

Research Article

Design and Research on Multi-function Juice Extractor

Xiaowei Jiang

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

Abstract: The purpose of this study is to design a juice extractor that has multiple functions, including making soy milk and milk shake, smashing pulp, crushing, stirring and juicing, specifically studying its shape design, color design and the design of internal transmission structure. The study elaborates that the shape design of this multi-function juice extractor should follow the art rule of variation and unity and meanwhile the whole shape still should be simple and direct; the color design of the multi-function juice extractor not only should satisfy the request of man-machine coordination and environment and function, but also should value the choice of tone, match the new age request of appreciation beauty and notice novelty. And then the detailed analysis for the function of the multi-function juice extractor is made, based on which the conclusion has been reached.

Keywords: Color design, juice extractor, shape design, transmission structure

INTRODUCTION

Take a wide view of the development process of juice extractor, it is not difficult to discover that those designed more excellently juice extractors 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). Juice extractor is a very important partner in contemporary people life. 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 juice extractor to deal with Zhan (1999).

In our country the industrialization processing of fruit juice started in the eighties of the 20th century. Due to the low manufacturing level of large-scale processing equipment of fruit juice, the manufacturing level of key working procedure of the core equipment is far from the world level. At that time the main type of domestic juice extractor was spiral juice extractor, of which the juice yield was only about 60%, 20% lower than the international advanced level. Then the juicing equipment used by processing factory of fruit juice was almost imported and the type was mainly the hydraulic universal juice extractor of BUCH-ER Company, of which the using effect is ideal in addition to the expensive price and high fittings cost. Because of the common influence of the scale of production of raw materials, domestic consumption level, economic strength of enterprise and other factors, with the addition of buying the expensive imported equipment, it made

our country's fledgling processing industry of fruit juice maintain for 15 years with difficulty. During this time, from the overall size of fruit juice industry to the manufacturing level of equipment is all at a standstill (Zhang and Wei, 1998).

After entering the 90s, with the significant increase of fruit yield in our country and gradual saturation of market for marketing fresh, it becomes more and more difficult to sell fruit. In addition, due to the enhancement of China's economic strength and the improvement of people's living standards, the fruit juice processing industry enters into a new period of development again. At present, the fruit juice processing industry is developing towards industrialization and some enterprises of great scale, high starting point and collectivization and facing the international market are increasing development and growth, which leads our fruit juice processing industry to the transformation towards large-scale industrial production. But the manufacturing level of juice extractor as main engine among a complete set of production equipment is still low and the key equipments of the domestic fruit juice processing factory of investing millions of yuans are all imported. Because having the large handling capacity, wide universality, high juice yield and good product quality, BUCHER hydraulic universal juicer and FLOTTWAG and AMOS belt juicer are the most kinds of models for the fruit juice processing factory in China to choose (Liu and Xu, 2006). The costs of these equipments are generally 3 to 10 times higher than the same level of domestic equipment and the high equipment investment affects and restricts the development of fruit juice processing industry. In order to reduce the investment cost of equipment, some domestic enterprises use the horizontal spiral

sedimentation centrifuge for juice processing at the expense of the benefits. Because of the low juice yield, it causes a lot of waste of raw materials and reduces the enterprise's economic benefit.

Our country has successively produced a variety of small and medium-sized juicing equipments such as single helix juicer, double helix juicer, bi-pyramid juicer, wrapping type juicer and belt juicer and currently the juicer industry presents the following features.

Fast speed of product up-gradation: While traditional small household appliances give priority to the product up-gradation, emerging small household appliances give priority to the new purchase. Juice extractor and other emerging kitchen and bath appliances have gradually enter into the households. From the point of the nationwide market of kitchen and bath appliances, the product will be to develop in the direction of serialization, intellectualization and beauty and the function tends to provide more help for people's health and shortcut (Zhan, 1987).

Big consumption elasticity: Juice extractor and other small household appliances are less affected by the seasonal change, but large affected by the income level, living conditions, consumption idea and price level. Unlike the color TV and refrigerator, the consumption of small household appliances is dispensable, so the elasticity of residents purchase is very big. It could be found from the ownership comparison of small household appliances that the ownership of small household appliances of the regions where the resident income is higher is relatively high, such as Guangdong, Shanghai and Beijing (Xiao *et al.*, 2003).

Being in the period of rapid growth: The market of small household appliances such as juice extractor is still in the period of rapid growth, having not yet been saturated. According to the data display, in recent years, the amplification of small household appliances is significantly higher than the big household appliances that have entered into the mature period, which reflects the consumption trend that the residents in our country in this respect demand for the high and the new.

The purpose of this study is to design a juice extractor that has multiple functions, including making soy milk and milk shake, smashing pulp, crushing, stirring and juicing, specifically studying its shape design, color design and the design of internal transmission structure, of which the shape design should follow the art rule of variation and unity and meanwhile the whole shape still should be simple and direct; of which the color design not only should satisfy the request of man-machine coordination and environment and function, but also should value the choice of tone, match the new age request of appreciation beauty and notice novelty.

MATERIALS AND METHODS

Shape design of the multi-function juice extractor: In the shape design of the multi-function juice extractor, above all, the inside quality and the hommization of using of multi-function juice extractor must be ensured. Never only pursue the scale and patter beauty of shape design, so as to reduce the quality and other technique function index. The various components of the multi-function juice extractor are made up of some geometry bodies which are composed of dot, line and face. The shape design of the multi-function juice extractor 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 to acquire the multi-function juice extractor of generous beauty and novel style (Qiu, 2005). The shape design of the multi-function juice extractor should be scale coordination, balanced steady and take" unity " as king, "variation" as assist and the line type has to be simple and generous, giving person with comfort, coordination and felling of dynamic in quiet.

Unity: The unity means that among each component of the multi-function juice extractor, it has same, similar, logical and harmony nature in the shape, line type, color, part, carriage, quality, amount and other aspects. But the variation refers to the difference and the contrast of above-mentioned various aspects. The perfect shape has to emphasize unity. But in order to making the image of the multi-function juice extractor different, vivid and attractive, it could add the variety in the same nature of unity, harmony and integrity to strengthen each other contrast, but the variation has to be appropriate, not excessive to avoid huge miscellaneous, chaos and centrifuge, as shown in Fig. 1.

Concision: The whole shape design of the multi-function juice extractor should be as far as possible simple and direct to acquire a whole, simple and direct style, which could adopt following two kinds of methods. The first, the body design of the multi-function juice extractor should apply some basic geometry body or some more simple curves and curved face, of which the shape is rule, simple and explicit, giving person with the deep impression and it is easy to achieve the art effect of simplicity, direct and clear, enrich and abstract, as shown in Fig. 2. Meanwhile, the manufacturing craft of rule shape is simple and easy to have extensive, high quality and low costly production. The second, adopting the shape design of close type, which not only reduces dust invading, but also covers up main body



Fig. 1: The shape design of unity



Fig. 2: The shape design of concision

of the multi-function juice extractor, makes its whole good and attains a simple, direct and clear visual effect (Jiang, 2014).

Color design of the multi-function juice extractor:

The color design is an important constituent part of the design of the multi-function juice extractor, as color has more ocular, more strong and more attractive magic power than the body. The color could firstly influence the person's sense organs than the body, moreover, that could raise user recognizing and watching degree to some operation controls, show instrument and appearance by making use of vision recognizing effect

and psychology of color, sequentially, the function of these device could be well developed and the mental request of user could be satisfied. The color design of the multi-function juice extractor should follow the following few important points.

Satisfy the request of man-machine coordination:

The color design of the multi-function juice extractor should well embody the relation of man-machine coordination, so as to make user's mood pleasant, don't easily produce confusion and then attain to the purpose of operating accurately. For example, generally, the base and body of multi-function juice extractor properly adopt heavy and solid deep color, not only bearing dirty but also making person have the dependable sense of stability to machine. The other parts are the components that person usually use, which properly adopt bright color, so as to get rid of depressed feeling, satisfying the request of operating accurately and man-machine coordination.

Satisfy the request of environment and function:

The color should well express the function characteristic of product and mutually coordinate with the use environment. If the greasy dirt of use environment is serious, usually the dark color is proper for bearing greasy dirt. The color of the panel of multi-function juice extractor generally properly use the neutral base color of low bright degree and low pure degree, contrasting with component color, so as to enhance the



Fig. 3: The color design of multi-function juice extractor satisfying the request of environment and function

vision recognizing degree. The panel should have no strong reflection and dazzle light. The color of display part should be obvious and refreshing, but not dazzle eye. The color of caution part should be fresh and gorgeous to come into notice and the color of concealment part should be quiet, as shown in Fig. 3.

Value the choice of tone: The choice of main tone of multi-function juice extractor is a problem of very importance, the different tone will form different art effect. In matching color of multi-function juice extractor, 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 multi-function juice extractor is more unify. 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 multi-function juice extractor, transform the tone of multi-function juice extractor to make it produce an unusual attraction, in the meantime, increase the category of tone to satisfy people's fondness for different colors.

Moreover, the base, the body and other big pieces of multi-function juice extractor 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 (Fu, 2002).

Match the new age request of appreciation beauty: With the progress of the age, the improvement of



Fig. 4: The color design of multi-function juice extractor matching the new age request of appreciation beauty

people's living standard and the increase of cultural art accomplishment, the appreciating beauty standards also change. In a certain period or a certain region or world scope, some colors are popular with people and are extensively popular, becoming the "popular color". The "popular color" has a strong age characteristic, as a result, in a period, it become the color which is used extensively. The color design of multi-function juice extractor also should sufficiently consider using the "popular color" to accord with the age request, as shown in Fig. 4.

Notice novelty: The color design of multi-function juice extractor should notice novelty and creativity to make it have vitality and more competitiveness. The color of multi-function juice extractor not only can satisfy the request for appreciating beauty, under the particular condition, but also has strong influence, which can cause the transfer of people's emotion and interest to attract people's attention. For example, on an international industrial product exhibition, a red multi-function juice extractor produced by some country appeared in the exhibition hall. Though the red is not the color that the multi-function juice extractor consistently uses, the factory surprisingly adopted red color to decorate the multi-function juice extractor, causing the purchaser to crowd in its vicinity and then understood its function characteristics, which produced a surprising sensation effect and made its order enormously exceeded other nation. It is thus clear that the novelty of color design is very important.

Design of internal transmission structure of the multi-function juice extractor: The internal transmission structure of the multi-function juice extractor is shown in the Fig. 5. The motor connects

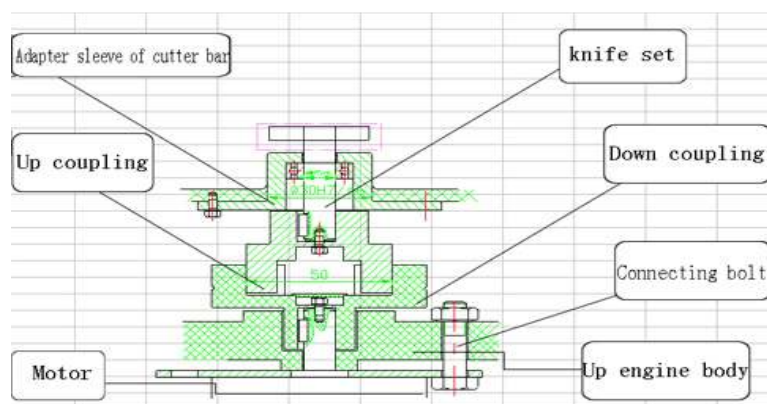


Fig. 5: Transmission structure of the multi-function juice extractor

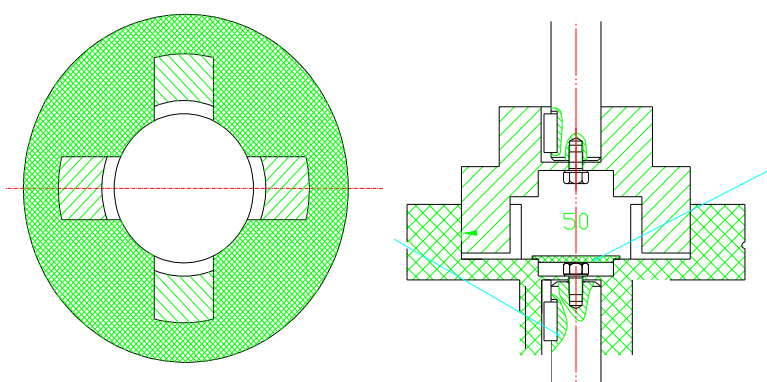


Fig. 6: Coupling structure

with the down engine body by the connecting bolt. The outer end of the motor is a drive shaft, which through the general flat key connects with the down coupling to make the axial restraint, which could transmit movement and power, at the same time through the screw to make the axial positioning to prevent the axial direction of the down coupling moving. According to the principle of spline, the up coupling and the down coupling are designed. While the down coupling is equivalent to the splined hole, the up coupling is equivalent to the spline shaft, as shown in Fig. 6. Hereunto it has transmitted the power from the motor to the up coupling that transmits the energy to the cutter bar axis and then passes to the blade through the same manner again. Hereunto it has passed the motor power to the executing mechanism_ the blade through the simple structure and then by changing the blade and the cup body it could achieve the desired purpose (Jiang, 2013).

RESULTS AND DISCUSSION

The multi-function juice extractor adds the heating device on the cup body of making soybean milk to solve the heating problem. The motor adopts adjustable speed motor to realize the slow-speed of revolution juicing and to slow down the revolving speed requires the strength

and stiffness of the transmission device and the blade to meet certain requirement. This design adopts the 5 in 1 juicing agitator, including a soybean milk cup, a grinding cup and a mincing meat cup. The function analysis is as follows.

Making soybean milk: After soaking a moderate amount of dried beans with water for six to eight hours, it could pour into the soybean milk cup loaded with strainer, add water to suitable position under the calibration line of maximum water yield of soybean milk cup, start the machine and begin to smash. Water rapidly turns into the white opacity and the concentration is higher and higher.

Grinding: Family often have the need of grinding, such as the commonly used seasoning_ the pepper, the chili powder and others; there are also accessories of some dishes, such as the rice flour that is needed when making the steamed pork with rice flour and the soybean flour that is needed when making the Dagao of North Korea or the glutinous rice cake of Sichuan, which all needs to use the grinding function of agitator. As it were, grinding function offers the possibility for making more professional food at home.

Mincing meat: The mincing meat function of agitator is generally suitable to mince a small amount of dogmeat for making ball, dumpling stuffing and other foods.

Juicing and making milk shake: Smashing fruit is an important function of juice extractor that consumers pay attention to and also is the function that consumers are easy to confuse. Many agitators all play with the sign "juice extractor", but in fact all agitators unable to make the pure fruit juice. There are two main ways in processing fruit for the multi-function juice extractor: The first is to use the soybean milk cup, put the fruit in the strainer of soybean milk cup, add water, milk or other beverages as a solution and start the multi-function juice extractor to stir. This way could put the fruit juice into the solution, getting the mixed juice and could separate most pomace with the strainer of soybean milk cup; the second is to directly put the fruit into soybean milk cup, do not use the strainer, add water, milk or other beverages as a solution and start the multi-function juice extractor to stir. This way could mix the fruit juice, pomace and solution together, getting a mixed fruit drinks and that is what is called milk shake.

CONCLUSION

- The multi-function juice extractor is easy to install, repair and replace spare parts. The design is in accordance with principles of ergonomics and it is convenient to operate and safe and reliable to use.
- The overall structure of the multi-function juice extractor is concise and reasonable.
- The manufacturing technical requirement and manufacturing cost of the multi-function juice extractor is low and the standard parts are plenty, so general machinery factories could make by themselves.
- Having the function of automatically controlling the concentration of beverage and others.

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