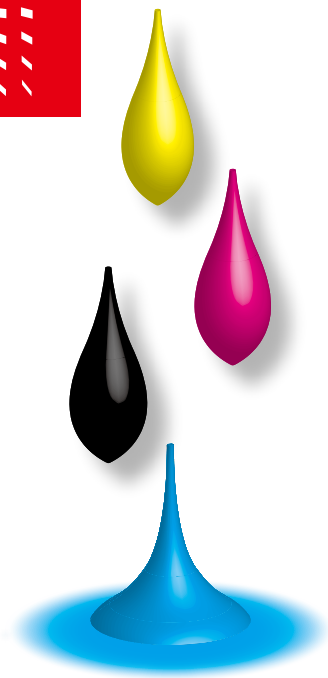


New Inkjet Printer Uses VOC-free Water-based Inks to Print on Packaging Film as a Short-run Printing Solution

Exhibitor

THINK LABORATORY CO., LTD.

www.think-lab.com

A likely candidate for the new de facto standard of short-run flexible packaging printing has emerged in Japan. In an industry that is seeing a battle for dominance between gravure, flexo, electrographic digital, LED UV inkjet, and LED UV offset printing, despite being a manufacturer of gravure cylinder making systems, THINK LABORATORY CO., LTD.'s announcement that it had completed a new water-based flexible packaging inkjet printer is turning the situation on its head. The FXIJ-1 AQUA water-based flexible packaging inkjet printer uses the world's first volatile organic compound (VOC) free water-based inkjet inks, developed by Kao Corporation. This technology overturns the long-held common belief that pure water-based film printing is difficult, and is thus finding strong interest among and has received inquiries from converters, printers, and existing ink producers. In addition, Kao's VOC-free water-based inkjet inks have been shown through tests on actual printing machines that slight changes allow them to be used for gravure printing as well, which is leading to growing expectations that the inks will stimulate the spread of water-based gravure printing. Kao and THINK LABORATORY will exhibit these Japanese innovations at drupa 2016, the world's largest printing related exhibition, to be held in Dusseldorf, Germany, from May 31 to June 10.

FXIJ-1 AQUA VOC-free Inkjet Printed Developed by THINK LABORATORY

Responding to the Demand for Short-runs

For many years, THINK LABORATORY, the manufacturer of the New FX2 laser gravure cylinder making system, has searched for a solution to the short-run printing problems faced by gravure printing companies, its main customers. Despite gravure's strength in long-runs of several tens of thousands or hundreds of thousands of meters, unlike in the US, Europe, and many developing nations, Japan's average gravure printing runs are estimated at 4,000 to 8,000 meters. Even these short-run lengths in Japan are too long for some customers, so gravure printers have struggled to handle printing runs of 2,000 meters, which, at 200 meters per minute, are printed in just 10 minutes. Considering the preparation and cleanup work, including printing cylinder washing, ink and substrate replacement, doctor blade setting, and warm-up for printing registration, however, such jobs can take 60 to 90 minutes from start to end depending on the number of colors. This means the operational efficiency of the printing machines is extremely low. With 2,000 meter jobs alone, printing companies will find

Plastic Containers of VOC-free Ink

themselves in serious trouble if customers are not charged appropriately. In reality, however, short-runs can be as short as 1,000 or even 500 meters. Therefore, other printing methods more suited to short-run jobs have emerged, including flexo printing, electrographic and inkjet digital printing, and LED UV offset printing, which are believed to be easier than gravure in terms of operation and plate setting.

Understanding that the gravure printing industry is faced with these current difficulties, THINK LABORATORY has felt driven to propose a breakthrough solution. Several years earlier, the company acquired a UV curable ink from outside of Japan, and began developing a short-run inkjet printer on their own with the help of a former gravure printing machine designer. Even so, UV curable inks have a unique odor that comes from the unreacted monomers and there is no such ink that can be used for applications that come into direct contact with food. As such, they faced the problem that these inks were only suited to non-food packaging applications.

After being introduced to Kao's technology by the president of a flexible packaging converter, THINK LABORATORY contacted the company immediately. From August 2014 on they worked with the Kao Techno-Chemical Research Center (Wakayama, Japan) to develop a VOC-free water-based pigment inkjet ink that can be used for food packaging. During this time, the Kao researchers brought the prototype inks to THINK LABORATORY, and repeatedly test printed the ink with an inkjet printer on film, evaluated the results, and made improvements until they finally perfected the ink. According to Tatsuo Shigeta, president of THINK LABORATORY, one reason the development went relatively smoothly was the high technological strength of Kao.

Rivaling Analog Printing Precision

The first 5-color VOC-free water-based page-width type inkjet printer, called FXIJ-1 AQUA, consists of five 108 mm inkjet heads aligned in parallel and can print widths of 540 mm at a speed of 5 to 30 m/min. The printing tests were made with the help of Futamura Chemical Co., Ltd. using their PET film for water-based printing. Although the details have yet to be released, the machine does not use an anchor coating, and has a print order of black, cyan, magenta, and yellow, with white being the fifth color. Drying uses hot-air. The ink (30% solid content) is diluted with purified water and is supplied through pipes to each of the printing heads from the plastic containers.

In addition, the printer is equipped with FANUC CORPORATION CNC (computer numerical control), which instantly detects misalignment in unwinding and rewinding and controls for this using servo motors. As such, there is no need for overlap or underlap processing during the flexible packaging design stage to compensate for register misalignment that causes the undercoat to become visible.

At a resolution of 600 dpi, the quality rivals that of samples printed with solvent-based and water-based gravure printing using a laser made printing cylinder, and is thus sufficient for making new product proposals. Because there is still room for improvement in terms of the ink and printer, however, THINK LABORATORY expects to make further improvement to the printing quality through improved ink properties and more convenient printer operations before the machine is introduced to the market in the fall or winter of 2016.

When customers make unannounced corrections to the print design, PACKZ (PACKZ Software BVBA of Belgium) and a PC can be used to make changes directly to the original PDF sent by the customer's designers, which can then be output on the new inkjet printer. Variable printing where each individual unit is different in terms of color and design is also a specialty of the printer.

With the help of Futamura Chemical, they are making printing tests on OPP films for water-based printing, which they will use to verify the applicable substrates. In the case of flexible packaging, however, post-printing lamination is essential, so they are also working with converters, adhesive producers, and laminating equipment manufacturers to test water-based

Correcting a Printing Design PDF With PACKZ Software

dry lamination. THINK LABORATORY is already in the process of assembling a second improved FXIJ, and the buyer, who will also test the machine, has already been determined.

Mr. Shigeta says that even convenience stores and major supermarket chains are releasing products differentiated by area for their private brands. Many products also have short life cycles, so the demand for short-run printing is clearly there. Mr. Shigeta goes on to say that if it is possible to capture printing runs of 2,000 meters or less—for which gravure printing is not economical—by combining the ink developed by Kao and the new inkjet printer, this will lead to further expansion of the demand for flexible packaging printing. They plan to have a production system in place to ship four or five units per month by the time they formally announce the machine.

Printing Samples Printed Using VOC-free Water-based Inkjet Ink (top), VOC-free Water-based Gravure Ink (middle), and Solvent Gravure Ink (bottom)

Discovery by Chance

During the repeated printing tests using the new water-based inkjet inks, they discovered something unexpected—THINK LABORATORY found that it might be possible to use the inks for gravure printing. Upon realizing this, they requested that Kao modify the inks for VOC-free water-based gravure printing, too. THINK LABORATORY also made changes to the cylinder making conditions, and through repeated trial and error tests on a gravure proofer, they discovered that they could print with cell depths of 5 or 6 μm (10 μm width), which is far shallower than the 12 or 13 μm cell depths typically considered ideal for standard water-based gravure inks. Conventional water-based gravure inks actually contain 20-30% alcohol. With the help of several gravure converters, they ran test prints at up to 150 m/min. on actual machines. Although no one expected that they would be able to print at all with cell depths of 5 μm, they are still looking to make further improvements.

Mr. Shigeta explains that because the water-based ink is VOC-free, it is also not considered a hazardous material under the Fire Services Act. Moreover, the ink overcomes one of the more difficult problems faced by solvent-based gravure printing today, namely meeting the VOC emissions regulations. In short, using these inks means there is no need to install expensive purification equipment.

To test the VOC emissions levels, THINK LABORATORY purchased five SHIMADZU CORPORATION gas chromatographs. After attaching these to a gravure printing machine at a printing company, they printed film with Kao's VOC-free gravure inks. Continuous measurement of the VOC concentration showed that the level barely fluctuated between 100 and 200 ppmC from the start. Mr. Shigeta explains, however, that the VOC detected during VOC-free water-based gravure printing was not VOC coming from the inks, but was the VOC coming from the work environment.

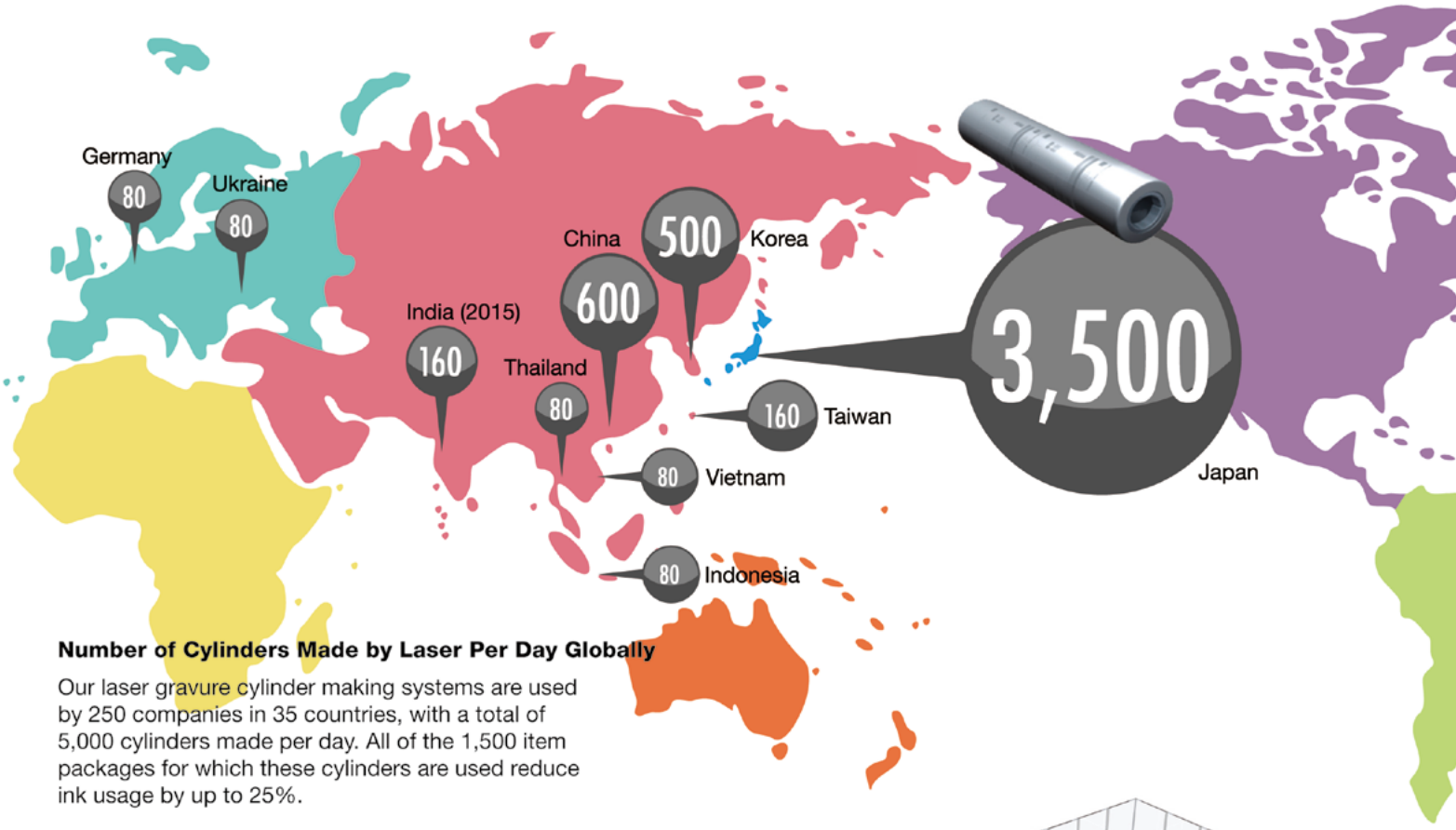
In the case of VOC-free water-based gravure printing, a technology was required to make even shallower cells of 5 μm on the cylinder surface. Therefore, THINK LABORATORY developed an advanced version of its New FX2. The new version uses TH dot and a new high-precision etching unit to stabilize the cell depth and improve the high-quality high-light expression and reproducibility. It also has a man-machine-interface that automates development time correction and a new development unit with an automated analysis function to stabilize the cell wall width. A new photosensitive material reduces drying times and eliminates the rotating drying unit. They also reduced the risk of defects and improved the productivity. Specifically, they adopted a copper plating unit anode that reduces the amount of additive by a maximum of 20%, they switched from nickel to alkali copper plating to stabilize the base layer and improve the anchorage, they adopted a water-saving mechanism that matches the cylinder face length to reduce the amount of sprayed fluids (ballard fluid, etc.), and they adopted a man-machine-interface that further eases operations (for example, by inputting the cell depth itself instead of the etching time). These modifications will be gradually added to models shipped after May 2016, and eventually will be sold as a new model, the New FX3, at the end of 2016.

THINK LABORATORY

FX eco project

Environmentally Friendly Laser Cylinder Making Being Recognized Globally

2015.1



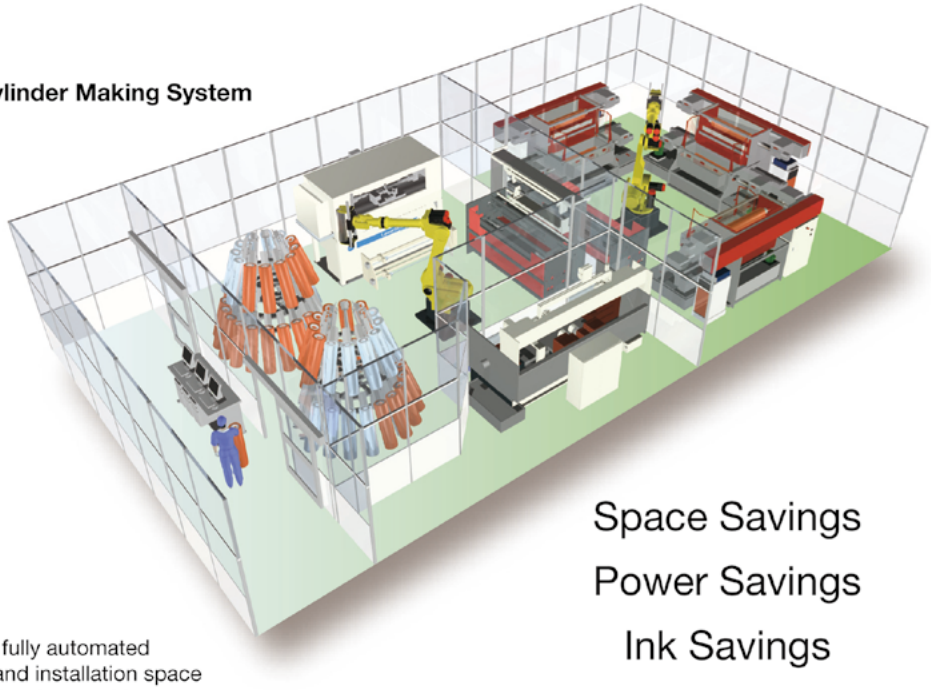
Number of Cylinders Made by Laser Per Day Globally

Our laser gravure cylinder making systems are used by 250 companies in 35 countries, with a total of 5,000 cylinders made per day. All of the 1,500 item packages for which these cylinders are used reduce ink usage by up to 25%.

An Environmentally Friendly Laser Gravure Cylinder Making System

New FX 2

Eco Gravure Cylinder Making System



Space Savings

Power Savings

Ink Savings

Cost Savings

Compared to the original model, the latest "New FX2" fully automated cylinder making system reduces power consumption and installation space by 50%, and ink usage by 25%. More than 20 New FX series machines are already in operation throughout the world. To visit our demonstration lines or for cylinder making for ink reduction tests, feel free to contact us directly.

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