Study on Guang-style Furniture Woodcarving Products and Its CNC Equipment

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Abstract. First of all, it defined the concept of Guang-style furniture firstly. Secondly, it analyzed the features of Guang-style furniture from material consumption, techniques and decoration themes. Finally, it put forward some equipment suggestions expected to be helpful to the modern production with the case of the modern guang-style wooden-carving company T using CNC equipment.

1. Features of Guang-style Furniture Products

1.1. Coarse and Abundant Materials
Take the red sandalwood edge of the Imperial Palace Museum as the example of the immortal fairy floor Pavilion, with the characteristics of coarse and abundant materials on both sides of the upper plane of the base pier, and the maximum width is nineteen centimeters, and the thickness is six point five centimeters thick. To cut such a large piece of wood into a small square bottle with a large neck and a small bottom, naturally a lot of wood has to be removed. Looking at the wooden pier of the screen base, fifty-five point five centimeters long, eleven centimeters wide and fifteen centimeters high, and digging out the curve outline below, the size of the material is related to the stability of the screen, so the main components of the leg foot and column of the Guang-style furniture, no matter how big the bending degree is, generally do not have the stitching, and the habit is made up directly with a piece of wood, and the other parts are generally the same, so the Guang-style furniture is mostly more robust.

1.2. Deep Carving Decorative Pattern, Ripe Knife Techniques and Fine Grinding Work
To some extent, guang-style carving is influenced by western architectural sculpture, and its carving patterns are higher and some parts are similar to circular carving. The grinders are fine, and the patterns are smooth without trace of knife and chisel. With the red sandalwood carved passion flower top vertical cabinet for example, the four door panels on the front of the cabinet are decorated with the style of the sun, the four corners and the middle carved flowers, the flowers and the branches and leaves are four out, and the sculptures are deeper and more stereoscopic. Although the patterns are separated by veins, there is no uneven phenomenon from the whole place. In the case of the complex pattern and the obstruction of the blade, it can be treated so flat that it is not easy under the conditions of manual operation at that time. This style of carving is particularly prominent in the guang-style furniture.
1.3. The Sculpture Theme of Chinese and Western combined
At the end of the Ming and the early Qing Dynasty, the western architecture, sculpture, painting and other arts were gradually used in China. From the Qing Dynasty to the Qianlong and Jiaqing periods, the style of imitation of western style architecture was great, and the decorative themes and ornaments of the guang-style furniture were influenced by western culture and art. In addition to making large quantities of furniture from Guangzhou and collecting large quantities of furniture every year, the Qing court selected excellent craftsmen from Guangzhou to the imperial palace for the Royal production of Chinese and Western furniture which harmonized with these architectural styles, that is, after making furniture from traditional Chinese craft, the Western patterns were decorated with engraving and inlaying. The most common type is called "Western Lotus", which resembles a peony pattern. Its lines are smooth and varied. It can spread branches freely according to different shapes. It is characterized by more than one flower or several flowers as the center, extending to the four sides, and most of the upper and lower symmetry. If it is decorated on circular objects, its branches and leaves are mostly circulated, and the decorative patterns of each surface are skillful and difficult to distinguish between the beginning and the end. In addition to decorating the western style, the guang-style furniture also has a considerable number of traditional patterns, such as various forms of sea water dragon, ganoderma striae, phoenix, kui long pattern, bat pattern, tangled flower and all kinds of lace decoration, etc., and some have two kinds of Chinese and Western ornamentation.

2. Types of CNC Machining Equipment for Guang-style Furniture Carving Products
With the increase of people's consumption ability and the continuous expansion of the traditional furniture market, the guang-style furniture has already had the scale of regional industry. Large and medium sized furniture enterprises have introduced CNC equipment in succession. Compared with traditional common machine tools or manual processing, the processing efficiency is significantly higher.

2.1. CNC Engraving Machine
The woodworking CNC engraving machines used in guang-style furniture can be divided into many types according to their structures and functions. Generally speaking, the number of shafts of constant-axis linkage control can be divided into the following three categories: fixed spindle engraving machine, four-axis linkage engraving machine, five-axis linkage engraving machine, in which fixed spindle engraving machine is mostly used for plate parts. The four-axis linkage engraving machine is mainly used for three-dimensional cylindrical relief and penetration engraving. The five-axis linkage engraving machine is generally used for multi-process woodwork processing. It is a processing center, rarely used in the actual production of guang-style furniture. Furthermore, the woodworking CNC engraving machine can also be divided into single axis, double axis and multi-axis engraving machine according to the number of feed shafts.

2.2. Auxiliary Equipment
At present, most of the sculptures used by manufacturers are mainly by machinery and secondarily by manual. In addition, enterprises in the entire processing process will also use such as CNC woodworking push table saw, joinery band saw and other functions of CNC equipment, but also with the help of some power tools or computer-aided tools, such as small-scale electric woodworking polishing machine, electric drill, computer scanning equipment.

3. Case Analysis of the Application of CNC Equipment for Guang-style Furniture Carving Products
T Enterprise, located in Dayong Town, Zhongshan City, Guangdong Province, is a well-known brand of guang-style furniture. This enterprise is one of the more mechanized enterprises in the present mahogany furniture enterprises where machine production is used instead of manual labor for batch
production. The following is about the status quo of T enterprise furniture engraving products numerical control equipment.

3.1. Comparison of Efficiency between CNC Equipment and Manual and Semi Mechanical Equipment
Guang-style furniture carving in the use of penetration technology is very high frequency, common in tables, beds, chairs, cabinets, frames, screens, dressing table. T enterprise has used more mechanical equipment to make rough billet and early carving processing, followed by fine carving and grinding by hand to make product quality to meet the requirements.

Hollowing, also known as hollowing out, is the first step in the actual operation of the design after the completion of the carving process. The quality of the carving process has a direct impact on the work of the pattern finalization and carving process efficiency. This process can be carved by a copying machine, and can also be operated by manual tools or semi-automatic tools. The profiling process is a kind of technology that uses NC profiling milling machine instead of manual to cut rough blanks. The plate-type penetrating pattern in guang-style furniture can be operated by profiling punching machine. Several rough blanks can be processed at a time. The profiling machine equipment is used to make rough blanks for wide-type penetrating carving products. As many as eight blanks can be processed at a time. Another method of carving process is to operate the machine or semi-automatic tool manually. First, the carving pattern is pasted on the corresponding position of the raw material parts of the carving work, and then the master operates a desktop gong machine or a hand-held gong machine to complete the rough carving. The quality of the manual cutting process is completely controlled by the operator, and the consistency of the batch of finished products can not be guaranteed. Generally speaking, the efficiency of the copying machine is higher than that of the manual and semi-automatic equipment.

3.2. Trend of Use and Machining Center of Multi Spindle CNC Equipment
NC technology is a technology that uses digital information to control mechanical movement and working process. It has the characteristics of high precision, high efficiency and flexible automation. It plays an important role in realizing flexible automation, integration and intellectualization in manufacturing industry whose level and possession of NC equipment is a measure of an important symbol of a country's industrial modernization. With the extensive application of CAD/CAM and CNC processing technology, it is possible and trend to popularize the modern production technology of CNC fine carving in guang-style woodcarving production enterprises. It changes the production mode which relies too much on manual carving of workers and realizes digital mass production.

CNC modern precision engraving equipment is mainly composed of computer and machine tool, and the implemental tools of its manufacturing process mainly include engraving software and engraving machine. As early as in the 1980s, foreign countries have already started the application research work of CNC technology in woodworking machinery field, but in our woodworking CNC machine tool field, the development speed is relatively slow. In the 1990s, China's first CNC woodworking milling machine was successfully developed in Jiangsu Changzhou Jiana Woodworking Machinery Manufacturing Co., Ltd. At the beginning of the 21st century, CNC carving technology began to be used in wood carving industry. In recent years, CNC carving technology began to be gradually promoted by enterprises.

At present, the most widely used and relatively mature technology is the plane precision carving technology of plate-type parts, and the technology and equipment of plate-type parts plane carving machine manufactured by many manufacturers in China are more mature and various, which can be used to carve plate-type bending parts. And straight plate, its processing equipment mainly includes single-axis or double-axis and multi-axis and other different types of CNC precision carving machine tools, including single-axis and double-axis CNC machine tools, a wide range of work, mostly for large plate-type parts of precision carving operations. Multi-axis CNC machine tools generally have three axes, four axes, six axes and other types, mainly used for the carving of many small parts with the same pattern.
At present, most of the planar CNC precision carving machines on the market are gantry structures, and the planar part is a two-dimensional XY coordinate to represent the cutting position of the tool head. The operating distance of the XY coordinate depends on the size of the table and the number of tool shafts. The table size is small, while the general larger table machine tools can implement 3, 5, 6, 8, 10 and other different knives. Head spindle multi-head replacement operation, some advanced CNC precision engraving machine tools also equipped with automatic tool change system, its carving speed up to 12m/min. Commonly used woodworking carving tools have a variety of flat-bottomed sharp knives, center sharp knives, straight knives and even forming milling cutters, and different cutting tools have their own processing purposes to adapt to different types of carving operations.

When carving parts of small size, it can be carried out simultaneously, and the production precision and efficiency are greatly improved. However, CNC precision engraving equipment mostly uses multi-tool axis and flexible machining unit, there is still a big gap in production efficiency and production scale compared with the production line formed by multi-station special machine tools. In addition, its adaptability is poor, and the carving process is subject to certain restrictions. Meanwhile, it is difficult to adjust in the process of machining, requiring higher positioning of parts. Due to certain restrictions, most of them are only used to process plane relief, relief or three-dimensional relief, so it is difficult to carve with other techniques.

3.3. Applicability of Mechanical Equipment
For the polishing process of guang-style furniture, the plate relief parts after the bottom repair is finished. Nowadays, CNC grinding machine is generally used in the processing of panel furniture and solid wood furniture. Because of the characteristics of furniture engraving products, few furniture enterprises use CNC grinding machine. Most of them use ordinary mechanical equipment after rough grinding, and then carry out manual fine grinding. There are many kinds of mechanical grinding equipment, if the blind pursuit of processing speed, all furniture components are all used high-speed grinding machine, the result is often appropriate, so it is necessary to combine the size of furniture components for the selection of appropriate grinding equipment. Abrasive belt grinder has a larger width and can be used to grind the back of large plate relief parts, while narrower width relief parts can be used to grind smaller amplitude relief parts. In addition, table grinding wheel grinder can be used to grind the small parts or be grinded with a handheld wheel grinding machine.

4. Suggestions for improving CNC equipment in Enterprises

4.1. Do Well The Maintenance and Repair Work of Equipment, Reduce the Loss Time of Equipment System
At present, T enterprise still adopts the method of ex post maintenance. In order to improve the efficiency of NC equipment, relevant analysis tools and improvement methods can be used to reduce the loss of efficiency caused by the equipment itself, that is, to reduce the maintenance time, or to make the maintenance response faster, and to increase the necessary link of active preventive maintenance.

4.2. Reasonable Purchase and Equipment Modification of New Equipment According to the Actual Situation of Enterprises
The equipment reflects the modernization and scientific level of enterprises. The technical performance of the equipment determines the production efficiency and product quality of the enterprise. Only by continuously adopting advanced equipment, the enterprise can improve production technology level. According to system engineering theory, equipment management can be decomposed into three-dimensional graphics in time dimension, resource dimension and function dimension. If guang-style furniture enterprises blindly pursue the advanced nature of numerical control equipment, while significantly increasing manufacturing costs, the improvement of production efficiency may not be as significant as expected. Through the transformation of old equipment the
economic benefits may be higher than the introduction of new equipment.

4.3. Improve People's Technical Ability
A key factor affecting the quality and efficiency of numerical control equipment in furniture enterprises is the technical level of operators. No matter how good the engraving CNC equipment also depends on people to operate, if the level of the operator cannot meet the requirements of the base wood, it will make the quality of work can not meet the requirements, and production efficiency is not talked about. Human technical ability includes two aspects: first, the improvement of operational technology; second, the enhancement of maintenance consciousness. The actual available time of equipment is limited. The loss of production system, such as shutdown caused by operation errors, unreasonable scheduling and other time losses, can be solved by technical training of personnel, and the improvement of maintenance awareness of numerical control equipment will also reduce the occurrence of potential failures of equipment.

5. Summary
Guang-style furniture is an important branch of Chinese traditional furniture system which absorbs and blends many factors, such as western art culture, and shows its unique features, showing the characteristics of compatibility and mutual promotion. Although modern guang-style furniture has been using numerical control equipment, the effective use of equipment is far less than the plate furniture and solid wood furniture, so enterprises should take equipment improvement measures to improve production efficiency, ensure product quality, and create better economic benefits for enterprises.

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