Industrial painting processes consist of a series of different procedures, such as cleaning, wet chemical treatment, surface activation, drying, coating and curing. As a result of the rising volumes of parts, higher quality standards and growing pressure for rationalisation, the demand for automated systems is also increasing.

Rippert Anlagentechnik has specialised in this area for many years and plays a pioneering role in technical terms and, in particular, with regard to service and flexibility. The company is well-known for its expertise in implementing large-scale paint shops. Different types of conveyor system have developed over the years to meet the requirements of differing applications.

The systems can be broken down into overhead or floor conveyors, which operate continuously, cyclically or as power and free systems. They are always based on a driven chain. Holders are fixed to the conveyor at regular intervals, with the exception of power and free systems. These are generally loaded with parts and emptied manually.

Frequently, it does not make sense or is not possible to have an end-to-end chain system for technical or logistical reasons. In cases of this kind, the parts have to be transferred from one conveyor to another and this is usually also a manual task.

**Influencing process management**

In recent years, conveyors have been subject to a whole series of additional technical requirements. Quality standards have risen dramatically, for example in the form of zero PPM strategies in the automotive industry. The standards relate to technical quality and also to decorative quality, in the case of vehicle interiors and exteriors.

Functional paint systems also increase the demands placed on process management. Processes have to be more precise than in the past and additional processes may be needed. Examples include systematic cleaning, grinding or abrasive brushing procedures, which result in a growing number of interruptions to the traditional conveyor systems.

In order to compensate for these interruptions, additional manual work or ext-
Automated systems may be needed. Increasing the amount of manual work can bring problems, because people often have the greatest impact on the quality of processes. Even if staff consistently wear clean room clothing and a disciplined approach is taken to plant management, it is often not possible to produce satisfactory conditions in the long term.

Reliable materials handling using image processing

At the same time as the requirements placed on conveyors have increased, significant progress has been made in developing flexible, automated handling systems, such as industrial robots. As the prices of these robots have fallen, they have also become more powerful.

Industrial image processing plays a key part in increasing the flexibility of automated handling systems. It is now a reliable and widely-used tool for identifying parts and for accurately determining their position. In this respect the requirements placed on paint shops and the opportunities for flexible automation systems have moved closer together.

Rippert Anlagentechnik’s response to this trend was to establish a subsidiary called Rippert Automation Systems.

The industrial concepts which will be particularly successful in future will be those that offer the ideal combination of functional elements, in terms of both technology and cost. As a result, there will be a significant increase in the use of robot systems and industrial image processing for handling tasks and in the use of robots in individual processes.

The practice of feeding parts manually into a painting system will also become less common. In many cases parts can be loaded into and removed from painting lines using reliable automated systems. In comparison with the situation some years ago, it will be often be possible from a financial perspective to maintain the same level of automation or increase the automated functions, despite the fact that the requirements on the system are becoming tougher. In order to make this feasible, sensible batch sizes and parts designed for handling by automated systems are needed. In other words, the parts must have holding and positioning points which allow them to be accurately positioned.

Automatic robot systems for a contract coating company

Below is a practical example of the successful use of automatic conveyor systems. The German contract coating company Saarcoating, based in Saarwerlingen near the French border, specialises in non-stick cookware and uses seven handling robots and four coating robots in its coating line for frying pans.

For technical and economic reasons, it was particularly important for this line to be highly automated. The pans are transported through the system by two floor conveyors. One operates cyclically and the other continuously. The cycle time for each pan is just a few seconds. Each batch consists of around 100 components and the company produces more than 100 different variants.

There are three separate workplaces for loading the parts, quality control and packaging. An additional workplace can be used for cleaning the parts if required. The remainder of the coating line is fully automatic.

Once the parts have been loaded into the system, two robots move them into the blasting booth. Depending on the type of component, the inside and/or the outside is blasted. After this the parts undergo a heat treatment and a plasma treatment process, where two robots are also in use.

One guides the plasma burner and the other moves the component into the screened-off plasma area. A stationary camera identifies the position of the parts before they are transferred. Subsequently the inside of the parts is cleaned using brushes and compressed air. At this stage of the process the parts are also handled by two robots and a camera is used to correct their position.

The next stage involves spray coating the inside and outside of the pans with several coats of primer and top coat. This takes place in four booths, each of which is equipped with a robot that applies the coating to the continuously moving parts with the help of a conveyor tracking system. Various drying and curing phases
follow the coating process. This involves the conveyor system passing through different ovens.

After the final coating process, during which the top coat is applied to the inside of the pans, they are transferred by a handling robot from the conveyor system to a continuous curing oven. The final stage involves quality control and packaging the finished products.

Large-scale conveyor systems
A second example of the use of automatic conveyor systems can be found on the painting line of agricultural machinery manufacturer Claas at its French plant in Le Mans, where tractor chassis, consisting of the complete, fully assembled substructure of the tractor, are coated. The line was designed in such a way that tasks which involved working in a difficult position or in unacceptable conditions could be automated.

The very large size of the tractor chassis presented the major challenge for the project. The components weigh up to eight tonnes and the largest chassis is 5.5 m x 3 m x 1.6 m in size. Because a wide variety of different types of chassis have to be coated, the company has opted for a moderate level of automation. The parts are transported through the coating system on a floor power-and-free conveyor with two handling robots and one coating robot. After the chassis have been suspended from the conveyor system, they follow a complex route to the coating line, covering a distance of around 40 m and accommodating a difference in height of 6 m by means of two vertical lifting units. The route to the painting line is used as a buffer storage area.

When the parts leave the painting line, the same stretch of conveyor acts as a cooling-off area. Because of a lack of space, two handling robots fitted with high pressure cleaners are used to clean the parts. This ensures that a reproducible, high-quality cleaning process can take place in a very small area. In this example, flexible automated solutions replace the normal process that uses stationary nozzle holders. This stage is followed by conventional automated degreasing and drying processes.

The parts are dried in the normal way by two employees who clean out any cavities in the chassis with compressed air. Subsequently, the chassis are exposed to a maximum temperature of 100 °C and then allowed to cool. In preparation for the coating process, the areas of the chassis which do not need to be painted are manually masked up. An employee and a robot work together to apply the coatings to each chassis. The robot paints the parts which are hard to reach. These are mainly underneath the chassis.

A high solid, two-component, solvent-based paint is used. After being painted, the parts pass through the flash-off area and the drying oven, where the temperature is just under 100 °C. The finished chassis are brought to the delivery area via the lifting unit and then removed from the conveyor.

Industrial systems with potential
These examples show that by combining conventional painting lines with flexible automated handling systems, it is possible to produce solutions which open up completely new possibilities in terms of flexibility, quality and productivity.

In future, it will be important to bring in plant and machinery construction expertise during the initial planning phases in order to exploit the full potential of these options.

The demands placed on products and paint systems and the requirements of environmental legislation will go on increasing. As a result, new solutions for painting systems will continue to be needed which can keep pace with the latest developments or even set new trends.

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