, enlarges the anti-skid design of the fuselage, and changes the installation mode of the power cord.

B. Question-mark hot-blower, through two layers of electric wire, control different temperatures, take question-mark as the prototype of product modeling, innovative design.

C. Using a variety of front barrels, can be replaced according to different conditions of use, and at the same time insulated cold air gear, temperature control is divided into low, medium and high, the temperature has a good control. The folding handle can be well accommodated.

4. Conclusion

In the process of product development and design, many factors should be taken into account. From a small screw to the overall appearance, detailed analysis is needed to calculate the relationship between the cost, function and many other factors. The innovative design of the electric hair dryer based on TRIZ theory is completed by using the relevant knowledge of product development and design, design psychology, color psychology, material structure and technology, and combining with the relevant means of product modeling design.

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