Combination of machine and automatic line development technology trends

Machine tools and automatic combination of technical development trend line

Combination of automated machine tools and machine tool portfolio is a dedicated high-performance line of automation technology and equipment, at present, it is still a large number of mechanical products for efficient, high-quality and economic production of key equipment, have been widely used in automobiles, tractors, internal combustion engines and compression machines and many other areas of industrial production. Which, in particular the automotive industry, is the combination of the largest machine tool and automatic line users. Such as the German Volkswagen plant in Salzgitter engine plant, used in the early 90's metal-cutting machine is automatic line (60%), Modular Machine Tool (20%) and processing center (20%). It is clear that mass production of machinery in the industrial sector, a large number of combinations used in machine tool equipment and automatic lines. Therefore, the combination of machine and automatic line technical performance and the level of integrated automation, determine to a large extent the industrial sector production efficiency, product quality and production structure, but also enterprise products to a large extent determines the competitiveness.

Modern machine tools and automatic line combinations as a mechanical-electrical integration products, it is the control-driven, measurement, monitoring, tool and machinery components, such as a comprehensive reflection of technology. Over the past 20 years, these technologies have made considerable progress, at the same time as the main users of combined machine tool and automotive industries, such as internal combustion engines have a lot of changes in the market for their products continue to shorten life expectancy, increasing variety and quality improved. These factors promote and stimulate the combination of machine tools and automatic lines for the continuous development of technology.

1 combination of tools focused on the development of varieties

Machine tools in the portfolio in such a dedicated machine, rotary combination of multi-machine and automatic line plays an important role. Because these two types of machine can work in many of the processes assigned to the position on a number of processing and at the same time from different directions on the workpiece surface for processing a few, in addition, can also switch fixture (in the rotary table machine) or by translocation, inversion devices (in the automatic online) the realization of the five parts or all of the processing process, which has a high degree of automation and production efficiency, by a car, motorcycle and compressors used in industrial sectors such as .

According to the statistics, Germany in 1990 and 1992, rotary combination of multi-machine and automatic production lines each combination of machine tool about 50% of the total.

It should be noted that rotary combination of multi-machine is a special type of small automatic lines, the outline of the size suitable for processing small and medium-sized pieces of ≤ 250mm. Compared with the automatic line, with a workpiece in the processing of cases, multi-rotary machine share portfolio automatically operating area than a small line of about 2 / 3.

At present, characterized by mass production of cars and light trucks, the engine output is usually around 60 million units, the realization of such a large volume, multi-station rotary machine and automatic line combinations in the three cases the operation , the beat period of 20 to 30 seconds, when a greater volume of production parts, the machine would also like to beat the time shorter. In the 70's, automatic line in order to achieve such a short period of the beat, often side by side duplex to be used or set up two ways, namely, the decision of the automatic line rhythms, processes the longest processing time through parallel processing of two identical workers spaces, if more restrictive process, then the same through the use of two automatic lines to balance the processing line system automatically beat. It is clear that this is necessary to increase investment in equipment and operating area.

Automatic beat short lines, mainly by shortening the time and support the basic time to achieve.

To shorten the basic time is the main way to the introduction of a new cutting tool materials and new tools, in order to through increased feed rate and cutting speed to shorten the basic time.

For example, the German Volkswagen plant in the processing of aluminum alloy cylinder head combustion chamber side, the use of PCD milling cutter, milling speed of up to 3075m/min, feed speeds of up to 3600mm/min; another example, in the boring of gray cast iron cylinder block when used with three CBN turning novel of boring cutter head blade, cutting speed of 800m/min, feed rate for 1500mm/min, processing depth of the 146mm cylinder, the actual processing time of only 5.8s, than traditional processing technology may be shortened by 2 / 3 of the processing time.

Shorten the lead time is shorter auxiliary including the workpiece carrier, the rapid introduction of the processing module and processing module is converted to fast-forward by the workers to the tool after the cut into the time spent by the workpiece. This part of space in order to shorten the travel time, commonly used to improve workpiece (workpiece direct transmission) or accompanying the delivery of fixture module processing speed and the speed of the fast-moving. At present, accompanied by the transfer speeds of up to fixture 60m/min or higher, the processing speed of fast-moving module 40m/min. At present, the accompanying high-speed conveyor fixture are commonly used to control electro-hydraulic proportional valve or cycloid drive transmission device. The end of the 70s, Honsberg processing in the automatic gearbox has been adopted in line electro-hydraulic proportional valve to control the delivery device. The automatic wire length 18.2m, 12-bit processing workers, transportation step for 1400mm, weight transfer 7000kg, transmission speed 45.6m/min, a step away from the delivery time of only 2.5s. Movement for the transfer characteristic curves of devices. As a result of electro-hydraulic proportional valve control system has a good start and braking performance, and the system is simple, so far, the delivery device is still used by many automated line.

3 combination of the rapid progress of machine flexibility

For more than a decade as a combination of the user's automobile industry an important tool in order to meet the personalized needs of people, cars increasing number of variant species to species to compete more than the automotive market has become one of the characteristics of competition, which combination of machine tool manufacturing industry is faced with change variety of production challenges. In order to meet the variety of production, the traditional varieties of processing a single combination of machine tools and automatic rigid line must

improve its flexibility. In 70 years, the reliability of numerical control system has been greatly improved, so that the end of the 70s and early 80s, like Alfing, Hüller-Hille and Ex-cell-o and other companies have developed a modular and flexible CNC Machining Auto-Line (FTL), then combination of CNC machine tools and flexible automatic line is increasing year by year. In 1988 to 1992, the Japanese machine tool and automatic line portfolio (including the part of other forms of dedicated machine) CNC production rate has reached 32% ~ 39%, the ratio of the output value of 35% of NC ~ 51%; the German combination of machine tools and CNC automatic production line of the rate of 18% ~ 62% of the rate of production of NC 45% ~ 66% (Table 2). These figures show that over the past decade, combination of the development of CNC machine tools is very rapid. It should be noted that since the 90's to enter, more intense market competition, product market to further reduce the life expectancy, the development of new models to shorten the growing cycle (currently 35 months in general), increasing car varieties, thus flexible automation technology for the automotive industry increasing demand for equipment. Such as Toyota Motor Corporation of Japan, the goal of the end of this century is under the plant's flexible manufacturing system to achieve 100% penetration. Obviously, the combination of machine tools and automatic lines, while maintaining its high production efficiency conditions, further enhancing its flexibility on the importance of more and more.

Flexible combination of machine tools is mainly through the use of digital technology to achieve. The development of flexible machine tools and flexible combination of automatic line is an important prerequisite for the development of numerical control processing module, and has a longer history of development of the machining center CNC machining technology for the development of modules to provide a mature experience. CNC Machining by a flexible combination of modules and flexible machine tool can be changed through the application and procedures to achieve NC Automatic Tool Changer, automatic replacement of multi-axle box and changing the processing of travel, the working cycle, the location of the cutting parameters and processing so as to species to adapt to change in the processing. Flexible combination of flexible machine tools and automatic lines with the CNC machining modules, according to NC coordinates (axis) the number of mainly single-coordinate (Z), dual coordinates (XZ, YZ, ZU and ZB) and coordinate (XYZ) Machining module; their main number, with uniaxial and

multi-axis machining modules, there are uniaxial and multiaxial composite processing module.

Coordinates the processing module from a single slide and spindle CNC parts (or axle box, including for multi-axle box) component. Two-Coordinate processing module by the NC cross slide and spindle components, such as CNC milling module dual coordinates. Mobile Column CNC Coordinate processing module, the tool can be achieved in three coordinates movement, the workpiece can be processed in accordance with the variety and processing tasks with a knife library, tool change and the necessary mechanical hand tools, are highly flexible. This processing module is a flexible multi-line varieties of automatic processing, one of the most important modules.

Mobile Column CNC Coordinate processing module can make use of X-axis and Y axis of the linkage to achieve peripheral milling process, especially in the milling body such as the transmission of the workpiece when less rigid, smaller diameter of the cutter can achieve high-speed (speed of 2500m/min) milling around, thus reducing the processing of cutting force and the deformation of the workpiece. This is a dual module coordinates milling cutter used for milling of large diameter to be much superior. Multi-processing module is also an important module, the main body for processing and flexible plate-type workpiece combination of automatic machine tools and flexible line. These modules have a wide variety of structural forms, but can basically be divided into automatic-for-box-type multi-axis machining modules, multi-turret processing modules and multi-axis Rotary Table-processing module. Automatically change as a result of box-type modules can be installed in a special library of multi-axle box store more multi-axle box, it can be used to process more different species of the workpiece. The turret and multi-axis Rotary Table processing module, as in the turret head and rotary table mounted to allow a limited number of multi-axle box (usually 4 to 6 months), so that the processing module can only achieve limited processing varieties.

In CNC coordinate the use of automatic processing of online modules and multi-turret processing modules can be realized not only the processing of different varieties of the workpiece, but also in the automatic line beat time (if time permits, then the beat), this type of processing module can also be in the same processing position on or through the Automatic Tool Changer for me, followed by the realization of multi-channel processing (rough boring,

semi-fine and fine boring boring; drilling, reaming and tapping), thereby reducing the processing work automatically median line and shorten the the length of lines automatically. Uniaxial and multiaxial composite processing module is a three-coordinate CNC Machining module, can automatically replace the Automatic Tool Changer or multi-axle box and the realization of single-axis or multi-axis machining process. It is worth mentioning that in the mid-80's introduction of Honsberg Germany CNCMACH modular system is a very unique modular system, which the full application of the principle of modular structure, in the module as a system based on CNC CMM module through changes in a variety of functional modules, assembled into a variety of different processes do not use coordinates or processing modules. Specifically, from the coordinates to see, with the exception of three-coordinate, the coordinates can be composed of double-and single-coordinates the processing module; from knife library, the library can be installed in the tool library and multi-axle box can be a separate tool to achieve one or more of the axle box automatic replacement of the tool can also be followed to achieve the replacement and multi-axle box.