Design of automatic press mounting machine for motor rotor bearing

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Abstract: The automatic press fitting intelligent production line of motor rotor bearing is composed of three parts: loading and unloading mechanism, whole column positioning mechanism and press fitting mechanism; The design applies the mechanical principle of gear rack transmission, synchronous belt transmission, manipulator, gas-liquid booster cylinder, vibrating plate and fixture positioning, and presses the bearing into the journal of motor rotor to meet the working requirements of motor rotor parts.

Automobile manufacturing industry is the industry with the most and best application of intelligent production line. An automatic press fitting machine for motor rotor bearing can be used in the robot workstation for assembly, welding, grinding, polishing, gluing and spraying production of automatic production line in automobile industry. The automatic press fitting intelligent production line of motor rotor bearing is composed of three parts: loading and unloading mechanism, whole column positioning mechanism and press fitting mechanism. The structure of motor rotor shaft is that both ends of the bearing are fixed in one direction, that is, the two ends of motor rotor shaft need to press fit bearings respectively. The working rhythm of the automatic press fitting machine for motor rotor bearing is $t_n = (20 + 20 \times n)$ (s), $t_{average} = (20 + 20 \times n)/n$ (s), "n" is the number of motor rotors for bearing press fitting, for example, after completing the automatic press fitting of one motor rotor bearing, $t_1 = (20 + 20 \times 1) = 40$(s), $t_{average} = (20 + 20 \times 1)/1 = 40$(s); Complete the automatic press fitting of two motor rotor bearings, $t_2 = (20 + 20 \times 2) = 60$(s), $t_{average} = (20 + 20 \times 2)/2 = 30$(s); Complete the automatic press fitting of three motor rotor bearings, $t_3 = (20 + 20 \times 3) = 80$(s), $t_{average} = (20 + 20 \times 3)/3 = 26.667$(s); 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 motor rotor bearing applies the mechanical principle of gear rack drive, synchronous belt drive, manipulator, gas-liquid booster cylinder, vibrating disk and fixture positioning to press the bearing into the motor rotor journal,

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 bearing press fitting are shown in Figure 1. The loading and unloading mechanism is driven by servo motor and driven by chain with tooling plate; The motor rotor positioning

mechanism adopts fixture V-shaped block and support nail for positioning; The whole row of bearing positioning mechanism adopts synchronous belt drive, direct vibrator and sensor to the jacking position, which is jacked by the cylinder and installed into the press fitting head for positioning; The press fitting mechanism is driven by the gear rack directly driven by the cylinder, drives the press fitting head to turn 90 °, and completes the bearing press fitting through the horizontal and linear movement of the gas-liquid booster cylinder.
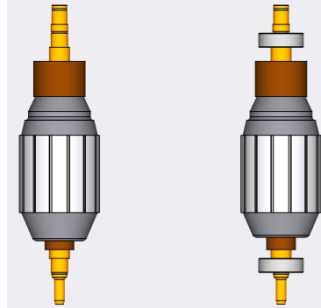
Fig. 1 motor rotor parts (left) and motor rotor after bearing press fitting (right)

(1) The motor rotor is fed from the chain drive 1 by the intelligent production line manipulator. One product is fed at a time. The product is placed on the workbench 1. The V-shaped block and the support nail fixture are positioned. The V-shaped block restricts 4 degrees of freedom and the support nail restricts 1 degree of freedom, with a total of 5 degrees of freedom.

(2) The bearing is loaded through the vibrating disc 1, and the bearing is transmitted to the jacking position through the whole row of positioning mechanism 1. The jacking cylinder 1 then acts to Jack a bearing into the press fitting head 1.

(3) The press fitting mechanism 1 is driven by the cylinder direct drive gear rack, which drives the press fitting head 1 to turn down 90 °, and after the bearing is pushed into the press fitting head 1, the press fitting head 1 turns up 90 ° to return to the horizontal position; The gas-liquid booster cylinder 1 drives the press fitting head 1 to move horizontally and linearly, presses the bearing into the journal of the motor rotor, and completes the press fitting of the bearing at one end of the motor rotor.

(4) The motor rotor is placed on the workbench 2 through the intelligent production line manipulator, and the V-shaped block and support nail fixture are positioned.

(5) The bearing is loaded through the vibrating disc 2, and the bearing is transmitted to the jacking position through the whole row of positioning mechanism 2. The jacking cylinder 2 then acts to push a bearing into the press fitting head 2.

(6) The press fitting mechanism 2 is driven by the gear rack directly driven by the air cylinder, which drives the press fitting head 2 to turn 90 ° downward. After the bearing is pushed into the press fitting head 2, the press fitting head 2 turns 90 ° upward to return to the horizontal position; The gas-liquid booster cylinder 2 drives the press fitting head 2 to move horizontally and linearly, presses the bearing into the Journal of the electronic rotor, and completes the press fitting of the bearing at the other end of the motor rotor.

(7) The motor rotor that completes the bearing press fitting is transported to the chain drive 2 for blanking through the intelligent production line manipulator.

The automatic press fitting intelligent production line of motor rotor bearing operates continuously according to the above movement process and production rhythm.

2. Mechanical structure design of automatic press mounting machine

The automatic press fitting machine selects the intelligent production line for automatic loading

and unloading. It completes the automatic press fitting of the bearings at both ends of the motor rotor shaft in two times and works circularly. The design idea of the 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 gear rack transmission, synchronous belt transmission, manipulator, gas-liquid booster cylinder, vibrating disk and fixture positioning, it operates intermittently according to the working rhythm of the automatic press fitting machine for motor rotor bearing, so as to meet the working conditions of the intelligent production line.

The engineering assembly drawing of automatic press fitting machine for motor rotor bearing is shown in Figure 2.
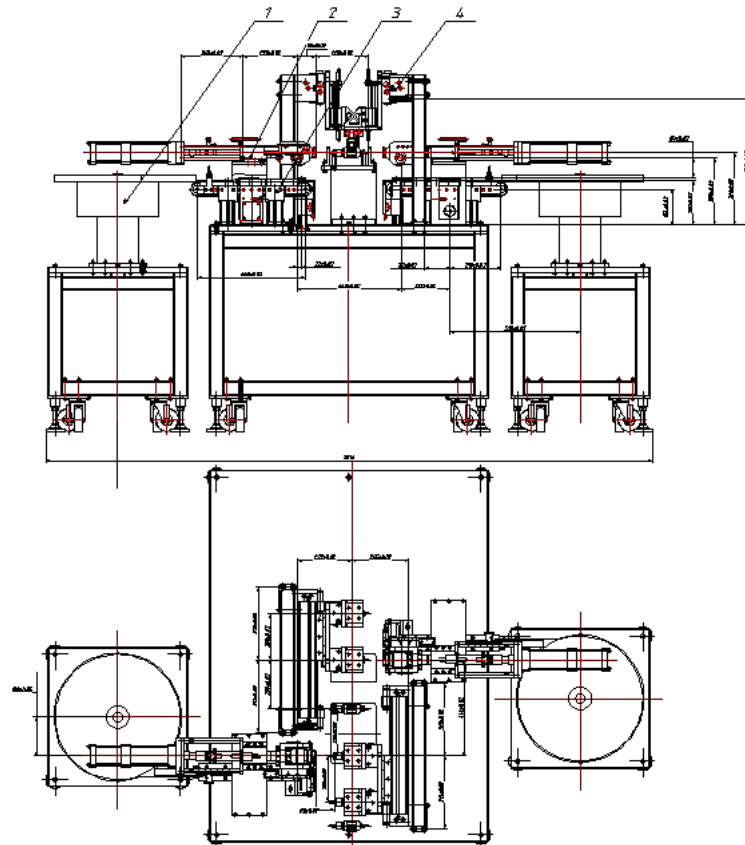

Fig. 2 design engineering assembly drawing of automatic press fitting machine for motor rotor bearing

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

The automatic press mounting machine for motor rotor bearing is designed with correct mechanical principle and transmission. The mechanical device is reliable, practical, high precision and fast. It moves intermittently according to the working rhythm, which promotes the technical automation and intelligent efficiency of the production line. The gas-liquid booster cylinder must be selected for the bearing press fitting station, otherwise the problem of insufficient driving force will occur, resulting in the failure of bearing press fitting.

The design of automatic press mounting machine for motor rotor bearing is to realize the mechanical principle and transmission design by using the typical machinery of engineering practice and life reality, but its theoretical knowledge is difficult, there are many calculation parameters, it is not easy to master, and the working principle will not be reasonably applied to

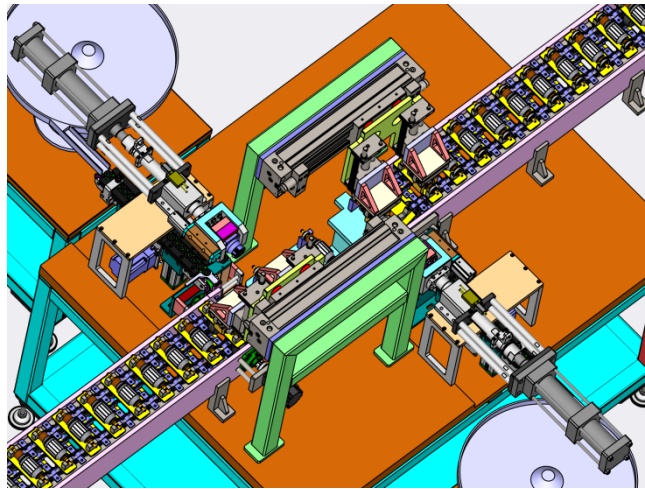complete the design calculation. Through the design of automatic press mounting machine.

Fig. 3 three dimensional design of automatic press fitting machine for motor rotor bearing

For motor rotor bearing with distinctive engineering practice characteristics, theory is combined with practice to guide the analysis, discussion and problem-solving of engineering projects. The difficulty degree of relevant knowledge and skill points of engineering projects will be different, and the analysis degree and conclusion of mechanical principles will be different, so as to make project discussion and evaluation the main body of teaching activities and create the ability learning mode of active participation, independent cooperation and exploration and innovation.

Acknowledgments

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