

# A Curtain Structure with the Ability in Automatically Open/Closed

Yu-Ping Kang and I-Tien Chu

## ABSTRACT

The paper proposes the automatic opening and closing blinds' structure. There is a bearing support seat located at the bottom of the inner beam to let the link rod set the position. Also, there are a front thread and a reversed thread, and a screw driven device on both sides of the link rod. Moreover, at the lateral end of the front and reversed threads, they are equipped with the holder of the ring set and hole set hub. On the other side of the link rod, there are a photosensitive resistor and a temperature sensor. Yet, there is a motor with shaft on another side. The drive systems can be linked by photosensitive resistor, temperature sensor, control switch and motor. Then the blind's body could adjust its shade and light barrier at the right time based on the value changes of indoor and outdoor light illumination and temperature.

*Keywords: Blind, photosensitive resistor, Temperature sensor.*

## 1. Introduction

Generally, most manual blinds or window blinds are used to obscure the sunshine. No matter the blinds are vertical or horizontal, people have to use man-made operating ropes to pull the blades or cord directly to expand or collapse the blinds and reach the shading effect [1~6]. Therefore, the users need to do open and close actions with the light irradiation angle or strength of the sun. Moreover, it is often heard that the improper use of manual blinds or children play around would result in injury cases of the rope to pull neck. For example, in November, 2009, there was a two-year-old boy reined by the blind's cord and caused arm and neck injuries in Colorado, U.S.A. In July, 2010, there was a four-year-old boy who had

neck injuries caused by the cord winding in South Carolina. Hence, the U.S. Consumer Product Safety Commission issued a statement on December 1, 2010, to urge the public to be aware of window blind cord safety. The government also recalled 6 million Roman blinds and 5 million Roller blinds sold by the second big families decorating retailer "Lowe's" [7]. The similar cases occurred in Taiwan as well. On December 28, 2011, there was a two-year-old boy's death resulted from asphyxiation by blind's cords because of curious play, which was an irreparable family tragedy [8].

In order to avoid the danger of neck injuries caused by the improper use of manual blinds or children play around, the paper proposes this creation based on years of experiences, multi-investigations, and design sample test, which based on *kansei* engineering [9]. The main design features are as follows.

1. Use the basic principles of link rod (lead screw) to change the opening and closing structure of general blinds.
2. With the light sensor, temperature sensor and the single-chip microcomputer controller, the automatic controlled blind's structure can be made.
3. There are four ways of opening and closing blinds, and they are manual push-button, remote control, automatic illumination and temperature.

In section 2, the idea point our innovation is presented. Section 3 is the achievement of our innovation. The final section of this study consists of a conclusion and recommendations for future research.

## 2. The New Idea Point

Fig. 1 shows the diagram of 3-D combination, and it is mainly about the both sides on the internal beam of the blinds, there is a bearing L-shaped holder, respectively. This L-shaped holder can provide the link rod set positioning, and place the guide rib on the internal beam of both sides' opposite convex horizontal wall. The link rod is a two-stage combination which forms opposite rotation of front and reversed thread section. On the relative area of front and reversed thread, there are polygon coverings. At the end of the front and reversed segments, there is

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Corresponding Author: Yu-Ping Kang is with the Department of Electrical Engineering and Energy Technology, Chung Chou University of Science and Technology, Changhua, Taiwan  
Tel.: +886-4-8359000 ext.2214  
Fax: +886-4-8364252  
E-mail: [ypkang@dragon.ccut.edu.tw](mailto:ypkang@dragon.ccut.edu.tw)  
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a ring segment, respectively. Also, there are screw holes, driven seat and holder in pairs, and they are linked to link rod's front and reversed segments, and the ring segment, respectively. The driven seat and holder are like rectangular blocks. Besides, we design the guide groove on the concave opposite sides to match the internal beam of both walls. Below the driven seat and the holder, there is an appropriate lug to be combined with X-shaped segment. With several hooks, the hanging positioning of the blinds can be decided. Besides, there are a photosensitive resistor and a temperature sensor on one side, and there is a motor with shaft, which is hidden in a cover, on the other side. Photosensitive resistor, temperature sensor and motor are connected by wired remote control or wireless remote control switch to become the drive system, and they are shown from Fig. 2 to Fig. 6.

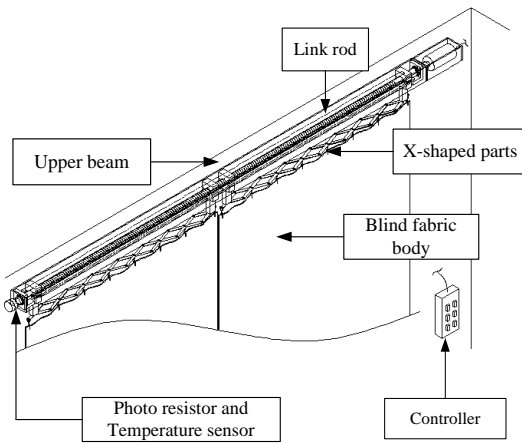


Fig. 1 The diagram of 3-D combination

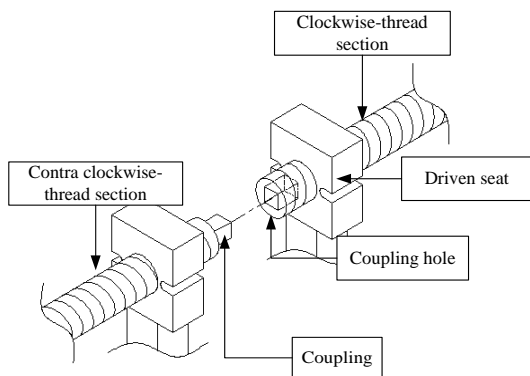


Fig. 2 Partial linked rod 3-D decomposition diagram-1

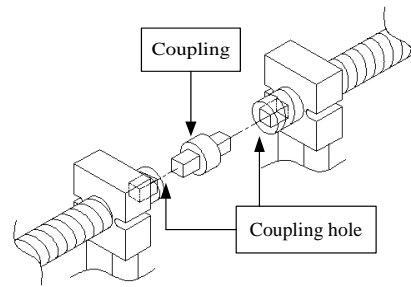


Fig. 3 Partial linked rod 3-D decomposition diagram-2

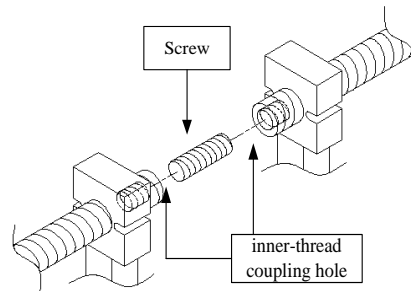


Fig. 4 Partial linked rod 3-D decomposition diagram-3

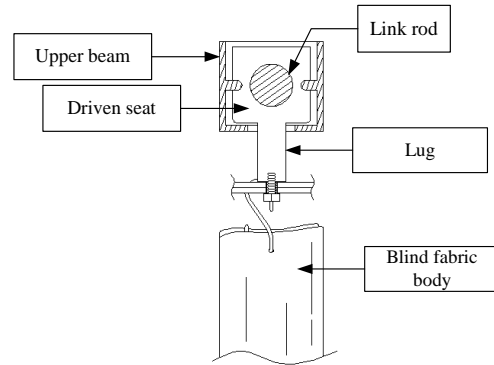


Fig. 5 Profile diagram of side combination

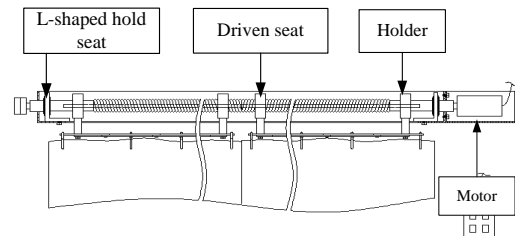


Fig. 6 Profile diagram of front combination

While using the work in this paper, we can use the controlled switch on the upper beam of the blind's body and settings of illumination and temperature values to judge lighting intensity and temperature

differences at any time. Through the design, we can control the motor revolutions, forward rotation and reverse rotation; as a result, we can control the opening and closing of blind's body. When the indoor and outdoor light illumination and temperature change, photosensitive resistor and temperature sensor sense the value of luminosity and temperature changes and then convey to control switch drive motor operation which makes motor to drive the rotation of link rod. At this point, we use the driven seat design of front and reverse threads, both sides of guide groove and guide rib on the inner wall of the beam, and the hole hub of the holder to make two driven seats activate. Also, the displacements of the driven seats move from both sides or the center (see Fig. 7). At this moment, the lugs installed below to driven seat and holder can also collapse from both sides synchronously (see Fig. 8) or expand to the center to pull the blind's body to the optimal location smoothly. Besides, due to the parts would be activated by both driven seats and the characteristics of equidistant condensation or expand of the blinds, they can receive the illumination sensor values of indoor and outdoor light and temperature. Finally, the design would pull the cords at any time to find the optimal shade and light barrier, which saves manpower because the users do not have to pull the cords back and forth according to the light irradiation angle or strength of the sun.

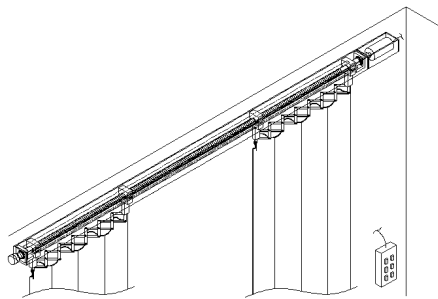


Fig. 7 The diagram of half-opened blinds structure

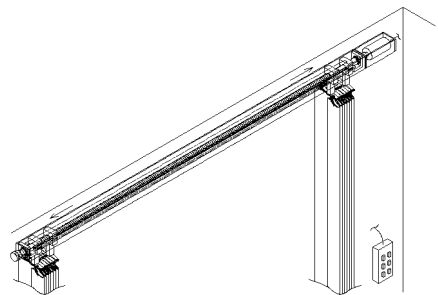


Fig. 8 Collapse diagram of blind's body to both sides

### 3. The Achievement

According to the idea and design mentioned above, the product is achieved, and describe in below.

#### 3.1 Characteristic and Advantage

1. By using the design of link rod, photosensitive resistor and temperature sensor on the upper beam of the blind's body, it is possible to open and close blinds fabrics to the best shade and the light barrier position based on judgment of indoor and outdoor light intensity and temperature differences. It not only saves manpower, but also has practical benefits.
2. The design is with simple structure and the smooth operation. Also, it is easy to install, and it is less expensive cost. It has the effectiveness of the health, safety and renewable energy education, and it not only has promotional values, but also has business benefits.

#### 3.2 The Photo of Real Product

Fig. 9 and Fig. 10 are appearances of the completed designed automatic opening and closing blinds. The lead screw is used to change the general blind's opening and closing structure, and we use solar panels to provide electricity. Also, the light sensor, temperature sensor and the single-chip microcomputer controller are with the design. Moreover, there are four ways of opening and closing blinds, and they are manual push-button, remote control, automatic illumination and temperature. Through these methods, we don't use the cord any more, and we can avoid the danger of injury the neck.



Fig. 9 The photo of half-opened blinds structure



Fig. 10 The photo of closed blinds structure

### 3.3 The Patent and award

The new product had got the utility model patent in the R.O.C., and the number is M337321, from year 2008 to year 2018 [10], and has been awarded with the Medal of Gold shown in Fig. 11 at the 13<sup>th</sup> Moscow International Salon of Inventions and Innovation Technologies “Archimedes” that was held from March 30 to April 2, 2010 in Moscow, Russia.



Fig. 11 Moscow International Innovation Salon “Archimedes-2010” (Russia)

## 4. Conclusions

With the improvement of living standard, blinds have become common essential goods. At present, the majority of the blinds in the market are manual; however, with the improper use or children playing around, there are many neck injury cases caused by blind’s cords. Hence, the paper proposes this creation which applies basic principle of lead screw to change the general blind’s opening and closing structure. At the same time, with the light sensor, temperature sensor and the single-chip microcomputer controller, the fully automatic control of the blind’s structure is made. This new creation can avoid the cord dangers aforementioned. Besides, we also apply for a patent, and it has application values in the technical field. It can not only be used in families and offices, but it is also used in areas which need temperature or lighting control. So, it has unlimited business opportunities.

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**Yu-Ping Kang** received the Ph. D. degree in Power Mechanical Engineering from National Tsing Hua University, Taiwan in 2002. He once worked at the Industrial Technology Research Institute (ITRI) and Formosa Airlines in Taiwan, and currently as an

Associate Professor in Department of Electrical Engineering and Energy Technology, Chung Chou University of Science and Technology. His researches interest includes energy technology, mechatronics, grey system theory and *kansei* engineering.



**I-Tien Chu** works as the lecturer of the Department of Creative Product Design, Asia University, Taiwan. As graduated from MA Illustration & Animation, Kingston University, London, she puts most of her effort into the research among graphic

design, product design and cultural creativity.