LITERATURE CITED

IMPROVING THE RELIABILITY OF ROBOT-BASED SECTIONS AND FLEXIBLE MANUFACTURING SYSTEMS

A. F. Chamin, M. R. Glebov, and V. P. Dyatlov

One of the main approaches to increasing productivity in plants under the Ministry of Chemical Equipment is automation of small-batch production, involving a large variety of products and high volume of manual work, through introduction of robot-based sections (RBS) and flexible manufacturing systems (FMS). The prerequisite for large-scale introduction of such systems is high reliability of the primary and secondary technological equipment, control and inspection devices.

The bulk of downtime related to breakdown of equipment in RBS is due to failure of secondary technological equipment. The main elements of this equipment are transport devices, piecewise blank dispensing devices, automatic lubrication devices, devices for separating sheet blanks (and checking presence of double sheets), flash trimming devices, intermediate tables, various types of clamps, and lifting-rotating tables.

An important element of RBS and FMS for stamping is the device for piecewise dispensing of sheet blanks. These systems can be divided into two categories: the first category covers RBS which work continuously, while the second covers RBS which have to be stopped for changing the cassette. In those cases when there is a shift from individual RBS to FMS the most effective way is to use multicassette devices with removal of blanks either from the bottom, or the top. Various modifications of the standard device (Fig. 1) are used widely. This device ensures piecewise dispensing of blanks in an automatic mode, without refilling, for 4-8 h (depending on the blank size). Refilling can be done by the operator during operation of the RBS.

The control system enables automatic stepwise rotation and fixing of the table during gripping of the last blank from the cassette which is in the operating position. The industrial robot can grip the blank directly from the suction lifting device, or from the movable supports mounted on the guide columns.

Fig. 1. Sketch of dispensing device for the industrial robot: 1) frame; 2) pneumatic cylinder; 3) ratchet; 4) table; 5) pawl; 6) suction cap; 7, 11) transducers; 8) pneumatic cylinder; 9) column; 10) blank stack.
Fig. 2. Vacuum grip with an ejector built into the suction cap.

Fig. 3. Circular vacuum grip with ejector mounted on a bracket.

The use of supports which also serve to separate blanks which are stuck together helps to improve the reliability of the device, particularly when the blanks which are loaded have a residue of anti-rust coating. The presence of blanks in the initial position of the robot and removal of the last blank from the cassette in the working position are checked by means of contactless inductive transducers.

Industrial robots which work with such loading devices can be equipped with mechanical, vacuum, or magnetic grips. Vacuum grips have been widely used in the RBS developed by the All Union Scientific Research Institute of Projects and Technology for Chemical Equipment. Modular designs of vacuum grips with built-in ejectors (Fig. 2, 3) are used to improve the integration with the above loading devices and to increase reliability. The grip design enables smooth regulation of the vacuum level and lifting of sheet-metal blanks (with center holes), or blanks of cylindrical or conical shape from a dispenser.

Technical Characteristics of the Device

Number of cassettes 4-12
Total weight of blanks, kg 500
Overall dimensions of the blanks, mm:
  maximum 360×360
  minimum 60×60
  thickness 0.5-3
Height of blank stack, mm 250
Dimensions of the dispenser, mm 1000×1000×1650
Weight, kg 220

The multiposition loading device with piecewise separation of sheet-type blanks from the top has been integrated in a RBS for manufacturing parts of the type of covers at the Pavlograd Chemical Equipment Plant.