Automated Loading of Plating Racks

Loading plating racks by hand is time-consuming and costly. Where production parts are being processed in large quantities, the use of a robot-controlled system can reduce cycle times and cut staff costs.

Daniel Bürgermeister

Electroplated surfaces can enhance the appearance and the functionality of high-tech consumer goods such as smartphones and cars. However, some of the manual stages in the plating process are much less technically advanced.

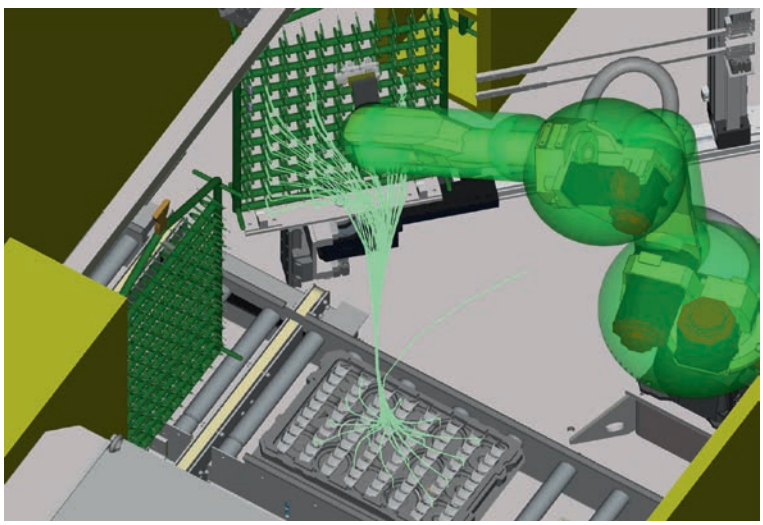
Parts with specific shapes where a high-quality surface finish is required are generally electroplated on racks. These are generally transported automatically through the electroplating machine, but are still loaded manually, which is a monotonous and unergonomic task. The finished parts are also usually removed from the racks and packed by hand after the electroplating process has been completed.

Manual loading no longer has a place in modern mass production processes, not only because of the high staff costs and the general shortage of skilled employees. Parts that are manufactured in large quantities are ideal candidates for automated processes. A customised robotic system is the perfect solution and takes up very little space.

A similar approach to electrocoating

After acquiring extensive experience of individually designed robotic systems, including some used for loading electrocoating racks, the specialist machine manufacturer Ulrich Rotte worked together with a customer from the electroplating sector to develop its first robotic system for the automated loading of electroplating racks. The goal was to remove two different types of small parts from parts holders and place them on electroplating racks and then to take them off the racks after the electroplating process and put them in clean parts holders.

The approach was similar to that for electrocoating processes, but the parts being electroplated are much smaller. While the tolerances for the relatively large parts on the electrocoating racks and the accompanying special parts holders are as much as several millimetres, the small parts for electroplating are themselves in some cases only a few millimetres in size. This led to the need for a very high level of precision when handling the parts. Extensive tests were carried out and a variety of procedures was considered.



© Rotte

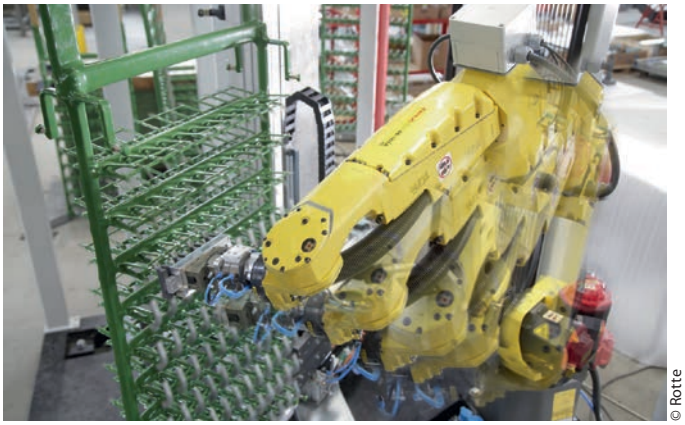
The components are carefully coordinated and the loading process simulated using a model.

Positioning the racks to the nearest millimetre

The option of optical detection of the contact springs and positioning the components on this basis using the robot was rejected primarily because of the cycle time. Image processing and evaluation take time and it is not possible to position more than one part simultaneously. Practical experience has shown that industrial robots provide the ideal combination of speed and accuracy if they always move to the same location. The necessary repeatability was achieved by centring the deep drawn trays used as parts holders. However, no tolerances had been specified for the previous manually loaded racks which would have allowed for positioning to the nearest millimetre.

Therefore, the user and the rack manufacturer worked together to adapt the racks for use in the automated process. The contact springs were manufactured with great precision and the racks were fitted with centring components which ensures that they can be fixed in the machine with a high level of repeat accuracy. The contact springs can also be precisely positioned using special centring

grids. The positioning of the parts holders and the racks to the nearest millimetre makes it possible to load and empty the racks quickly and reliably.



The industrial robot picks up several parts at the same time and loads the rack with a throughput of around 1600 parts per hour.

© Rotte

Cycle times of less than 3 seconds

The central feature of the machine is a six-axis robot with a payload of 12 kilograms which moves quickly and with a high level of accuracy. The other parts of the machine are designed to accommodate the robot and arranged in such a way that the robot's speed can be used to best effect. The robot's ability to handle several parts at once is what makes the very high throughput of more than 1000 parts per hour possible. The cycle time always depends on the way in which the parts are supplied, the characteristics of the parts and the type of rack. Some sorts of parts are picked up mechanically and others using suction pads that leave no marks.
The very latest production processes were used to develop the grippers, which ensures that the parts can be handled safely and without marking them. When the parts are picked up before loading, they are the same distance apart as they will be on the rack. The robot works against the force of the contact springs to pick up the parts in the same way as a person would during manual loading, but the robot is faster, more accurate and can hold several parts at once.

Unmanned production possible for several hours

After enough racks and parts have been supplied to the machine and it has been started in automated mode, the operators no longer need to intervene in the process. In the loading machines that have already been installed, the parts are already positioned correctly in parts holders before being transported to the machines on a conveyor. The parts holders can be stacked to allow the loading process to continue for several hours without the involvement of the staff.
Because the machines are designed specifically for each customer, other supply options are available, including some for small bulk parts. These have already been successfully used in other sectors of industry. After the electroplated parts are removed from the machine, they are generally placed in their packaging. Different options are also available for transporting the racks to the machine. The use of an overhead conveyor is just one example of the way in which the individual racks can be supplied in a continuous flow. This system can be connected with almost any type of existing conveyor. Another option is the provision of several racks complete with support rails or trolleys.
The robot operates in a secured production cell, but the operators can access the conveyor system outside the cell at any time. This allows the conveyor to be used as a buffer so that continuous production is possible. If intervention is needed from an operator, for example because more parts holders or racks are required, the machine can emit an audible or visual signal and also display a message on the control panel. This makes it possible and also practical for one person to operate several machines.

Short set-up times and small installation space

It is easy to switch quickly between loading and unloading modes. The operator selects the appropriate mode and the necessary set-up tasks are displayed immediately on the control panel. This generally only involves exchanging the grippers, which can be done manually or automatically. If the manual option is chosen, this takes only a few seconds using a quick change coupling, with no tools needed. The exchangeable grippers are individually coded and are stored in a gripper rack in the machine.
The exact size of the machine depends on the racks, the parts, the parts holders and the transport method. Wherever possible, the robot and the centring components are mounted on a compact base plate that fits on a standard truck. This allows the carefully coordinated assemblies to be transported in one piece without the need for complete disassembly. It also enables the machine to be set up and commissioned quickly. If necessary, the position of the machine can be changed relatively easily at a later date.

Machine status in real time

The machine is easy and intuitive to use. All the functions are displayed on the large control panel and can be accessed directly via the touch screen. The programs and the user interface are designed individually to meet each customer's needs.
One special feature is the option of integrating the machine into a smart factory platform, which enables it to be operated remotely, for example from a tablet, and also allows for extensive interaction with the machine. Depending on the design, the operator can use the smart factory panel (SFP) on one or more machines to obtain real-time information about the status of the machines and intelligent assistance. It is also possible to communicate with other operators. In addition, images, videos and other information can be used to develop a machine wiki. The complete documentation set, spare parts lists and operating instructions can be accessed instantly from the SFP. All the data are transmitted securely and stored only on the customer's server. //

Author

Daniel Bürgermeister
Technical project manager

Contact

Benedikt Rotte
Ulrich Rotte Anlagenbau
und Fördertechnik GmbH
Salzkotten, Germany
benedikt.rotte@ulrich-rotte.de
www.ulrich-rotte.de