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Shaping Machine Reformed by Numerical Control System

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Abstract: This incorporates the numerical control system revamped shaping machine and the self-developed CNC method for machine shaping.The numerical method and the shaping mechanism redesign the NC shaper; the control system is adopted as its hardware by the open PC bus unified structure modularization and structure of its software is adopted, with the graphical characters menu user interface and functions of Graphic Programming, simulation run, auto-checking instrument, tabulated curve programming, tool abrasion automatic compensating, real-time processing control and dynamic tracking display system.The shaper machine is a reciprocating type of machine that is used basically to create horizontal, vertical or flat surfaces. The shaper keeps the single point cutting tool in ram, and the work piece in the table is set.The ram holds the tool reciprocating over the work piece during the forward stroke to cut it into the required form. No metal is cutting during the return-stroke. The rotary motion of the drive in the shaper machine is converted into reciprocating motion of the ram holding the tool.

Keywords: CNC System,Cutting, Operation,Ram, Shaper Machine,Table.

INTRODUCTION

A numerically controlled machine and wire-electrode cutting (piece production) will process by short lengthen non-cylindrical surface.But when the cylindrical surface exceeds a certain length range, the two methods said will not match or the processing cost will be greater than the benefit, such as the roots vacuum pump rotor and the roots blower[1].The author has reformed the shaping machine with an IPC-based vacuum pump manufacturer and self-developed CNC system for shaper to satisfy the processing of complex curved section contour.The numerical control system modified shaping mechanism successfully processed the impeller of the blade model of the water ring pump and massively processed the Roots vacuum pump rotor[2].CNC system has real-time control functions, fitting and programming of complex curve and tabulated curve, tool abrasion automatic compensation, auto-checking tool, auto-graphic programming, analogue simulation and dynamic tracking display system processing[3].

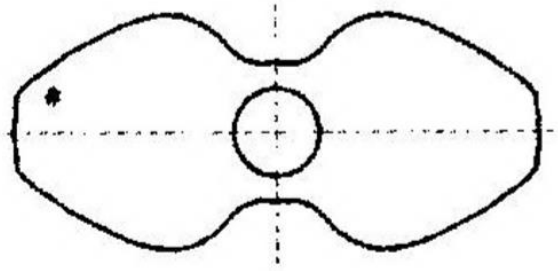

Figure 1: Section View of Roots Vacuum Pump

The method of reforming a shaper is to change the hand slide remaining from the RAM head to the NC knife rest driven by the stepping motor, and the stepping motor also dives the operating platform.Attach three approach switches on top of the lathe bed; install an iron block attribute on the RAM that will detect the direction and location of the RAM[4].Deploy on the operating platform a tool setting unit. The stepping motors are all 110BF003 style by load measurement moment of inertia, friction etc., which pushes the knife rest moving up and down and making the rotating platform shift right-and-left.The Pulse equivalents of the dual coordinating directions are all 0.01 mm[5].

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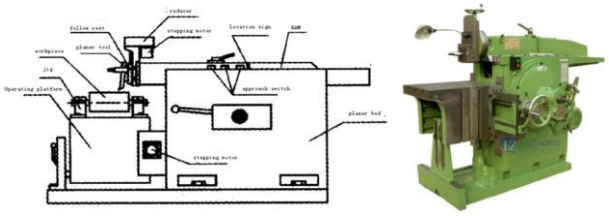

Figure 2: Shaping Machine

HARDWARE STRUCTURE OF CNC SYSTEM SHAPING MACHINE

An excellent control system not only has to provide detailed control functions and is highly reliable, but it should also be easy to maintain and consistent with related product formwork, which includes a robust and standardized hardware structure.The numerical system adopts the bus industrial control machine 468PC as the host, which has standard 16-digit data bus and versatile flashboard layout, performing customized configuration according to system specific requirements[6].At the interface board 8255A, the numerical system adopts IO/TIMER to control the two stepping motors, receive the RAM return signal and its position, operating platform limit switch signals, function switch signals, using the 8253 timer as the stepping motor interrupter during the serving procedure, the timer's frequency is 2MHz.The CNC system software planer framework is composed primarily of three modules: programming, device location adjustment and process control. And every single module is divided into several sub modules[7].

1. *Module of programming:*

There are so many stages to go in planning the right way for the processing procedures programming, simulation and emulation, mechanical precision analysis, device intervention and gouge testing.It can follow several ways for programming processing in this CNC system software manual programming, automated graphics programming, and tabulated curve programming.The data of the tabulated curve files and the processing procedures programmed elsewhere can be entered with the keyboard via software driver or full-screen editor and can also be entered via serial communication interface connecting to other computers[8].

The computer programming consists of:

a. *Editing Input of the Contour Curves:*

Input parts of axes, arcs in the interactive graphical user interface according to pattern curves and those curves can be expanded, adjusted, narrowed, made symmetrical, etc.

b. *Demand of Offset Curves:*

The isometric curves in conjunction with the nose radius of the tool are created towards the curves edited called offset curves.

c. *Automatic Programming:*

Fit the defined accuracy specifications with straight lines centred on offset curves, and simultaneously pass the offset curves to G code processing.

d. *Operation of Simulation and Emulation:*

Operate the processing generated on simulation operation, and then dynamically view the device nose operations trajectory.If the calculation is right, the superposition between the simulation display trajectory and the above offset curves will appear.The programming of tabulated curves is also performed within the interactive graphical user interface. First, in the tabulated curves, read the file data link the adjacent dots into line and then display them in the data files depending on the order.Second, the sample splines match, smooth and offset based on the above. And then, divide them into short straight lines according to the specifications of precision, and then immediately become the sorting.The operation of interactive graphical programming and simulation and emulation enables the programming of intricate curves and tabulated curves to be compiled efficiently, intuitive,convenient, and reliable[9].

2. *Operation Control:*

In this CNC system software the task of process control consists mainly of the following contents: rapid dry running, manual operation,automatic operation and jog running.Automatic running is the core of the CNC system software that runs as per the processing. In the processing statements on operation, if the last instruction

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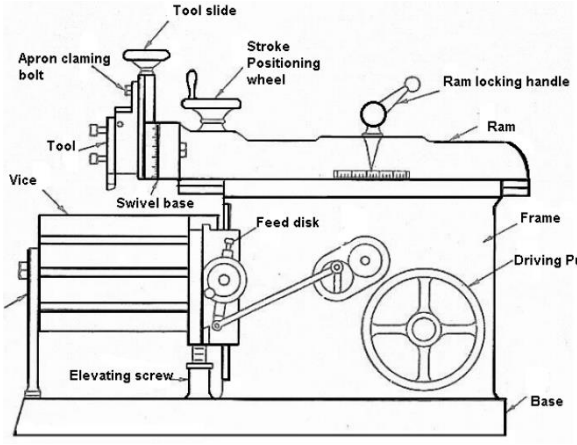
is M32, the cutters and the working tables will operate creep feed; while if it is M33.It will make continuous movements and it will be free from the influence of the signals from the square ram to and fro movements, namely the feature of quick dry operation.But if the square ram during processing stops to and fro movements, the cutters and the working tables will bring the feed operations close.And this function allows workers to continue using the previous methods to operate the planer and to control the beginning and end of the creep operation with the joysticks[10].In keeping with the processing, rapid dry running regulates the cutters and the work tables, but it works continuously.With this approach, it will test the comparative spatial relationships between the cutters and the rough versions of the work piece in order to determine the cutter height during the preliminary processing.And this processing segment also consists of the foreground and background programs, whose arrangements are identical to those of automated processing, while in the interruption service programs they are free of control of the square ram to and fro movements.When the selection switches are in the state of automatic operation, the jog feature only operates in the square ram to and fro movements and it is possible to set the largest scale of the continuous movement of the cutter, making it easy to change the cutter location during processing.And at the same time, when cutting too deeply, it can lift the cutters without halting production.The manual running can produce an intermittent movement under the control of the square ram to and fro movements depending on the choice?This manual function may apply to the processing of the plane but not to programming, the method of which brings a great deal of convenience to the processing of the plane[11].

PARTS OF SHAPER MACHINE



The following are the main parts of shaper machine:

a. Ram
b. Table
c. Cross-rail
d. Column
e. Base

1. *Ram:*

On the column guide ways, the ram reciprocates and holds the head of the tool with a single point cutting tool.The tool head is in the clapper box which causes cutting action only in the ram's forward stroke and the tool's sliding motion in the ram's reverse stroke.The cutting or feeding depth of the instrument shall be determined by the down feed screw.The tool head has graduations of the swivel base degree which helps move the tool head to any desired inclination on the work pieces for machining inclined surfaces.

2. *Table:*

The table is fixed to the saddle and the saddle cross rail experiences cross- and vertical motions.T-bolts are used for top and side-line clamping.The table can be swivelled from any angle.The table can be swivelled onto a horizontal axis in a universal shaper, and the upper part of the table can be fitted up or down.The table clamped in heavier type shaper with table support to make it stiffer.

3. *Cross-Rail:*

Cross rail is mounted on front vertical surface of the column on which saddle is also mounted.Using the

elevating screw the vertical motion is provided to the table by raising or lowering the cross rail.Horizontal motion is provided to the table by using the cross feed screw to move the saddle.

4. Column:

This is made of cast iron, which is identical to a box and mounted on the frame.On the top of the column on which the ram reciprocates, two specifically machined guide ways are given.The column acts as a cover for the drive mechanism and also supports the worktable and the reciprocating ram.

5. Base:

The base is the bed or support needed for all the machine tools.The foundation is a hollow casting made of cast iron to withstand vibration and fixed onto all parts of the shaper.It is designed in such a way that the whole load of the machine and the forces generated by cutting tool over the work can be taken up[12].

CONCLUSION

The author's self-developed CNC system for the shaping machine can not only apply for numerical control reformation on the shaping machine but can also be used for double housing planer of small size.The CNC system is adopted by an integrated open PC bus framework with a wide functional expansion capability; its software architecture is adopted in C language ofstructural andmodularization,CNC program user interface adopts a Chinese drop-down and pop-up menu, the display of Chinese characters is small fonts and Off-screen drawing mode, useful in its operation and graphical programming functions, tabulated curve programming, simulation run, auto-checking instrument, device abrasion automatic compensation, real-time processing control and dynamic monitoring display system also have special functional features in inching, manual operation (HM) and automatic operation.CNC system software planer framework is composed primarily of three modules: programming, device location adjustment and process control. And every single module is divided into several sub modules.The operation of interactive graphical programming and simulation and emulation enables the programming of intricate curves and tabulated curves to be compiled efficiently, intuitive, convenient, and reliable.

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