Process Scheme Formulation of Combined Machine Tool

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Abstract

The determination of the process plan is the key step of the design of the combined machine tool, because the process scheme has solved the structure configuration and the performance of the combined machine tool to a great extent. Therefore, according to the processing requirements and characteristics of the workpiece, according to the principle of one point, combined with the combination of the common process methods of machine tool, all kinds of influence factors should be taken into full consideration, and the advanced, reasonable, economical and reliable process plan should be drawn up after the technical and economic analysis. This paper analyzed the basic principles of the combined machine tool process plan and develops a reasonable process route.

Keywords

Combined machine tool, Process plan, working procedure diagram.

1. Introduction

Tool is the symbol of the progress of human civilization. Since the late twentieth Century, modern manufacturing technology and automation of machinery manufacturing technology have made considerable progress. The modular machine tool is a semi automatic or automatic machine tool, which is composed of special parts and jig designed on the basis of general parts, which are designed according to the specific shape and processing technology of the workpiece. Combined machine tools are suitable for mass production. [1]On the modular machine tool, drilling, reaming, reaming, boring, tapping, turning, milling, grinding and rolling can be completed. The general design of the combined machine tool is usually carried out, then the cutting force, the cutting torque and the cutting power are calculated according to the material and hardness of the workpiece, and the cutting torque and the cutting power are calculated. Then, the motive components, the sliding table, the supporting components and the fixture are selected, and the connection diagram of the processing intention and the size is drawn.

2. Determination of the Process Scheme of Combined Machine Tools

2.1 Basic Principles for Determining the Process Scheme of Combined Machine Tools

(1) Principle of separation of coarse and fine processing

The cutting recheck in rough machining is larger, the hot deformation, the deformation of the workpiece caused by the cutting force and the cutting vibration are very unfavorable to the machining, which affects the precision of the machining dimension and the surface roughness. [2] Therefore, when drawing up a continuous multi process process, the principle of separating coarse and fine parts should be chosen.

(2) Principle of process centralization

With appropriate consideration of the concentration of the same type of process, the same process can be concentrated on a machine tool or the same station to simplify the cycle and structure when conditions permit. The processes with relative position requirements should be concentrated, and the machining of holes with strict position accuracy between each other should be concentrated on one machine tool once. It is completed under the installation, and the rough finishing of the hole is best concentrated on a machine tool. This can make the machining allowance evenly distributed, which is more conducive to ensuring the processing precision.

2.2 Problems to be Paid Attention to In Determining the Process Scheme of Combined Machine Tools

(1) Some restrictions on determining the process plan according to general principles.

The limit of center distance between holes: according to the requirements of the cutting torque calculation, the spindle diameter and bearing outer diameter have a minimum allowable size; for the machining of threaded holes, the radial size limit of the corresponding screw die should be considered; for the boring, the size limit of the floating card head and the guide size or the rigid spindle should be considered. [3] Therefore, whether the short distance hole can be machined on the same multi axle box at the same station will be restricted by the minimum center distance allowed by all kinds of spindle.

The technological property of the workpiece structure is not good: some of the workpiece structure is not good, for example, the diameter of the coaxial line on the multi-layer wall of the box is two hours in the middle, and it is difficult to get the knife. For example, the distance between the sides of the box body in the center of the hole should also be sufficient for arranging the intermediate guiding device.

(2) Other issues .

Attention should be paid to whether the hole surface is allowed to be pushed to the knife marks when finishing boring.For connected shell parts, the connecting holes should be machined from the intercepting surface respectively.When drilling a staircase hole, a large hole should be drilled before drilling a small hole.The plane is generally used in milling.

In the process of making several complete sets of machine tools or assembly lines to process a workpiece, the finishing process should be concentrated in all rough machining to reduce the influence of internal stress and deformation and to ensure the processing precision.

3. The Formulation of The Process Scheme for Combined Machine Tools

3.1 Determination of Configuration Form

Through the assembly package can be seen, the overall design of the robot can be divided into three parts to design: two-dimensional feed platform structure design, two-dimensional needle posture adjustment rotation structure design and needle into the body design, the following specific description of three Parts of the design.

First of all, the configuration of the combined machine tool is determined, and the horizontal machine tool is selected through many aspects, that is, the horizontal double side boring machine tool is designed, and the workpiece to be processed is shown as the following figure.

In order to ensure the final machining accuracy requirements, and follow the following principles: follow the rough, finish, first face, back hole, baseline first, etc. [4]

(1) take the upper surface of the box as the rough datum, scrape the lower surface and the guide block of the box.

(2) the surface of the box is scraped and studied with the bottom surface of the box as the fine reference. The parallel degree of the upper and lower surfaces is less than equal to 0.01, the scraping point on the upper surface is 25 points and 2 inches, and is used for the research with the 0 level plate.

(3) the following surface is rough base milling rough φ120mm and φ130mm surface.

(4) the following surface is fine reference milling, and the surface is φ120mm and φ130mm.

(5) the following surface is the reference rough boring φ80mm and φ90mm holes.

(6) the following surface is fine reference semi fine boringφ 80 and φ90mm holes.

(7) the following surfaces are precise reference boringφ 80mm and φ90mm holes.

The parallelism of the axis to the bottom of the diameter of the diameter of the diameter of the diameter of the diameter of the diameter of the diameter of the diameter of the diameter of [Phi] and [Phi] 130mm and [Phi] 80mm and [Phi] 90mm is less than 0.002, and the perpendicularity of the axis of the phi 120mm plane and the diameter of theφ80mm hole is less than 0.003, and the perpendicularity of the diameter of the φ120mm is less than 0.01 to the axis of the diameter of the φ90mm hole. And because of the requirement of the roughness of Ra0.2 in the φ90 hole. [5] It is difficult to achieve or not meet the principle of economic processing by a fine boring, so it is necessary to finish grinding at the end of the machining to meet the requirements of roughness.

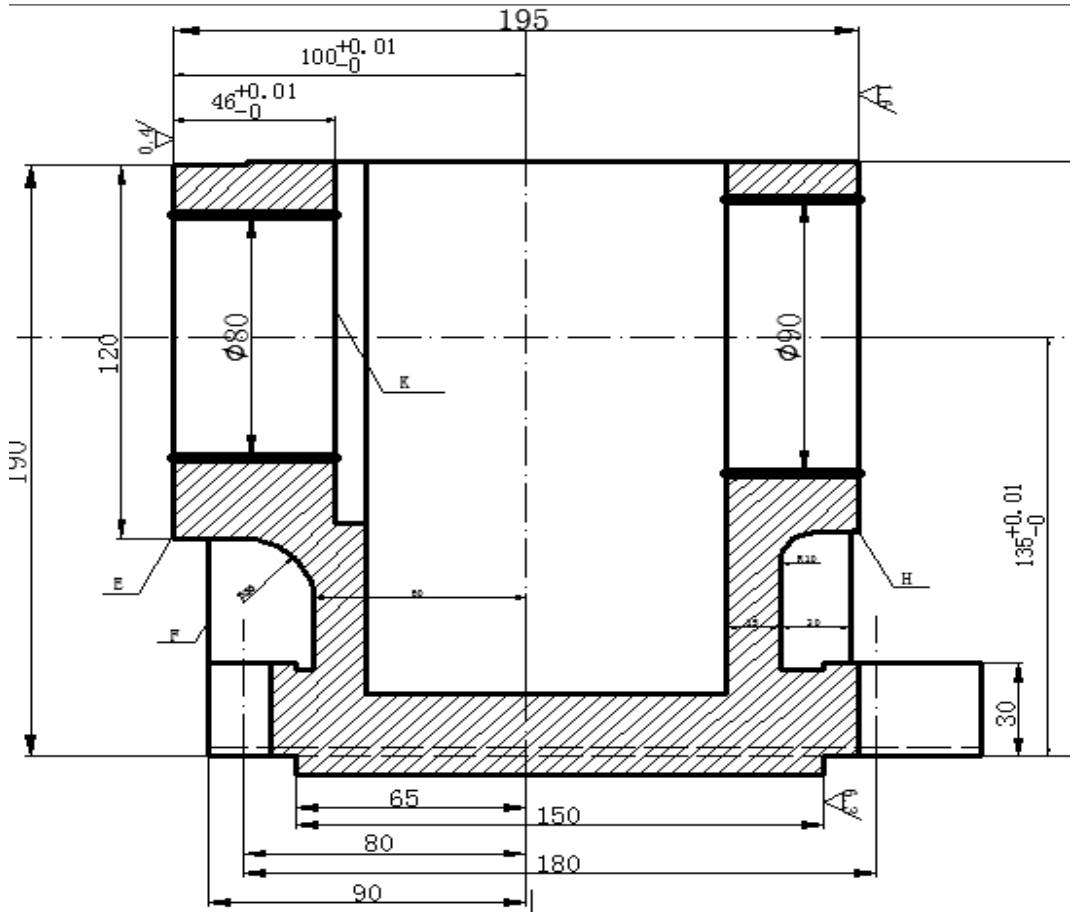

Fig 1. Boring procedure diagram of box

3.2 Tool Selection

First, as long as conditions permit, standard tools and general simple tools should be used as far as possible.

Second, in order to improve the concentration degree of process or ensure machining accuracy, two or more surface compound cutting tools can be processed or processed at the same time. But the assembly structure should be used as much as possible.

Third, because the large diameter reamer is not easy to make, the boring technology is chosen for any Kong Yingxian with a diameter more than 100. The boring cutter is made and the grinding is simple, especially for the high precision hole, the straightness and position of the center line, and the precision

key cutting is very profitable: and most of the hard alloy boring is used. The cutter head is mounted on the boring bar for boring.

Because this process is a fine boring part hole, the cutter chooses the hard alloy boring cutter, and the boring knife is generally inclined one angle on the boring bar, so that the boring knife has a long installation length in the boring bar and there is enough position to install the screw and adjust the screw. Generally, according to the diameter of boring bar, it can be installed from 10°~15°, 25°~30°, 40°~45.

In order to avoid the boring tool in processing because of the workpiece. The material is uneven and "wedge" into the workpiece. Generally, the boring cutter head is slightly higher than the center line. This can also increase the supporting surface of boring cutter, which is beneficial to boring small diameter holes. The boring cutter on the combined machine tool is generally higher than the center for the processed aperture of 1/20, that is, the corner of the boring knife changes about 5 to 6 degrees in the section perpendicular to the axis of the boring axis when machining a medium diameter hole.

The boring cutter should not be extended beyond the boring. Lest rigidity is not enough. Boring diameter D boring rod diameter D boring cutter cross section B * B relationship. Generally considered by (D-d) /2= (1 ~ 1.5) B, we can refer to table 2-1.

Table 1. Boring parameters

Boring diameter D	30~40	<40~50	<50~70
Boring bar diameter d	20~30	30~40	40~50
Boring cutter section B×B	8×8	10×10	12×12

3.3 Determination of Processing Allowance, Procedure Size and Tolerance

In order to ensure the machining quality reliably, the remaining allowance must be determined reasonably. The remainder of the common process of machining the hole of the machine tool is used.

The following problems should be paid attention to in determining the margin of the process:

The workpiece is reinstalled and machined by multi station machine tool. When the positioning error is large, the allowance should be larger. When the workpiece is semi finished and fined at one time, the finishing allowance is smaller. The diameter allowance should not exceed 0.4~0.5mm in precision boring.When determining the allowance for boring, attention should be paid to the effect of allowance on the diameter of boring bar. Especially when the tool is needed, the machining allowance and the amount of cutters determine the degree of diameter needed to be cut.O determine the machining allowance, process size and tolerance of 90 holes:

The precision boring process remainder Z fine =0.3mm;

After fine boring, the basic size is 90mm.

The precision grade of precision boring is IT6, the upper deviation is 0.221mm, the lower deviation is 0.208.

4. Conclusion

In this paper, the process plan of modular machine tool is analyzed, and the machining workpiece is analyzed according to its basic principle, and the technological scheme of machine tool is finally determined. The problems that may arise in the process planning are also analyzed, and the process charts of the workpieces are worked out, and the suitable cutting tools are selected. Among them, the determination of machining allowance, process size and tolerance is very important for the whole process when drawing up the process diagram.

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