

Research Article

Design and Application on Food Machinery

Xiaowei Jiang

Institute of Machinery and Vehicle Engineering, Changchun University, Changchun 130022, China

Abstract: The research purpose is to investigate an effective method of design for food machinery, thereby raising the external appearance quality and pleasant of food machinery, strengthening additional value and whole shape effect of product, satisfying the demand of market competition and creating higher economic efficiency. The article elaborates on the shape design and the design of each part of food machinery, including the design of monitor, console, control device and protection device, to introduce the humanity design of food machinery, based on which the conclusion has been reached.

Keywords: Control device, food machinery, shape design

INTRODUCTION

Take a wide view of the development process of food machinery, it is not difficult to discover that those designed more excellently food machineries have already got away from icy cold, boring mechanical face and also got away from the characteristic of disobeying human's nature, but become full of affinity, match appreciation of the beauty and the interest of modern people and occupy more outstanding position in the competition (Jiang, 2011). Food machinery is very important equipment in contemporary food industry. Therefore, at the premise of satisfying the function, carrying on a research, development and design to it, continuously raising its outside quality and satisfying the demand of the market competition, have become an impending problem for the industry of food machinery to deal with (Zhan, 1999).

In our country, the food machinery is given a high value as well and after the effort of several decades, our food machinery gradually approaches advanced level in the world in the aspect of function design, but in the aspect of modeling design, it still doesn't cause enough value of the insider. In the modeling design, the food machinery exists many problems, such as dull color, improper collocation; huge body, crude lines, inconvenient operation; inappropriate show device to observe etc., (Jiang and Cheng, 2010), which makes some food machineries originally have the same market competition ability as the foreign products, but because of neglecting modeling design, resulting in low outside quality, it makes the whole quality greatly discount (Jiang, 2013). The development design of new age food machinery aims at investigate an effective method of the modeling design of food machinery, thereby raising the external appearance quality and pleasant of food machinery product, strengthening additional value and

whole shape effect of product, satisfying the demand of market competition and creating higher economic efficiency (West and Deng, 2010).

The main purpose of the research is to investigate an effective method of the components design and shape design for food machinery, thereby raising the external appearance quality and pleasant of food machinery, strengthening additional value and whole shape effect of product, satisfying the demand of market competition and creating higher economic efficiency.

MATERIALS AND METHODS

Design of each part of food machinery: With the progress of the age and the improvement of people's appreciation ability of the beauty, it presents higher request to food machinery, that is, the food machinery should not only have high-tech function and good function, but also have a pleasant effect which makes person feel work delightful, decreases tired and pleases the eye. Therefore, the color and material choice of food machinery affects the whole felling which food machinery gives person. The good console design can make the operator quickly identify and can't take place a mistake operation and ensure accuracy and efficiency, comfort and convenience of operation. The number monitor put inside the normal scope of vision can raise the accuracy and efficiency of recognizing and reading and can also ease the vision tiring for a long time watching.

Monitor design: No matter what monitor, wants to attain to provide accurate, quick and convenient vision information, of which the design should accord to the person's vision characteristic and conducts according to the best observation fashion of person. Raising the

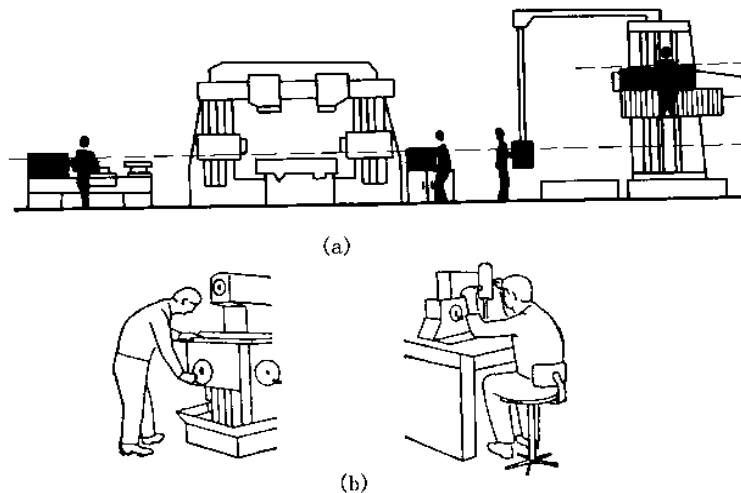


Fig. 1: Relationship of food machinery and human body scale

accuracy and efficiency of recognizing and reading, the better vision distance of monitor and person is in the scope of 560 ~750 mm, which can ease the vision tiring for a long time watching and be easy to observe for operator and can attain quick and accurate control when delivering the information to person.

Console design: In console design, the key is that the arrangement of the console and monitor should be located in the normal scope of operation space, ensuring that the operator could well observe the necessary monitor, operate all the controllers and provide comfortable operation posture for long-term operation. Sometimes, the console also has operation area at the side before operator; certainly all these districts have to be within the area of seeing and reaching. Therefore, the design of console height and work zone should accord to the person's size parameter and machine mechanics parameter, sufficiently considering the influence of food machinery upon the person, reasonably choosing various parameter and making person easy to operate, not tired and easy to observe process situation, which builds up a kind of best working environment.

Design of control device: The control device which converts the operator's output signal into the machine's input signal is a device that transports the person's information to the machine, in order to adjust and change the machine status. Therefore, the design of control device firstly should sufficiently consider the figure, the physiology the mental state, the physical strength and the ability of operator. The size and shape of control device should adapt to the sport characteristic of the person's hand or feet and the strength scope should be placed in the best scope of human body strength, could not outrun the extreme limit of human body strength. The important or using frequently

control device should arrange in the space scope where the person's responding is the most sensitive, the operation is the most convenient and the body could attain. The design of control device still needs to consider enduring nature, revolve speed, external appearance and energy consuming. The control device is an important constituent part in man-machine system, of which the design whether proper, relates to the normal safety movement of the whole system (Zhan, 1999), as shown in Fig. 1.

Design of protection device: Protection device, which exclusively provides a safe protection by the object obstacle, which includes machine hull, cover, screen, door, lid, close type device and others, is a constituent part of food machinery. The protection device could be used alone, as well as be used through uniting with allied lock device together. If used alone, only when closed, can it have a protection function; if used through uniting with allied lock device together, no matter what positions, it could have a protection function.

Shape design of food machinery: In the shape design of food machinery, above all, the inside quality of food machinery and operator's safety must be ensured. Never only pursue the scale and patten beauty of shape design, so as to reduce the processing accuracy and other technique function index. The various components of food machinery compose of some geometry bodies composed of dot, line, face. The shape design of food machinery is combining the material techniques such as structure and function of food machinery 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



Fig. 2: Manual enema machine



Fig. 3: Double conveyor

shape, that is important means to acquire food machinery of generous beauty and novel style (Qiu, 2005). The shape design of food machinery should be scale coordination, balanced steady and take "unity" as king, "change" as assist and the line type has to be simple and generous, giving person with comfort, coordination and felling of dynamic in quiet.

Proportion: The body proportion of food machinery means the contrasting relationship of size between the whole and the local and the local and the detail, pursuing visual ratio beauty. The form surface is mostly rectangular and the aspect ratio could choose golden ratio ($1: 0.618$) or root-mean-square ratio ($1:\sqrt{n}$, $n = 2, 3$). In the shape design of food machinery, each part usually adopts the equal or similar proportion, which is easy to get harmonious, comfortable effect, as shown in Fig. 2.

Equilibrium: Equilibrium is the processing approach for the asymmetric shape of food machinery. According to the principle of mechanical equilibrium, the asymmetric shape uses the fulcrum to show the equilibrium sense that the form size and the product to the fulcrum distance is equal, achieving balance effect. In the meantime, it also will have well-organized beauty and dynamic beauty of motion in quiescence and quiescence in motion, as shown in Fig. 3. In addition, it also could strengthen the equilibrium effect by color, texture and surface decoration (Fu, 2002).

RESULTS AND DISCUSSION

The profession of food machinery is similar to other professions, requesting people fully consider various factors including physiological and mental factors in development design of food machinery, making the operation simple, labor-saving and accurate and making the work environment comfortable and safe and making work efficiency and work quality of the man-machine system attain superior (Ding, 2005).

The food machinery is a high-tech product, of which the structure is very complicated and usually has a lot of buttons and control plank. People usually think that mastering its operation is very difficult and needing very high technique level and thereby influencing its usage. In consideration of the man-machine factors in design, the humanize control panel should be adopted, which can draw near the distance of person and machine, if considering the design of operation panel from the point of view of person's cognition, it is easy for operator to learn, understand and do a reaction. As a machinery of processing food, in addition to having a high technique, it should infuse deep sensitive cognition into the product. Do not forget giving more concerns and more popular and convenient operation method to operator in design, which makes the product hominization and gives operator with affinity. For example, in the noisy environment, the distinguishing ability of eye to the warm color descends, but the distinguishing ability to the cold color (particularly green) raises on the contrary, which should cause a value in the design of indicating and control device of food machinery. Only hard study in the cognition design of a man-machine interface, endowing thoughtfulness and affection in design process, can raise the friendliness of the product interface and the market competition ability of the product.

The workbench and the operation panel of food machinery are to be provided for person to operate, so their size, position and high should all accord with the size of "average person". For example, the size, position and shape of hand handle in the door of Japanese product all consider the man-machine factors and the diameter much took to be suitable for the size (4~5 cm) that the Asian hand holds and the position of hand handle is in the center partial to the next position in the door, which is as far as possible to make the wrist keep natural state and keep the hand and the small arm in a line. The operation panel is a main interface for man-machine interaction, where person conducts the careful operation of information-based control type, so its position, tilt angle, upper show, the size and position of control device all should make the person observe and operate in a comfortable, accurate and efficient working condition, as shown in Fig. 4 and 5.

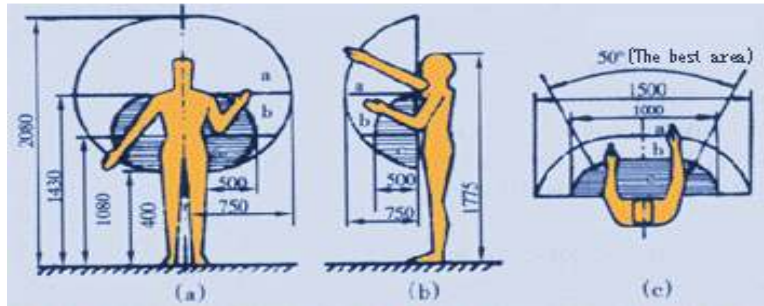


Fig. 4: Range of activity of human arm and hand

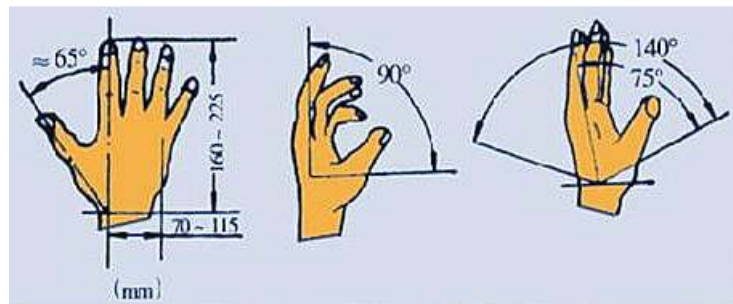


Fig. 5: Structure and range of activity of hand

CONCLUSION

The above is the design method for food machinery which is presented by the author, aiming at our country current development condition of food machinery, combining the industrial design principle and esthetics rule which should be followed by the modeling design of food machinery. The author makes an exploration on design method for components of food machinery, including the monitor, the console, the control device and protection device. And then the shape design of food machinery has also been pointed out, hoping that the exploration would have a help towards accelerating the development of modeling design of our food machinery and hoping that the design of food machinery should cause an extensive value and a related development work also should be energetically carried out.

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