Universe Scientific Publishing

Design of Automatic Press Fitting Machine For Motor Rotor Snap Ring

Hong Zheng

Wenzhou Polytechnic, Wenzhou 325035, China.

Abstract: The automatic press fitting intelligent production line of motor rotor snap ring is composed of three parts: loading and unloading mechanism, push positioning mechanism and press fitting mechanism; The design applies the mechanical principle of cylinder, rolling guide rail, manipulator, transmission chain and fixture positioning, and presses the two snap springs into the snap spring grooves at both ends of the motor rotor at the same time, so as to meet the working requirements of motor rotor parts.

Keywords: Design of Automatic Press Fitting Machine for Motor Rotor Snap Ring; Rolling Guide; Manipulator; Cylinder; Conveyor Chain

Introduction

The automobile manufacturing industry is the industry with the most and best application of intelligent production line. An automatic press fitting machine for motor rotor circlip can be used for automatic production line assembly, welding, grinding, polishing, gluing and spraying robot workstation in the automobile industry. The automatic press fitting intelligent production line of motor rotor circlip is composed of three parts: loading and unloading mechanism, push positioning mechanism and press fitting mechanism. The structure of motor rotor shaft is that both ends of bearing are fixed in one direction, that is, the motor rotor needs to press one circlip at both ends at the same time. The working rhythm of automatic press fitting machine is 22 seconds / 1 cycle. It can be seen that the larger the production batch, the shorter the average working hours and the higher the productivity.

1. Mechanical principle of automatic press fitting machine

The design of the automatic press fitting machine for the motor rotor circlip applies the mechanical principle of cylinder, rolling guide rail, manipulator, transmission chain and fixture positioning to press the circlip into the circlip groove of the motor rotor, which promotes the technical automation and intelligent efficiency of the production line, improves the labor productivity and reduces the production cost. The motor rotor parts and the motor rotor after the snap spring is pressed are shown in Figure 1. The snap spring is an E-shaped open snap spring. The loading and unloading mechanism of motor rotor is driven by servo motor and driven by chain with tooling plate; The sliding table cylinder drives the push block, and the push block pushes the circlip for step feeding; The motor rotor pushing mechanism adopts fixture V-shaped block for positioning; The cylinder drives the push plate to move in a straight line, and the positioning cylinder is positioned at the press fitting station; The press fitting mechanism moves vertically and linearly by the direct drive press fitting head of the cylinder to complete the press fitting of the snap springs at both ends of the motor rotor.

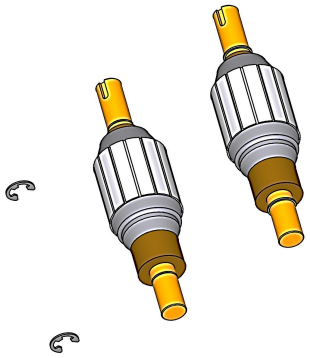

Fig.1 E-type circlip (left) and motor rotor parts (middle), motor rotor after pressing the circlip(right)

The intelligent production line manipulator grabs the motor rotor from the two V-shaped positioning blocks of the feeding conveyor chain, grabs one product at a time, and places the load on the two V-shaped blocks of the pushing plate of the workbench. The two V-shaped block clamps support the motor rotor journal and locate the outer circular surface. The two V-shaped blocks restrict a total of 4 degrees of freedom.

The slide table cylinders at both ends of the automatic press fitting machine drive the push blocks 1 and 2 to move towards each other. The push block pushes the snap springs 1 and 2 to feed step by step and enter the snap spring groove of the press fitting head for positioning, but the snap spring must expose the snap spring groove by 0.2-0.3mm.

The pusher cylinder drives the pusher plate to move forward horizontally and linearly to the press fitting station to realize Y-direction positioning. The positioning cylinder then butts against the right end face of the motor rotor, and the support nail on the left end face of the motor rotor is positioned to realize X-direction positioning, restrict 1 degree of freedom. Combined with the positioning of two V-shaped blocks, the motor rotor restricts 5 degrees of freedom, which belongs to incomplete positioning, but does not affect the assembly work.

The press fitting mechanism is driven directly by the press fitting cylinders 1 and 2, and the press fitting heads 1 and 2 move downward in a straight line. The press fitting heads 1 and 2 press the circlips 1 and 2 into the circlip grooves at both ends of the motor rotor at the same time. After stopping for 1 second, the direct drive press fitting heads 1 and 2 of the press fitting cylinders 1 and 2 move upward and recover in a straight line to complete the automatic press fitting of the circlips at both ends of the motor rotor at the same time.

The positioning cylinder of the pressing station is loosened, and the pushing cylinder drives the pushing plate to move back horizontally and linearly. The manipulator moves the motor rotor after the compression of the retaining spring in parallel and places it on the two V-shaped blocks of the blanking conveying chain. The blanking conveying chain is output step by step to complete the blanking.

The automatic press fitting intelligent production line of motor rotor snap ring operates continuously according to the above movement process and the production beat of 22 seconds / 1 time.

2. Mechanical structure design of automatic press mounting machine

The automatic press fitting machine selects the intelligent production line for automatic loading and unloading, and completes the automatic press fitting of the snap rings at both ends of the motor rotor at one time, and works circularly. The design idea of automatic press fitting machine is based on promoting the technical automation and intelligent efficiency of the production line, improving labor productivity and reducing production cost. Combined with the mechanical principle of cylinder, rolling guide rail, manipulator, transmission chain and fixture positioning, it acts intermittently according to the working beat of the automatic press fitting machine to meet the working conditions of the intelligent production line.

The engineering assembly drawing of the motor rotor snap ring automatic press fitting machine is shown in Figure 2

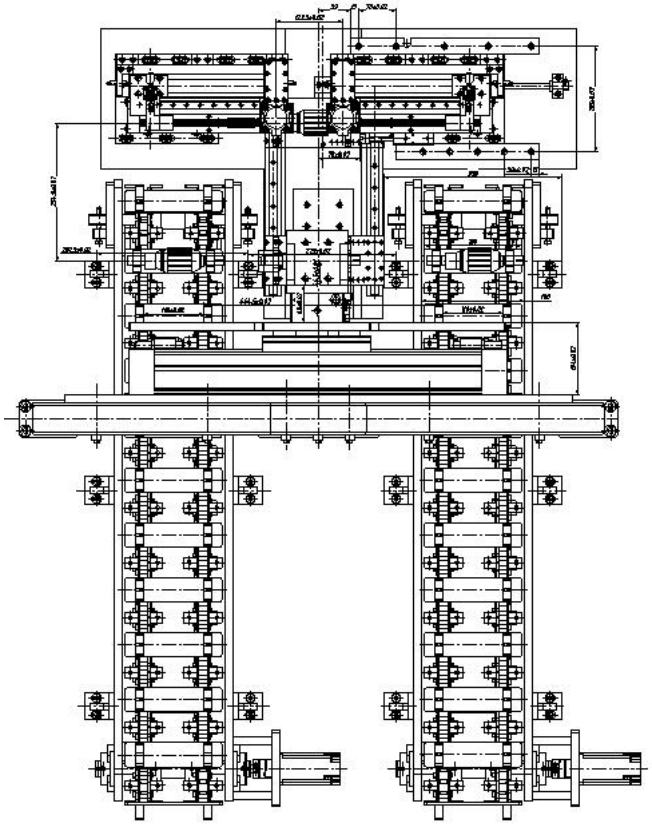

Fig.2 Design engineering assembly drawing of motor rotor snap ring automatic press fitting machine

The three-dimensional design drawing of the automatic press fitting machine for motor rotor snap ring is shown in Figure 3.

The mechanical principle and transmission of the automatic press fitting machine for motor rotor snap ring are correct. The mechanical device is reliable, practical, high precision and fast. It moves intermittently according to the working beat, which promotes the technical automation and intelligent efficiency of the production line. In the circlip pressing station, the circlip must expose the circlip groove of the pressing head by 0.2-0.3mm, otherwise the next circlip will clip into the circlip groove a little, resulting in the failure of circlip pressing.

It is difficult to master the theoretical and practical design of the rotor spring, but it is difficult to complete the mechanical design and practical calculation of the rotor spring. Through the design of motor rotor snap ring automatic press with distinctive engineering practice characteristics, theory is combined with practice to guide the analysis, discussion and problem-solving of engineering projects. The degree of difficulty of relevant knowledge and skill points of engineering projects will be different, and the degree of analysis and conclusion of mechanical principles will be different, so as to make project discussion and evaluation the main body of teaching activities, turn over the classroom, and create active participation, independent cooperation Explore innovative ability learning mode.

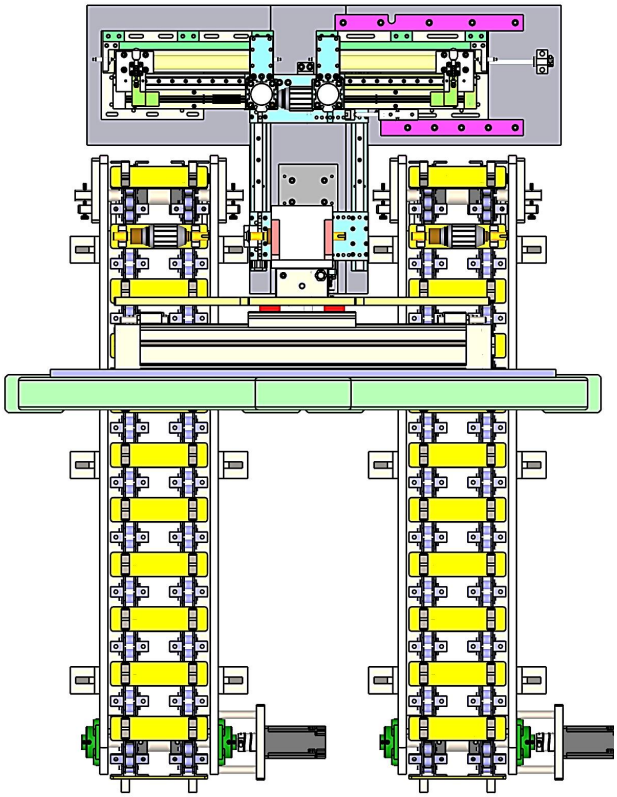

Fig. 3 Three dimensional design diagram of motor rotor snap ring automatic press fitting machine

References

[1] Zheng, H., Design and teaching feedback of switching steering transmission device in production line [J].Internal combustion engines and accessories. November 2022.

[2] Zheng, H., Design and teaching feedback of rotary load transfer transmission device on production line [J]. Value engineering. November 2022.

[3] Zheng, H., Design and teaching feedback of multi station angle steering transmission device in workstation [J].Internal combustion engines and accessories. November 2022.

[4] Zhao, F., Hu, ZZ., Hou, JP., Guo, JH., Computer simulation analysis of parameters of double overhead synchronous belt timing transmission system based on MATLAB [J]. Journal of Qiqihar University (NATURAL SCIENCE EDITION). September 15, 2020.

[5] Zhang, JQ., Chen, X., Liu, ZP., Design of high-level bag stacker based on synchronous belt drive [J]. Food and machinery. April 30, 2020.

Fund and project

1. This paper is the research result of the project "Design of automatic press fitting machine for motor rotor snap ring" of Wenzhou Science and Technology Association.

2. This paper is the research result of the comprehensive research project of back feeding teaching developed by Wenzhou Polytechnic, "Research on back feeding teaching of the design of automatic press fitting machine for motor rotor snap ring".

3. This paper is the research result of the research project "Design of automatic press fitting machine for motor rotor snap ring" of teaching construction and teaching reform of Wenzhou Polytechnic.

About the author: Zheng Hong (1968 -), female, from Nanchang, Jiangxi Province, associate professor, senior engineer, master and professional leader of intelligent manufacturing College of Wenzhou Polytechnic. Her main research and teaching direction is R & D and design of intelligent equipment and intelligent production line and NC machining technology.