ISRA Revolutionizes Can Inspection: Image processing system optimizes production processes

Zero-defect tolerance during production of metal packaging for beverages and food products

The production of metal cans as packaging for food is typically done with very high conveyor belt speeds and at high capacity. Production generally runs around the clock, 365 days a year. Transportation speed of the conveyor belts with the cans can be up to 240 m/min. Both lead to high demands on the Quality Control Department. The ISRA VISION business unit, Integrated Systems of Karlsruhe (Germany), makes the modular-based image processing system CanExpert available for the production of steel and aluminum cans. The experience that these leading image processing specialists have gained in areas such as surface inspection and quality control within the framework of just-in-time production has been implemented in the design of the system. The new system guarantees not only 100% quality control of cans and lids with a previously unmatched degree of precision, but also makes it possible to track systematic defects – something entirely new to the market.

The idea of offering beverages in cans can be traced back to the Gottfried Krueger Brewing Company after the end of prohibition in the USA, which was then able to increase its sales of beer by more than 500% in the few years up to 1935. Today, beverage cans are valued as a cost-effective form of packaging with a favorable weight.
ratio between packaging and content, as well as volume efficiency. The large openings make fast filling speeds possible. The "mini advertising columns" are also popular as marketing instruments.

The non-breakable and easily-transportable containers made of tin foil or aluminum are among the most important forms of industrial packaging for beverages. The almost legendary "crack" noise when opening guarantees consumers that the contents are fresh. So it is hardly a surprise that the cylindrical cans enjoy annual growth rates of ca. 5% in Europe. World-wide, 200 billion beverage cans alone are produced yearly. However, these cans that are absolutely impervious to both light and oxygen are being increasingly used for the packaging of other food products.

**Complex production process**

Can and lid are produced in separate production plants and only brought together for the first time at the can filler. Worldwide, there are at present app. 450 production lines for cans and about twice as many for lids. The manufacturing process of the cans begins with the uncoiling of the tin foil or aluminum tape, which is then coated with a light lubricant or stretching agent. After this, the work of cutting out suitable discs, out of which the body will be formed, is begun.

In the stretching machine, the originally flat cup is pushed over several increasingly narrower pull rings, thus, lengthening the can more and more. The base of the can is brought into shape by a stamp. After this the blank will be cut to the desired height and the stretching agent washed off. To protect against corrosion, the outer surface of the cans will be varnished and printed in one production step. After an extensive drying procedure, the interior varnishing is done with the help of spray guns. This also helps protect against
corrosion and avoids alterations to the taste of the contents.

The can, still in cylindrical form, must be tapered in diameter at the top end in order to receive the smaller lid. This task is done by forming tools in several stages. For a secure bonding of the can to the lid, the can will be flanged at the edges, i.e. bent towards the outside. After a separate varnishing of the base and a second inner coat of varnish, the cans are nearly ready to be placed on pallets.

Prior to being placed on the pallets, test procedures with the help of image processing systems are carried out to assure the quality of the cans. The particularly high demands made on the food industry must be taken into account when doing this. For example, the manufacturers test all metal packages produced for holes or flange cracks. These faults may occur as a result of the massive deformations the metal goes through in the course of the manufacturing process. Moreover, every can must be inspected for internal faults. Faulty cans will be sorted out from the belt by a blow-out unit.

For 100% quality control of cylindrical metal packaging, ISRA VISION, is making the new product family CanExpert available. The extensive experience, worldwide, of this group has allowed the development of this modular-based system. The modular structure of the system gives the users the ability to deploy models selected according to their testing strategy and upgrade the system as needed later. This enables adjusted investments for the first time.

50 cans per second

The system can inspect 50 varnished steel or aluminum cans per second at a conveyor belt speed of 240 m/min. The individual test stations distributed throughout the production area are configured to
detect defects that so far could not be recognized, thanks to a noticeably heightened camera resolution. The best part: the system makes it possible to trace a product on its way through the modules in order to correctly assign the individual results, as well as to automatically synchronize product tracing. Furthermore, statistical evaluations can be called up online.

The module TCI (Total Can Inspection) is responsible for the interior inspection of the cans. This module reliably detects bright or dark contaminations such as varnish and dirt, as well as varnish defects and deformations such as splits, cracks, wrinkles, dents, puckers, bat wings, folds and also waves and creases of sizes from 0.2mm x 0.2mm upwards. Three high-resolution matrix cameras with overlapping image areas see to it that a significantly higher degree of coverage of the inspected areas of the interior of the can is achieved than is possible with the other systems on the market. The image field of every camera encompasses 120° of the can. A new illumination procedure forms the basis for more exact results. Elaborate software algorithms keep the pseudo reject rate down to an extremely low level – a substantial argument, considering the total manufacturing costs of the cans.

The station NPG (Neck Plug Gauge) is responsible for the dimensional accuracy control and measures the edge of the flange with an accuracy of up to 0.02mm. Moreover, this module determines the ovality or roundness. A high-resolution matrix camera, flashed LED-arrangements and a special illumination arrangement for the reproducible contrasting of the neck, are all part of this module.
Important feedback for process optimization

A further noteworthy feature of the CanExpert system is the optical WIM station, which reads the body-maker number on the base of the can. This number, which can barely be recognized by the naked eye, makes it possible to trace back systematic defects. Example: The cans from a particular pressing machine exhibit a certain type of defect particularly often. Thus the user obtains feedback for the optimization of his manufacturing processes.

All three stations can be operated at one integrated station. The flexible user-interface is distinguished by clarity and precision. Various system overviews and live images provide the user with extensive information regarding the inspections and thus, ensure the necessary transparency of the processes. Freely allocable Fast-Access-Buttons make a quick and safe operation of the system possible. The user can call up the required system overview with one-button access. Type-management with revisions, user-management and online-teaching are some of the other features of the user-interface, which was developed together with ISRA’s customers.

All measurement results for the individual measuring stations are assigned by the Host computer, stored in a database and thus, remain permanently intact for further assessment. This means that is possible to instantaneously call up the overall results as well as, for example, statistics as a live trend. The soft PLC in the Host computer assumes the task of product tracking for the entire process.

The comprehensive statistic functions and user-graphics can be adapted individually to meet the customer's wishes in many areas.
The industrial PCs of the individual stations communicate with each other via Ethernet TCP/IP. This also enables easy forwarding of information, for example to the information network of the can manufacturer.

Two additional test modules will shortly compliment the CanExpert System. The module ESI (End/Shell Inspection) inspects the dimensional accuracy of the can lid (end) and also the position of the opening tab in the lid. Furthermore it also detects defects such as foreign objects, scratches, deformations, paint and varnish irregularities, as well as dirt. The module PQI (Print Quality Inspection) recognizes color defects and inspects the printed decor on the cans.

**Your partner for high quality**

With the system CanExpert, the manufacturers of cans and lids can ensure fault-free production in a growing market and minimize rejects in production. Compared to similar solutions on the market, the system offers an extended performance spectrum with a higher degree of accuracy and higher measurement resolution. The ability to track defects makes it possible to optimize the production process, as the successful implementation of the CanExpert system at a leading company of the can industry shows, which has chosen ISRA as partner for a long-term strategic cooperation.

With ISRA VISION a specialist for industrial image processing is at your disposal who knows exactly the demands of the branch and whose ready-to-use systems and solutions can be flexibly tailored to the given production of cans and lids. Quality becomes transparent.
Moreover, with the image processing specialist ISRA, can manufacturers also win a partner that has proven its ability on the international scene in several thousand projects. Alongside their strong presence in Europe, branches in Asia and North America ensure the necessary proximity to customers.

Pictures

WIM Module for Reading the Body Maker number with a speed of up to 3000 cans/minute (WIM.jpg)
TCI Module for Total Can Inspection with a speed up to 3000 cans/ minute (TCI.jpg)

NPG Module for Measuring Neck Plug Diameter with an accuracy of up to 0.02mm (NPG.jpg)
Can Expert Modules for Can Inspection, Total Can Inspection, Neck Plug Gauge and Reading the Body Makers Number (Can Expert.jpg)