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A laser mechanical pen for power generation based on human body temperature

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---------- ***ABSTRACT***----------
In order to collect the weak energy generated by human body temperature difference, a writable laser mechanical pen using human body temperature difference to generate electricity is studied and manufactured based on the principle of thermoelectric effect Seebeck effect of thermoelectric semiconductor materials. The device mainly uses the body temperature difference of the human body, converts and collects the generated energy through the thermoelectric generator, and then supplies it to the storable battery. Finally, the power of the storable battery will be used to light the laser lamp. In this study, through the three-dimensional modeling and real rendering of the device, the working performance of the device is preliminarily estimated and the digital structure design is carried out. The research results will further improve the thermoelectric power generation equipment system.

Keywords: *Semiconductor thermoelectric power generation; 3D rendering; Mechanical laser pen*

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I. Introduction

Semiconductor thermoelectric power generation can directly convert heat energy into electric energy. It can not only effectively use non polluting energy such as geothermal energy, ocean heat and solar energy in nature, but also recover a large amount of waste heat and waste heat generated in industry and life, so as to improve energy utilization [1]. Before that, LV Xiao, Chen Jiawei and others designed a series of experiments using semiconductor thermoelectric chips to explore the influence of temperature difference and the number of power generation chips on power generation characteristics [2]. Huang Shaohan, Zhang Jianchen and others use the temperature difference between the road surface and the ground to generate electricity, so as to save the consumption of fossil energy. Through the combination of thermoelectric power generation and photovoltaic power generation technology, the rich thermal energy and solar energy on the road will be transformed into a steady stream of electric energy [3]. Therefore, the application of thermoelectric power generation technology is an important topic. According to the principle of "thermoelectric power generation", there are many "waste heat" that can be used, such as industrial waste heat, waste combustion heat, waste heat of automobile exhaust pipe and so on[4].However, at present, the temperature difference of most research projects basically comes from natural media, such as combustion and thermal convection, which is rarely used in human body temperature difference. In this paper, a laser mechanical pen device based on human body temperature difference is proposed. The device uses the temperature difference between human body temperature and mechanical laser pen to collect and utilize weak energy through temperature difference power generation technology. At the same time, SolidWorks 3D modeling and keyshot rendering technology are adopted, which provides a reference for the subsequent utilization of temperature difference power generation technology.

II. Device structure

2.1 Structural design

The device is composed of laser pen system, thermoelectric power generation device system and ordinary neutral pen system. The overall theoretical design dimension is 155 mm long and the maximum diameter is 14 mm, which basically meets the requirements of ergonomic design. The common neutral pen system is composed of conventional refill, pen head cap, pen holder and conventional parts.

In addition, keyshot is used to render the components and the whole of the device. Color itself has no temperature, but people's perception of color has temperature. Seeing the color of gray, black and other cold

colors will associate it with cool and cool; Seeing warm colors such as red, orange and yellow will be associated with flame and the sun [5]. Therefore, the whole laser pen is selected in the warm color system on the color tone, and then decorated with black, which is in sharp contrast, concise and generous. At the same time, it can make the whole laser mechanical pen full of vibrant color. In terms of materials, the refill is a conventional refill in the market, and the pen head cap and pen holder are made of PVC. In order to avoid abrupt color, the annular temperature difference sheet, pen cap and pen holder are designed as orange yellow. The overall rendering of laser mechanical pen is shown in Figure 1, the rendering of structural drawing is shown in Figure 2, and the perspective view is shown in Figure 3.

Figure 1 Overall drawing of laser mechanical pen

In the partial perspective view of the laser mechanical pen in Figure 2, you can see the internal structure of the pen holder and the placement position of the laser mechanical pen after removing the parts of the thermoelectric generator.

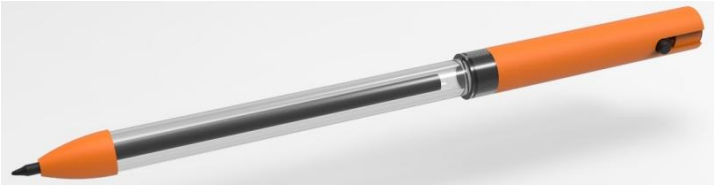

Figure 2 Partial perspective view of laser mechanical pen

After further removing part of the pen holder parts used to support the laser mechanical pen, as shown in the overall perspective view of the laser mechanical pen in Figure 3, the internal structure of the laser mechanical pen and the line arrangement of collecting electric energy can be clearly observed.

Figure 3 Overall perspective of laser mechanical pen

In the laser mechanical pen system, there are several parts, including rechargeable battery, spring, positive and negative connecting pieces, regulated current regulator, press switch, laser wick, lens, wire and placement slot. The positive and negative connecting pieces are made of brass and have good conductivity. Other parts are rendered according to the style of conventional parts in the market, and the specific part rendering is shown in Figure 4.

After the parts are assembled, all parts will be placed in the placement slot. Considering the color matching effect, the placement slot is still rendered as orange yellow, as shown in Figure 5. Finally, install the placement slot into the end of the pen holder, as shown in Figure 6.

In this system, the negative pole of the storable battery is connected to the negative connecting piece through a spring, one end of the negative connecting wire is connected with the negative connecting piece through tin welding, and the other end of the negative connecting wire is connected to the negative pole of the voltage stabilizing current regulator; The positive pole of the storable battery is connected through the positive connecting piece and the positive connecting wire, and the positive connecting piece and the positive connecting

wire are also connected through tin welding. The voltage stabilizing and current passing device has the functions of voltage stabilizing and current passing, and this subsystem only shows the function of current passing. The push type switch is respectively connected with the voltage stabilizing current regulator through the positive and negative conducting wires. The laser lamp is connected with the push switch through solder.

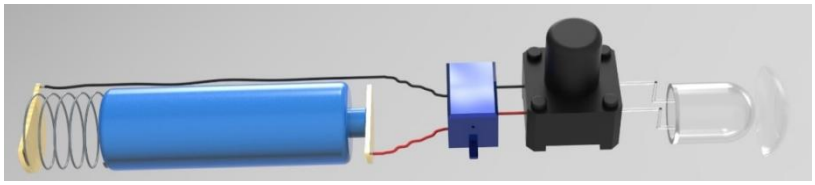

Figure4 Power supply circuit diagram of laser mechanical pen

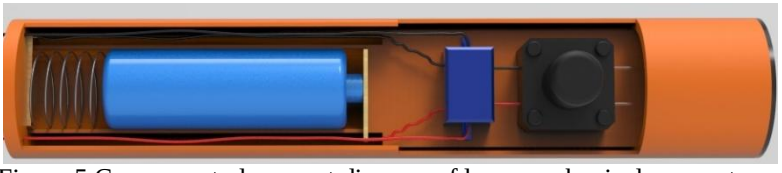

Figure 5 Component placement diagram of laser mechanical pen system

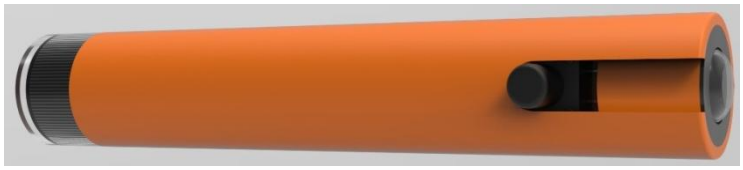

Figure 6 Component placement diagram of laser mechanical pen system

In the thermoelectric power generation system, the negative and positive collecting wires and collecting heads form a power transmission device with the thermoelectric sheet, and the negative and positive receiving wires and receiving holes form a power receiving device. The connection is completed through the snap fit between the collecting head and the receiving hole. The negative and positive receiving wires are respectively connected to the positive and negative poles of the voltage stabilizing current regulator, and the current after voltage stabilizing charges the storable battery through the negative and positive connecting wires. Refer to Figure 7 for the electric energy collection process.

In the whole system, the components of thermoelectric generator play an important role. All electric energy will be transformed and collected through it. Finally, after boosting and stabilizing the current, it will be stored in the storable battery to supply the laser lamp system at any time. In the process of rendering, considering the color matching, the thermoelectric chip is rendered orange yellow one by one. Two wires are led out at one end of the annular thermoelectric sheet, which are rendered as one red and one black, corresponding to the positive and negative wires. After being connected with the buckle of the receiving hole through the collecting head, the electric energy enters the current stabilizing and voltage stabilizing module through the wire, and then flows into the storable battery for energy storage. The whole thermoelectric power generation system is shown in Figure 7, and the details are shown in Figure 8.

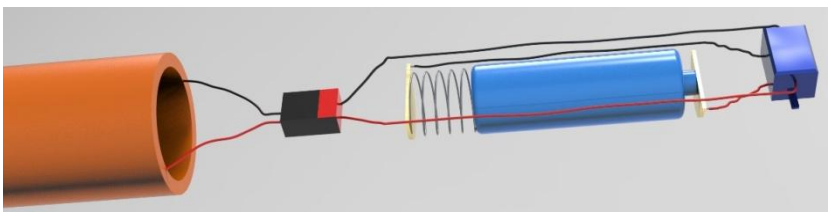

Figure 7 Power generation circuit diagram of human body temperature difference

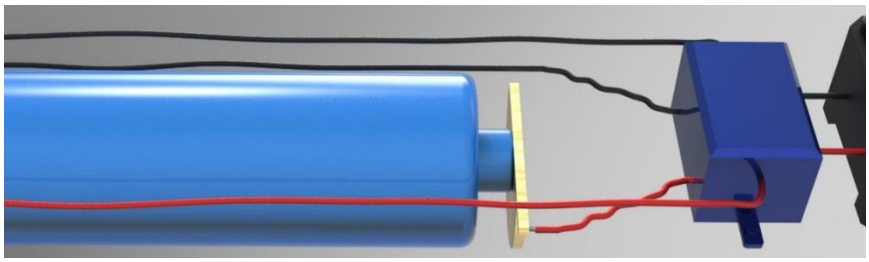

Figure 8 Detail display diagram

2.2 Functional principle and Operation process

In the process of holding the pen, a temperature difference is formed inside and outside the thermoelectric generator, that is, the start of power generation. The current passes through the negative and positive collecting wires, and the negative collecting wires pass through the collecting head, receiving hole, negative receiving wire and positive receiving wire. Finally, it passes through the negative connecting piece and positive connecting piece, and uses the voltage stabilizing current regulator to stabilize the voltage, and then charges the storable battery.

In the process of using the laser pen, the negative pole of the storable battery is successively connected to the voltage stabilizing current regulator through a spring, a negative pole connecting piece and a negative pole connecting wire; At the same time, the positive pole of the storable battery is successively connected to the voltage stabilizing current regulator through the positive connecting piece and the positive connecting wire. At the same time, the current flows into the switch through the negative conducting wire and the positive conducting wire. When the user presses the push switch, the internal circuit is closed, the current flows to the laser lamp, the laser lamp is lit, and the process is completed.

III. CONCLUSION

A laser mechanical pen for power generation based on human body temperature is invented by using human body temperature difference and combined with temperature difference power generation technology. The conventional pen is combined with the laser pen, and the human body temperature difference is used for power generation.

REFERENCE

[1]. Yan Wei, Qiu Guoyue, yuan Xufeng Application and research summary of semiconductor thermoelectric power generation technology [J] Power technology, 2016, 40 (8): 1737-1740.
[2]. LV Xiao, Chen Jiawei, Liu Cong, et al Research on semiconductor thermoelectric chip [J] Communication power technology, 2019,36 (07): 17-18, 22.
[3]. Huang Shaohan, Zhang Jianchen, an Minghui, liuhaorui Research on power generation highway based on temperature difference [J] Automotive practical technology, 2021,46 (22): 200-204.
[4]. Yu Xuemei, Wu Haina, Huang Ankang, Jin Kaidi Study on the manufacture of waste heat power generation of gas stove [J] Physics teacher, 2016,37 (02): 54-55 , 57.
[5]. Zhou Donghong Product color design based on big data [J] Fashion color, 2021, (04): 22-23.

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