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Development and Industrialization Overview of Intelligent, Low-Noise and High-End Personal Hair Clippers

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Abstract: With the development of technology and the improvement of people's quality of people's life, intelligent, low-noise and high-end personal care appliances are increasingly favoured by the market. Taking the example of intelligent low-noise and high-end self-service hair clippers and suction hair clippers, this paper introduces the research and industrialization of high-end personal hair clippers, analyzes their market prospects, technological highlights, industrialization strategies, etc., to provide reference for the products transformation and upgrading of relevant enterprise.

1   Introduction

In recent years, in the field of personal care appliances in China, with the intensification of market competition and the diversification of consumer demands, how to enhance product competitiveness, innovate product features and reduce noise has become the focus of attention for electrical appliance enterprises. As a convenient hairdressing tool, personal hair clippers are increasingly favoured by consumers. However, existing personal hair clippers often face problems such as significant noise during use, which affects the user experience and potentially causes noise pollution. Therefore, this paper proposes a research and industrialization scheme for intelligent, low-noise, high-end personal hair clippers.

2   Current Situation Analysis

Personal care home appliances are an important part of smart home appliances. With the continuous improvement of people's quality of life and the emergence of new products and demands, personal care home appliances, such as self-service hair clippers, suction hair clippers, etc. are evolving towards personalisation, energy saving and intelligence. The increasing market demand has driven 39% of domestic OEM and ODM service providers to transform and upgrade, leading the trend of emerging consumer preferences.

Compared with the advanced level abroad, domestic personal care home appliances, especially hair clippers, face the following problems: (1) Insufficient personalised design, which requires optimisation of product appearance and fashion features to meet the needs of different consumer groups. (2) Lack of application basic research, such as friction analysis and air flow field analysis, in material selection, heat treatment processes and product structural design, which affects product performance, lifetime and energy efficiency. (3) Low level of product intelligence, with self-service visual hair clippers still at an early stage. (4) Product processing, assembly and testing processes need to be optimised, the level of automation and intelligent need to be improved, including heat treatment, cutter head flatness, roughness detection, lubrication testing and life testing and so on.

3   Typical Products and Technical Specifications

3.1 Suction Hair Clippers

Suction hair clippers are an innovative hairdressing tool that combines the functions of a vacuum cleaner and a hair clipper, effectively collecting cut hair during the haircutting process to prevent hair from being scattered.

3.1.1 Features and functions

(1)Features
1) Equipped with a dust collector or container to collect the cut hair and prevent it from being scattered in the environment.
2) Easy to clean, with a suction function design that allows users to easily remove or empty the dust collector, simplifying the cleaning process and facilitating equipment hygiene.
3) Multifunctional design. With different hair length settings, different hair clippers appendix and styling tools to meet the diverse needs of users.
4) Power source. Most of the automatic suction hair equipment and hair clippers are electric, powered by charger or batteries, making them portable, flexible and environmentally friendly.

3.1.2 Technical parameters and functions

Whole machine power: 5W
Charging current: 600-800mA
Usage time: 60 minutes (suction hair mode is on); 90 minutes (suction hair mode is off)
Motor operating voltage: 3V
No-load cutter head motor speed: 5000rpm/min
Loaded cutter head motor speed: 4000rpm/min
No-load fan motor speed: 15000 rpm
Loaded fan motor speed: 11000 rpm
Wind speed: 2.3~3.5m/s
Waterproof level: IPX7

3.2 Self-Service Hair Clippers

3.2.1 Features

Self-service hair clippers use an intelligent recognition system that can automatically identify head shapes and provide the most suitable haircutting solutions based on each person's head shape and hair quality. Equipped with the high precision cutting blades ensure cutting accuracy during hair cutting. In addition, it has an automatic cutting length adjustment function and incorporates safety considerations by adopting an anti-pinch design to effectively reduce the risk of injury during hair cutting.

3.2.2 Technical parameters and functions

Whole machine power: 5W
Charging current: 600~800mA
Usage time: 60 minutes (camera mode is on); 90 minutes (camera mode is off)
Motor operating voltage: 3V
No-load fan motor speed: 7000 rpm
Loaded fan motor speed: 5500 rpm
WIFI: 2.4GHz
WIFI transmission distance: up to 3 meters
Waterproof level: IPX7

4 Hardware Design

4.1 Functional Framework Design

The system functional framework is shown in Figure 1, mainly divided into the following parts:
(1) Automatic hair suction: easily handle broken hair, ensure cleanliness, and prevent pollution.
(2) Adjustable comb cover: allows customers to conveniently choose the length of their hair.
(3) Hair storage compartment: easily clean hair, saving time and increasing effort.
(4) Low noise: optimize motor design, use silent bearings, improve air duct design, and other methods to reduce product noise during operation and improve user comfort.
(5) Whole machine waterproof: can be directly washed with water after use to avoid cross infection.
(6) USB interface: plug and play, long battery life after charging, suitable for computer power banks, etc., simple and convenient to use.
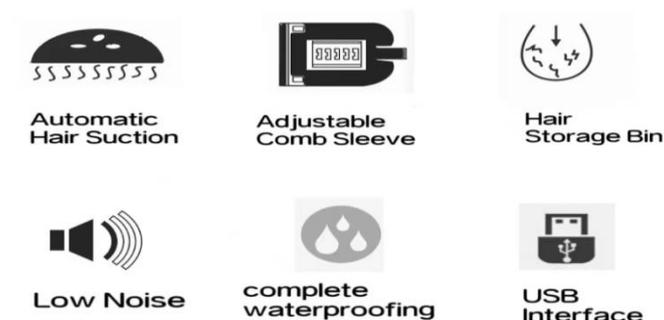
Figure 1. System Function Settings

4.2 Functional Module Design

4.2.1 Automatic hair suction and storage

Equipped with a turbo motor and vacuum system, hair can be directly sucked into the inside of the hair clipper, avoiding hair scattering in the hair cutting area. Simultaneously equipped with a filtration system to ensure that sucked hair does not cause damage to the motor and other internal components, extending the lifespan of the hair clipper. The structure of the hair clipper turbine motor is shown in Figure 2.

Figure 2. Hairdressing turbine motor

Use induction technology to detect the position and quantity of hair. When the hair is detected, the hair suction system can automatically start.

Idle fan motor speed: 15000 rpm

Load fan motor speed: 11000 rpm

Wind speed: 2.3~3.5m/s

4.2.2 Adjustable comb sleeve

As shown in Figure 3, through various models of comb sleeves and adjustable bases, an embedded structure is adopted to ensure more stability during the hair cutting process, allowing users to choose the length which they want and meet their personalized requirements. In Figure 3, A is an adjustable base, fixed on the hair clipper, with 1~5 gears that can be adjusted by pushing. B is a comb sleeve, which can be selected according to different customer needs.
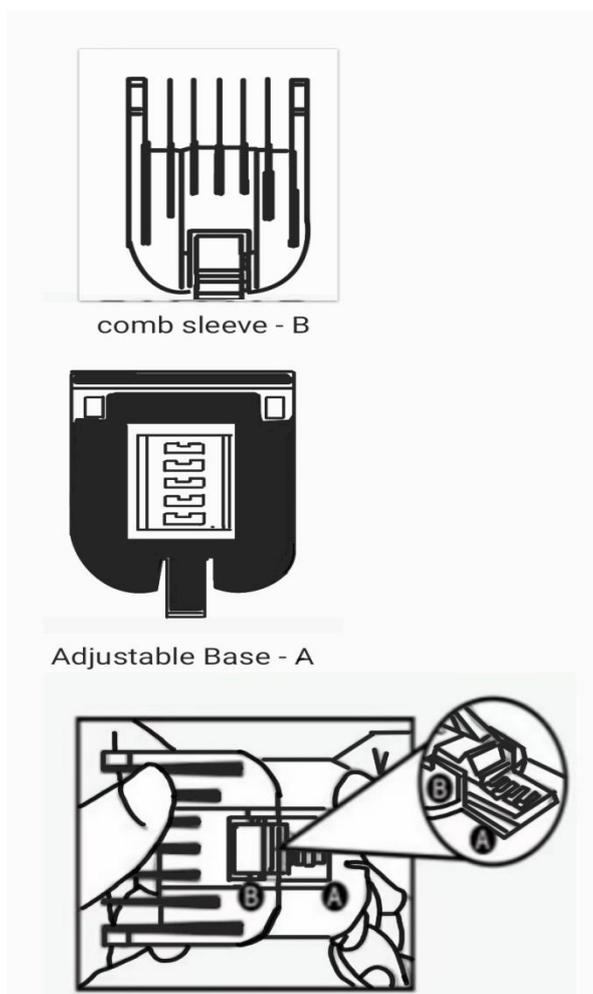
Figure 3. Adjustable comb sleeve

4.2.3 Hair storage bin

Set up a hair storage bin, as shown in Figure 4, to prevent hair from scattering in the surrounding environment. At the same time, users can easily empty the container, handle inhaled hair, and maintain equipment hygiene.

Figure 4. Hair storage bin

4.2.4 Low noise

Adopting advanced motor design technology to reduce the noise generated during motor operation and provide a quieter haircut experience. At the same time, soundproofing materials are used in the casing or key components of the hair clipper to absorb and slow down noise transmission, and reduce the noise level generated by the equipment. Figure 5 is the low-noise motor rotor. Through optimized design and active noise reduction, the noise generated by the hair clipper is reduced.
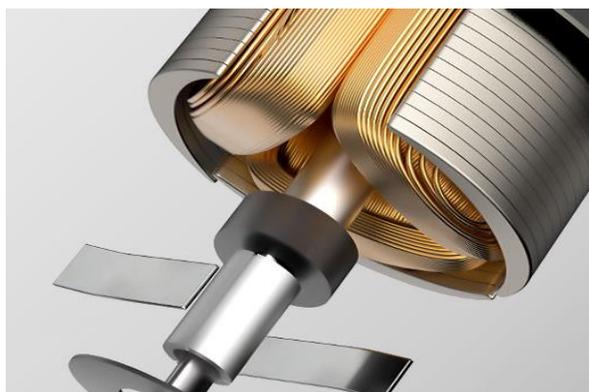

Figure 5. Click on axis optimization

4.2.5 Waterproofing of the entire machine

The whole machine uses waterproof materials and advanced waterproof technology, which can form a protective layer on the outside, effectively preventing water infiltration, improving the overall waterproof performance. As shown in Figure 6, the whole machine's waterproofing has the following advantages:

(1) Suitable for wet shave, users can use it while showering, combined with shaving cream or shampoo to improve shaving comfort.

(2) Users can directly put the hair clipper into water for cleaning without worrying about damaging the circuit or other components. Making the cleaning process easier while avoiding cross infection.

(3) It can effectively prevent moisture from corroding the internal circuits and mechanical components of hair clippers, thereby improving the durability and lifespan of the equipment.
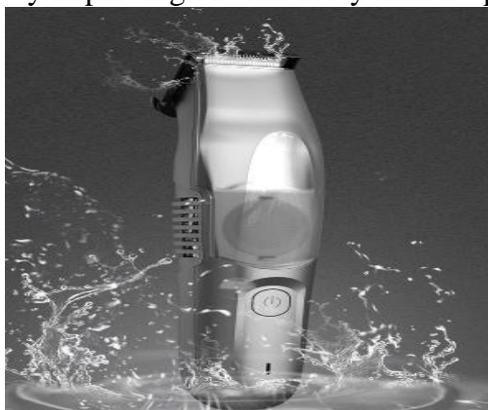
Figure 6. Waterproofing of the entire machine

4.2.6 USB interface

The USB interface can be used for charging, and users can connect the hair clipper to various devices by connecting a USB cable, making it convenient to charge and use at any time.

USB interface can be used for data transmission. This includes functions such as updating device software, adjusting settings, or recording usage data.

The USB interface can also be used to connect various accessories, such as different types of cutting heads, trimmers, or other accessories, making the hair clipper more flexible and adaptable to different hair cutting needs.

Figure 7. USB interface

5. Technical Analysis

5.1 Low Noise Technology

Reducing noise is a crucial technology for high-end personal care appliances. The product's noise is reduced by optimizing motor design, using noiseless bearings, and improving air duct design. This enhances user comfort.

5.2 Intelligent Technology

Intelligent technology includes perception, processing, control and communication. Personal care appliances are intelligentialised through the integration of technologies such as sensors, microcontrollers, and cloud computing. This integration provides consumers with personalized and convenient user experiences.

5.3 High-efficiency Technology

High-efficiency technology can reduce product energy consumption and increase cruising power. This is achieved through circuit design optimization, high-efficiency motor usage, increased battery

energy density, and other methods.

6 Industrialization Strategy

6.1 Increase Research and Development Investment

Enterprises should increase their investment in research and development, establish high-quality R&D teams, focus on market demand, and consistently launch competitive new products. Additionally, they should collaborate with universities and research institutes to conduct technical research and make breakthroughs in key technologies.

6.2 Enhance Brand Image

Enterprises should intensify brand promotion efforts, enhance brand awareness, and shape a high-quality, high-value brand image. By participating in domestic and international exhibitions, holding new product launches, and other activities, so as to showcase their corporate strength and expand market channels.

6.3 Optimize Supply Chain Management

Enterprises should strengthen cooperation with suppliers, establish a stable supply chain system, and ensure product quality and production efficiency. Meanwhile, by introducing advanced production equipment and management concepts, they can improve production efficiency.

6.4 Expand Marketing Channels

Enterprises should use both online and offline channels for diversified marketing. Online, they can expand brand influence through e-commerce platforms and social media channels. Offline, they should focus on deploying in high-end shopping malls, specialty stores, and other locations to increase product exposure.

7 Market Outlook Analysis

7.1 Consumer Upgrade Drives Market Demand

As China's economy continues to grow, residents' consumption levels are steadily rising, and the trend of consumer upgrading is becoming increasingly pronounced. Consumers are shifting their demands for personal care appliances from basic functionality towards high-quality, intelligent, and personalized features, thereby offering extensive opportunities for the market of intelligent, low-noise, high-end personal care hairdressing appliances.

7.2 Promotion of Healthy Life Style Promotes Market Growth

With the widespread adoption of the concept of a healthy lifestyle, consumers are placing increasingly higher demands on personal care appliances. These demands extend beyond meeting basic usage requirements to encompass qualities such as health, environmental consciousness, and comfort. Intelligent, low-noise, high-end personal care hairdressing appliances are poised to become the new standard in the market.

7.3 Intelligent Technology Helps Market Expansion

With the rapid advancement of technologies like the Internet of Things (IoT) and big data, intelligence has become an important development direction of the electrical appliance industry. Intelligent, low-noise, high-end personal care hairdressing appliances leverage innovations such as smartphone applications and artificial intelligence to offer consumers more convenient and personalized user experiences. Consequently, they are anticipated to emerge as market leaders.

8. Conclusion

This paper proposes a comprehensive research and development strategy for intelligent, low-noise, high-end personal care hairdressing appliances to address existing issues such as noise in conventional personal hair clippers. By selecting high-performance motors, optimizing transmission system designs, adapting sound insulation materials, enhancing overall product quality, and incresing intelligent functionalities, these method can effectively mitigate noise while improving quality. Consequently, they hold significant promise for expanding the market for intelligent, low-noise, high-end personal care hairdressing appliances.

Funding

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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