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Research Article

Research on Design Method of Intelligent Vending Machine for Cupped Beverage

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Abstract: The purpose of this study is to design an intelligent vending machine for cupped beverage, specifically researching its humanized design, shape design, color design and the main mechanism design including the beverage powder transporting mechanism, paper cups detaching mechanism and paper cups slide mechanism. The study elaborates that the design of beverage powder transporting mechanism is mainly the selection of electromagnet and the determination of electromagnet stroke, requiring that the electromagnet stroke and the maximum weight that the electromagnet could bear should have rationality, to ensure its safe operation; the design of paper cups detaching mechanism mainly includes selecting electric motor and V belt; the design of paper cups slide mechanism mainly presents the design of slide structure. And then the design of control modules of the intelligent vending machine for cupped beverage is introduced, based on which the conclusion has been reached.

Keywords: Cupped beverage, humanized design, intelligent vending machine, slide mechanism

INTRODUCTION

In our country, the intelligent vending machine for cupped beverage has vast development prospect. Our existing city population is about more than 500,000,000 persons. If every 500 people own one intelligent vending machine, the need quantity of latent market of the intelligent vending machine for cupped beverage demands 800,000 sets. According to the introduction of relating data, in Tianjin, every day the sale of one intelligent vending machine for cupped beverage on the average is 200 Yuan, 280 Yuan in Dalian. If every day the sale of each intelligent vending machine for cupped beverage is 200 Yuan, the sale of the whole year could attain 60,000,000,000 Yuan. The advantages of the intelligent vending machine for cupped beverage come to a decision that it has vast development foreground, including the high (high technique), new (new sale method), big (the huge market potential), true (the real merchandise) etc. According the measurement and calculation of the relevant experts, in China, the most conservative estimate of market capacity of intelligent vending machine for cupped beverage also could reach to 470,000 sets (Wang and Zheng, 2009).

The places where it is suitable for the intelligent vending machine for cupped beverage to manage are relatively extensive. Airport, station, wharf, subway, Business Street, campus, office building, residents living area and play place etc., are all good places to install the intelligent vending machine for cupped beverage (Zheng and Liu, 2000). It is believed that along with the continued development of our country economy and the continuously raise of people consumption level, the demand for the intelligent vending machine for cupped beverage necessarily will be more and more and more and more extensive (Liu and Wei, 1997).

At present, in domestic there have been many manufacturers having the capacity of developing and producing intelligent vending machine. The domestic manufacturers of intelligent vending machine are distributed in different areas, some having been in the stage of product promotion and some being in the stage of investment promotion. At present, due to various reasons, the market promotion of intelligent vending machine is slow and there is no better business model. The market of intelligent vending machine is in the stage of cultivation (Jiang, 2013). The products produced by the domestic manufacturers of intelligent vending machine are mainly the intelligent vending machines for cold (hot) drinks, foods, cigarettes and other products (Pei, 2003).

The aim of this study is to design an intelligent vending machine for cupped beverage, specifically researching its humanized design, shape design, color design and the main mechanism design including the beverage powder transporting mechanism, paper cups detaching mechanism and paper cups slide mechanism.

HUMANIZED DESIGN AND APPEARANCE DESIGN

Humanized design: Traditional design takes product as the main target, only considering the realization of the function of product itself. Although the human factors are also involved more or less, mainly considering how to let a person to adapt to the machine, not considering the human factors and taking people as a goal of design. So it is difficult to guarantee the operation efficiency of

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Fig. 1: Whole appearance modeling

machine best and it is not easy to judge the quality of the design. Humanized design emphasizes that humans and machines as two basic parts of mutually linking each other constitutes a whole, forming the man-machine system. The man-machine system is to put people as a part of the system design and put the human-machine-environment as a system for the overall design. People do not passively adapt to the machine any longer, but are together with the machine to complete a system target, so that it could acquire the highest comprehensive efficiency of system. Designing the intelligent vending machine for cupped beverage must take the more convenient using for people as the breakthrough point of the whole design.

Shape design: In the shape design of the intelligent vending machine for cupped beverage, above all, the inside quality and convenience of using must be ensured. Never only pursue the scale and patter beauty of shape design, so as to reduce the man-machine nature and other technique function index. The various components of intelligent vending machine for cupped beverage compose of some geometry bodies composed of dot, line, face. The shape design of intelligent vending machine for cupped beverage is combining the material techniques such as structure and function and art contents together, forming a 3D space stereoscopic shape, which has to correspond to art rule, masterly makes use of shape composing principle and masters shape appearance characteristic and forming psychology and vision error of related shape, that is important means

Fig. 2: Entrance of casting currency

Fig. 3: Device of dropping cup

Fig. 4: Hole of dissipating heat

to acquire the intelligent vending machine for cupped beverage of generous beauty and novel style (Qiu, 2005), as shown in Fig. 1 to 4.

Color design: The choice of main tone of the intelligent vending machine for cupped beverage is a problem of very importance; the different tone will form different art effect. In matching color of the intelligent vending machine for cupped beverage, having main tone can seem to be to unify. The color is more little, the main body characteristic is more strong, the decorate characteristic is more good and the external form relation of the intelligent vending machine for cupped beverage is more unify (Jiang, 2011). Contrary, the color matches more much, causing the color more disorderly, so that it is difficult to adjust generally, the main body characteristic is unclear and the harmonious effect is broken.

The choice of tone still needs to notice whether unique beauty. It needs to hold tight people's mental request for the color of the intelligent vending machine for cupped beverage, transform the tone of the intelligent vending machine for cupped beverage to make it produce an unusual attraction, in the meantime, increase the category of tone to satisfy people's fondness for different colors (Fu, 2002).

Moreover, the base, the body and other big pieces of the intelligent vending machine for cupped beverage are suitable to use a low pure degree color as the main body color and use clear, elegant and clean color to unify overall situation to make the main tone definite. Using little area of high purity color to embellish to make the whole seem to be abundant, change and organic. The whole color generally uses monochrome or two sets of colors, not more than three sets of colors.

DESIGN OF MAIN STRUCTURE

Design of beverage powder transporting mechanism: Beverage powder transporting mechanism mainly takes advantage of the magnetic characteristics of electromagnet to send the powder to the specified location. The powder drops to the blender under its own gravity and eventually flows into the cup. The essential parts of the mechanism are made up of electromagnet, powder barrels, slider and others, of which the main characteristic is that the transportation is smooth and accurate, the structure is tight and the leakproofness is good. The central part of slider is designed according to the appropriate volume of powder.

Selection of electromagnet: It's a good choice to use MQ1 series pull electromagnet according to the mechanism character.

According to design it is known that the centre line distance between the hopper and the leaking hole designed is 54. It is finally determined to choice the electromagnet of 50 mm stroke according to the Mechanical Design Manual (Cai, 1993).

Structure design of beverage powder transporting mechanism: The following figure is the three views of beverage powder transporting mechanism, in which the size of each part is designed according to the space size

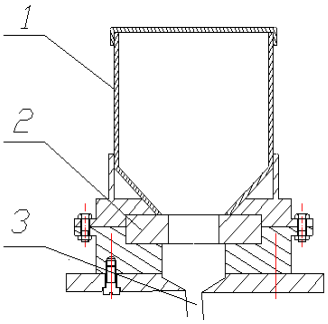

Fig. 5: Main view of beverage powder transporting mechanism
1: Plastic barrel; 2: Slider; 3: Plastic pipe

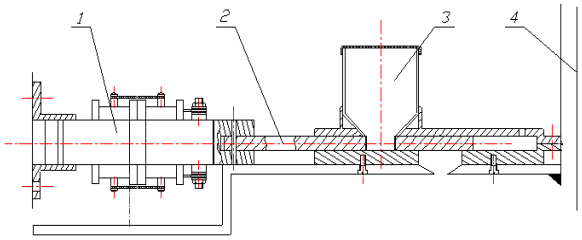

Fig. 6: Side view of beverage powder transporting mechanism
1: Electromagnet; 2: Slider; 3: Plastic barrel; 4: Machine wall

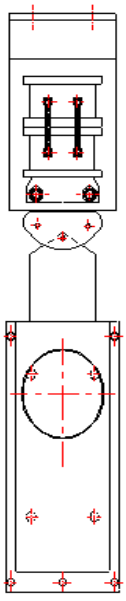

Fig. 7: Depression view of beverage powder transporting mechanism

of the intelligent vending machine for cupped beverage, as shown in Fig. 5 to 7.

Design of paper cups detaching mechanism: Paper cups detaching mechanism is the main constituent part of the intelligent vending machine for cupped beverage, which is made up of an electric motor, a pair of outer

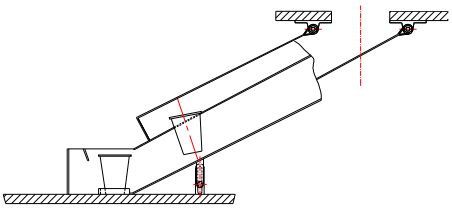

Fig. 8: Main view of slideway

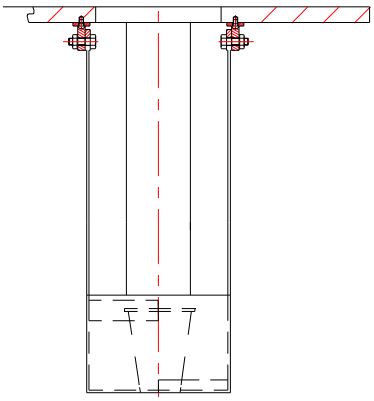

Fig. 9: Right view of slideway

occlusive gears, inner occlusive gears and specific gears. It drives initiative wheel with electric motor and drives driven shaft to turn, making paper cup detach (Li, 2005).

Selection of an electromotor: Electromotor could be divided into synchronous electromotor, continuous current electromotor, asynchronous electromotor and others. As the output power of the structure is small and requiring stable and accurate work, it should adopt TYV series high-precision miniature reduction continuous current electromotor.

Selection of V belt: Known: p = 0.37 KW $n_1 = 25\,r/\min$.

Calculating the power: According to the Mechanical Design Manual, it is determined the work coefficient $K_A = 1.0$, so:

$$p_d = k_A = 1.0 \times 0.37 = 0.37kw$$

Selecting the narrow V belt type: According to the power calculation, p_d = 0.37 kw and truckle n_1 = 25 r/min.

According to the Fig. 8 and 9 in the Mechanical Design Manual, it is determined to choice the SPZ type.

Calculating the datum diameter of pulley: As the size of paper cup has been determined and other space is also limited, rotational speed of pinion is 30/min.

Design of paper cups slideway mechanism: This design requires that after detached by paper cups detaching mechanism, paper cup could be accurately sent to appointed position. Mechanism liking this has a lot, such as the mechanical hand and others, but this design adopts the slideway mechanism that is not only simple but also accurate to deliver paper cup. The paper cup will slip on the smooth orbit to appointed position after falling. This mechanism requests material have good and smooth character to promise the paper cup smoothly to slip to bottom, so this slideway adopts the stainless steel as material. While designing it should ensure the slideway size corresponds to the size of paper cup, thus promising that it is unlikely for paper cup to be blocked in the process of moving downward.

Structure design of slideway: This structure design of slideway is simple and reasonable, which could accurately send paper cup to appointed position, as shown in Fig. 8 and 9.

DESIGN OF CONTROL MODULE

Preset price system of selling merchandise: The same kind merchandise that is sold by the intelligent vending machine for cupped beverage could be divided some variety, of which the setting price before selling should be stored in the control system in advance. The system of setting price of intelligent vending machine is made up of the key and the storage. Through pressing the key, the category and price of merchandise that is established price is selected and the price is written in the storage. This storage has the protecting function when losing electricity.

System of money accumulative total, merchantable pointing and refund: The Core CPU of control system carries on a circuit check to the signal of identifying currency, refund, having no goods examination and buying goods. After having the signal of identifying currency, it sends the money numerical value to the storage of money accumulative total to add up and through the serial expanding port to display. In the meantime it would carry on a comparison between the numerical value in the storage of money accumulative total and the one in the storage of preset price. If the numerical value of money accumulative total is equal or bigger than the one of preset price, it could make the light of merchantable pointing light through the serial interface to hint to buy goods and it could press the button of buying goods at this time. After the CPU examines the signal of buying goods, if the numerical value in the storage of money accumulative total is equal with the one of preset price, it would drive solenoid valve or micro motor to drive a merchandise out through the parallel interface and make the storage of money accumulative total reset, completing the process of selling goods once; if the accumulative money is bigger than the preset price, after driving a merchandise out, the subtracting balance is driven by

the signal to refund, realizing the function of selling goods and refunding and returning change.

Function system of accumulative total of working off and self testing: After working off merchandise every time, the CPU would accumulate the data of working off to the storage of accumulative total of working off and it would display the result of accumulative total on the display window of money through the key in vending machine. In addition, after pressing function key of self testing, it appears function signal of self testing and by operating the external key, it could examine the function of driving merchandise in each storage way (Ye, 2008).

CONCLUSION

The intelligent control part occupies a very important position in this design and runs through the whole mechanism, from this to control the working of whole vending machine.

After customers select taste, the intelligent vending machine for cupped beverage drops cup automatically, this not only brings customer convenience and keeps the cleanness and hygienism of beverage, but also effectively saves manpower and increases the practical function. In the meantime of dropping cup automatically, the beverage could also fill up automatically, which also makes the whole process of selling goods become more safe, avoiding that customers burn or make dirty a clothes when after fetching paper cup holding cup to take beverage.

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