



13th Global Congress on Manufacturing and Management, GCMM 2016

Development of Electric Brush-plating Machine Tool Based on Inverter

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Abstract

Electric brush-plating is very useful in surface strengthen and redemption for shaft. The spindle of Electric brush-plating machine tool is infinitely variable speed. On the basis of frequency control, the infinitely variable speeds control for machine tool spindle is realized. Through the designing of electric control system, the functions such as start, stop, speed control, status display, feeding automatically and protection are realized automatically, so the automatic and productivity effect are increased remarkably. Electric brush-plating machine tool was applied successfully in a project about re-manufacturing for scrapped parts.

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Peer-review under responsibility of the organizing committee of the 13th Global Congress on Manufacturing and Management

Keywords: Electric brush-plating; Machine tool; Frequency control; Automatic control

1. Introduction

Electric brush plating technology is a surface coating technology, which is rapid deposition of the specified thickness on the surface of the conductive workpiece through electrochemical deposition principle^[1]. Electric brush-plating is one of the effective methods in some technical fields, such as restore the dimensional precision and geometrical shape, surface strengthening for wear parts. Some revolving surfaces of most shaft parts are easy to wear and tear. Through the application of brush plating technology, these vulnerable surfaces can be effectively strengthened or repaired^[2-3].

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2. Design of Machine Tool Transmission System

Principal of Brush Plating

The basic principle of the brush plating technology is shown in Fig.1. Using a dedicated DC power, the positive electrode is connected with the brush and the brush is used as anode, the negative electrode is connected with the workpiece and the workpiece is used as cathode while brush plating. The brush with plating liquid moving on the surface of the workpiece with a certain speed, and the appropriate pressure is maintained^[3].

For the brush plating of shaft parts, the relative motion between the brush and the workpiece is composed of two parts: circumferential direction motion of the work piece (the main movement) and the axial reciprocating motion along the workpiece (feed motion). According to the type of the bath, the diameter of the workpiece and the temperature of the plating solution, the velocity of main movement and feed movement are adjusted.

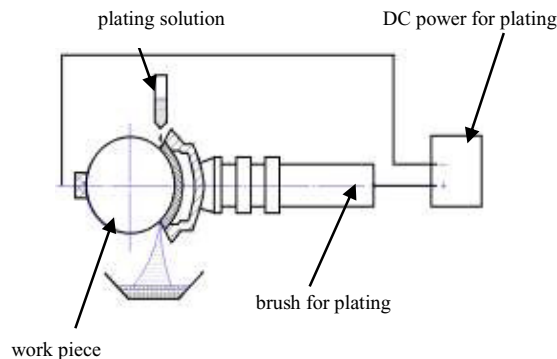


Fig.1.brush plating principle diagram

Design of Drive System

The drive system of electric brush-plating machine tool is composed of two parts: the main drive system and the feed motion drive system, they are independent each other. The rotation of spindle is realized by main drive system. This drive system adopts frequency converter as the motor driver, the motor drives the gear box and drives the main shaft to rotate through the speed reducer and the belt drive.

In order to meet the requirements of variable speed and speed control in the process of electric brush-plating, YVSP801-4 type variable frequency motor is used as the main drive power. The nominal power of the motor is 0.75KW and the rated torque is 4.7N.m. VFD007M43A type inverter is adopted as the motor drive. The motor is directly connected with the speed reducer, and the horizontal structure is adopted. XWDV0.75-8095-11 type planetary gear reducer is adopted in main transmission system, which transmission ratio is 11. A triangle belt transmission is adopted between the speed reducer and the input shaft of the transmission box, and the transmission ratio is 1. The gear box has high speed and low speed gear transmission, which transmission ratios are 58:51 and 88:21. The machine tool spindle is gearbox output shaft. Three jaws chuck is installed at the end of the spindle for clamping workpiece^[4-5].

The feed motion drive system realizes the reciprocating movement along the axis of the work piece. The YS7124 type three phase asynchronous motor is used as the feed motion drive power. The nominal power of the motor is 0.37KW and the rated torque is 2.4N.m. VFD004M43A type inverter is adopted as the motor drive. The linear feed motion of gear box along the guide located on the machine tool is driven by the motor, speed reducer, gear box and the machine body rack. The plating brush is mounted on the transmission housing and moves along the axis of the workpiece with the gear box. The gear box has high speed, medium speed and low speed gear transmission.

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