

Design of Connecting Rod Fixture

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Abstract: Mechanical fixture installation is an important part of the production process system, especially in the manufacturing process to improve the efficiency of production and processing of parts, and to ensure the use of quality processing equipment is particularly important. The parts in this design are connecting rods, and the clips are specifically small-hole fixtures for connecting rods. The principle of the clamp that holds the connecting rod is the six-point positioning principle. To simplify the structure, the clamping method is thread clamping. The tasks and technical requirements for this design are to determine the type of production, perform process analysis on the parts, and set up specific fixtures for the specified process.

Keywords: machining process; connecting rod parts; connecting rod fixture

1. INTRODUCTION

Nowadays, with the rapid development of science and technology, the development level of people's productivity in all countries has reached an unprecedented height. At present, the world's more sympathetic view is that mechanization replaces traditional human handicraft production, social sectors, including transportation, animal husbandry and agriculture, development and utilization of non-renewable energy, development and utilization of renewable energy, automation, medical devices, aerospace, etc., are all related to various mechanical devices. However, almost all devices are produced by the machinery manufacturing industry [1]. The design of machine tool fixtures refers to a discipline that considers the technological problems that arise during the manufacture of machinery in the scientific system of modern machinery manufacturing.

2. MAIN TECHNICAL REQUIREMENTS FOR CONNECTING ROD

2.1 Large and small hole size accuracy, shape accuracy

For the large head hole and the piston pin can be closely matched to reduce the impact of the impact and heat and heat, the tolerance level of large head hole IT6, surface roughness Ra should not exceed 0.4 μ m; the cylindricity tolerance of the big head hole is 0.012mm, the

tolerance of the small head hole is IT8, the surface roughness Ra should not be greater than 3.2 μ m, and the cylindricity tolerance of the bottom hole of the small head bush is 0.0025mm.

2.2 The parallelism of the axis lines of the large and small head holes in two mutually perpendicular directions

The error of the parallelism of the two-axis axis line in the direction of the connecting rod axis will cause the piston to tilt in the cylinder, resulting in uneven wear of the cylinder wall, and at the same time, the edge of the connecting rod journal of the crankshaft is worn, so the tolerance of parallelism of the two-axis axis line in the direction of the connecting rod axis is small; the error of the parallelism of the axis of the two holes in the direction perpendicular to the axis of the connecting rod has little effect on the uneven wear, and therefore the tolerance value is large. The parallelism of the two-hole shaft line in the axial direction of the connecting rod has a tolerance of 0.04 mm over a length of 100 mm; the parallelism in a direction perpendicular to the axial direction of the connecting rod has a tolerance of 0.06 mm over a length of 100 mm.

2.3 Technical requirements for both ends of large and small holes

The basic dimensions of the distance between the two ends of the large and small head holes of the connecting rod are the same, but their technical requirements are different. The dimension tolerance grade of the large and small ends is IT9, and the surface roughness Ra is not more than 0.8 μ m, the dimensional tolerance grade of the two ends of the small head is IT12, and the surface roughness Ra is not more than 6.3 μ m. This is because there are requirements for the cooperation between the two ends of the connecting rod's big head and the crankshaft connecting rod's journal shoulder surfaces, and there is no requirement for the matching between the two ends of the connecting rod's small head and the inner surface of the piston pin hole seat. The tolerance zone of the distance between the end faces of the connecting rods is exactly in the tolerance zone of the distance dimension between the end faces of the connecting rods, which is a great convenience for the machining of the connecting rods.

3. ANALYSIS OF TECHNICAL REQUIREMENTS FOR CONNECTING ROD FIXTURES

3.1 Basic requirements for connecting rod fixture design

- ① Ensure the workpiece machining accuracy.
- ② Increase productivity.
- ③ Good craftsmanship.
- ④ Good use performance.
- ⑤ Good economy.

3.2 Basic steps for connecting rod fixture design

Explicit design requirements, careful investigation and research, and collection of design materials

- ① Carefully study part work drawings, blank drawings and their technical conditions.
- ② Understand the parts production program, production volume and production organization and other relevant information.

- ③ Understand the process specification of the workpiece and the specific technical requirements of the process, understand the positioning of the workpiece, the clamping scheme, and the selection of the machining allowance and cutting amount of the process.
- ④ Understand the type and specification of the precision grade, tool, and auxiliary tools used.
- ⑤ Understand the main parameters, performance, specifications, accuracy of the machine tool used, and the contact dimensions with the structure of the fixture connection part.
- ⑥ Prepare a variety of standards for the design of fixtures, process regulations, typical fixture drawings, and design guidelines for fixtures.
- ⑦ Collect information about designing and manufacturing fixtures of the same type at home and abroad and absorb reasonable parts that are advanced but can be combined with actual conditions of the company [2-3].

Determine the structure of the fixture

- ① Determine the clamping scheme for the workpiece and design the clamping mechanism.
- ② According to the positioning principle of the process, the positioning method of the workpiece is determined and the positioning element is selected.
- ③ Identify other components of the fixture, such as indexing devices, counter-blocks or guide elements, and fine-tuning mechanisms.
- ④ Coordinate the layout of each component and device to determine the overall structure and dimensions of the clip.

In the process of determining the plan, there will be various options for selection, but from the perspective of guaranteeing accuracy and reducing costs, choose an optimal plan that suits the production plan [4].

4. LINKAGE CLAMP POSITIONING

4.1 Six-point positioning principle

Any unpositioned workpiece has six degrees of freedom in a rectangular coordinate system. The task of positioning the workpiece is to limit all or part of the degree of freedom of the workpiece according to the machining requirements. The six-point positioning principle of the workpiece refers to the method of limiting the six degrees of freedom of the workpiece by six supporting points respectively, so that the workpiece can be determined in space.

4.2 Comparison and selection of positioning schemes

Option one: The workpiece is positioned with $\phi 91$ holes, which limits the four degrees of freedom, leaving the rotation around the Z axis and the movement in the Z direction. Positioning the bottom surface again limits the movement in the Z direction. Finally, the V-block restricts the rotation around the Z axis.

Option 2: Workpieces are positioned on the bottom surface and the four sides of the front and rear, so that the six degrees of freedom can be completely limited.

Compare plan:

Due to the low processing precision required for this design and the principle of simple structure, this design adopts scheme one.

5. CONCLUSION

From the results of this design, the designed connecting rod fixture basically achieved the technological design requirements such as reasonable structure, convenient and safe, economical and applicable. The connecting rod is an important part of the automobile engine, so the reasonable design of the connecting rod fixture improves the reliability of the automobile engine. The selection of the connecting rod fixture is also used to make the connecting rod more safe and reliable, so this design meets the expected requirements.

REFERENCES

- [1] Edited by the Editorial Board of Mechanical Engineering Handbook. Mechanical Design Manual [M]. Third Edition. Beijing: Mechanical Industry Press, 2008.
- [2] KADOYA HARUKATSU, WATANABE TORU, ARAKI NOBUHIRO. CONNECTING FIXTURE OF PILE HEAD REINFORCING ROD[P]. : JP2009114727,2009-5-28.
- [3] CONNECTING ROD FRACTURING FIXTURE[P]. : WO2002000386,2002-01-03.
- [4] Liu Youcai. Machine tool fixture design [M]. Beijing: Mechanical Industry Press, 1992.