Expanding Applications on the Thermal Transfer Printing

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Abstract

Thermal transfer printing technology has been applied primary for ticket printing, label, PC' Peripherals and so on.

However, the thermal transfer printer is capable of transferring wide variety inks on the ribbon directly onto the printing material. The foil gold/silver, opaque white and other functional ribbons are available for replacement of the ordinary flexo or gravure printing process in short-run applications. Also, the Retransfer Printing Process using Retransfer Sheet has started using for the printing on variety of hard materials such as such as CD and plastic card. The thermal transfer printing has entered the next generation of technical research for the expanding applications.

Introduction

The thermal transfer printing technology has been applied to many applications for issuing tickets, printing label, and PC-peripheral. On the other hand, the Inkjet printer and Laser printer are actively done the marketing not only for the PC-peripheral but also industrial-use application, and have begun not to see the clear application difference between each printing technology. However, the most unique feature of thermal transfer printer is that can be transferred any kind of inks can be coated on base film of the ribbon to wide variety of material.

Moreover, as reported the development of 1200dpi thermal head recently, the thermal transfer printer is expected moving into the application in high-resolution printing area. Also, Foil gold, silver and opaque white inks are available only on the thermal transfer printing that has been started to use for replacement of the flexo, the screen, and the gravure printing. Moreover, development comes into printing on various hard materials with retransfer film etc., and new applications of those thermal transfer printing technologies is described in this thesis.

Evolving Thermal Transfer Printing Technology

Thermal Transfer Printing has been used many variety of black and white printing applications because of high speed, reliability, easy designable system. However, it was limited to use for color printing application and others because color quality.

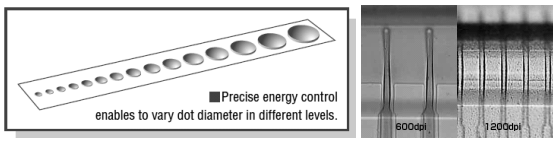
Recently, as ALPS is introducing Micro Dry™ Printing Technology applying 600dpi and 1200dpi, high resolution is advanced to the thermal transfer printing technology. That made new application for the thermal printer such as desktop size color proofing device.

However, ALPS is working for the core technology development in order to expand the application for the thermal transfer printer as follows:

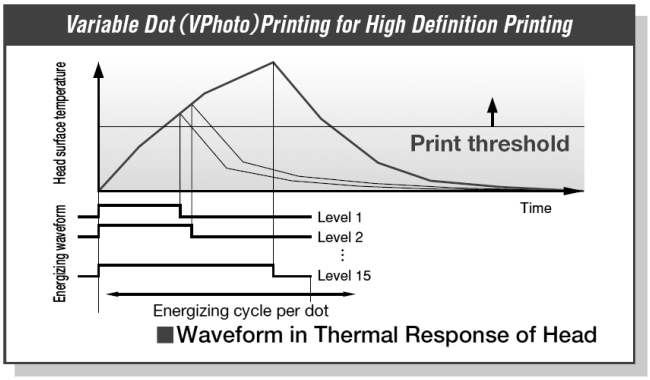
Thermal Head Technology

Variable Dot (VPhoto) Printing Technology Enabling High Definition Printing

"Variable Dot (VPhoto) printing" denotes the technology used to control dot diameter by changing energizing period required to print dot in different levels. This technology allows us to vary and attain ultra minute printing of 20 um/dot, the visual threshold by 600 dpi head, which is equivalent to 2400 dpi. We are determined to continue the research and development to materialize higher resolution of the head.

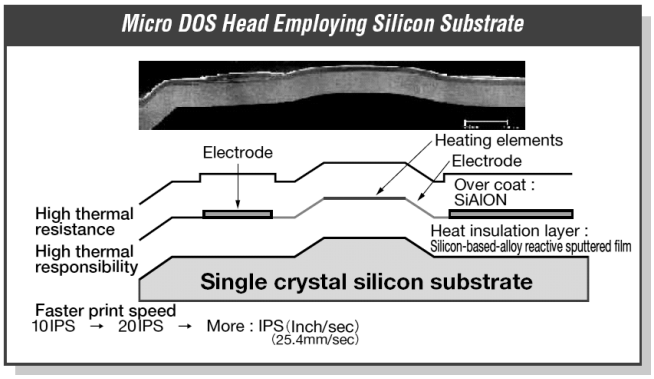


Technological development of making to a high resolution by the head further 1200dpi will be advanced in the future.



Head Materials and Head Structure Supporting High Speed Printing

In order to attain high speed printing, heating and cooling of the head must be done very rapidly. Thermal diffusivity on our micro DOS head is almost six times greater than that on the conventionally used aluminum substrates thanks to employment of single crystal silicon wafer for the base substrate. And, when combined with Silicon-based-alloy reactive sputtered film, our micro DOS head now prints at 10-inch/second at 6 KHz. 20-inch/second is our next developmental objective.

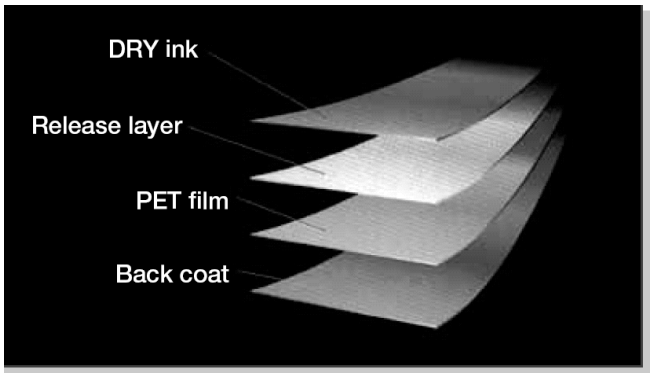


The size of the head is adopted and it is large for two inches and four inches from 0.4 inches, and adopts not a current serial method but the line method. Therefore, a steady high image quality without the banding and high speed can be printed. In addition, high production capacity of several thousand an hour which equals a rotary press can be obtained by arranging the line head in the tandem.

Ink Ribbon Technology

Ink Ribbon to Attain Offset Print Quality

Our ink ribbon is composed of multiply pigment ink being applied on approximately 3μPET thin film. Thanks to the water-free ink, printout is neither blurred by ink or any moisture nor affected by light, which contributes to fine print quality equivalent to offset printing.



High Scratch Resistant and High Heatproof Ink Ribbons

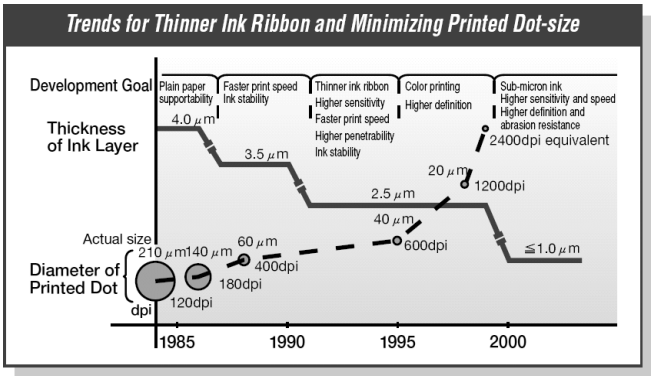
Furthermore as an application of our ink ribbon technology, such highly weather-resistant and heatproof ink ribbons as one would be applied to outdoor sign board can be obtained by choosing appropriate resin substance for ink layer.

Functionality Ink Ribbon of Foil Gold, Silver and Opaque White, etc

If a certain type of pigment is used in ink layer, special colors like white ink can be provided. In addition, other various print such as hologram or stealth print as well as gold and silver foil print is also available by the use of aluminum metallization process. These spot color inks are the features only of a difficult thermal transfer printer in the ink jet and the laser printer which uses a liquid or a powdery color material.

Thinner Ink Ribbon

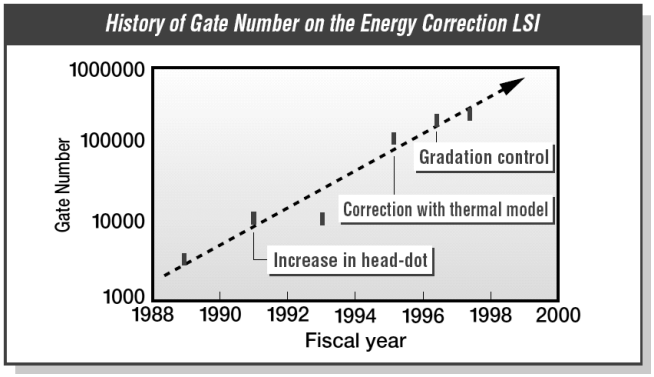
In order to ensure high definition dot printing, it is indispensable to realize thinner ink ribbons. The thinner ink ribbon is, the less heat generated from the head is transmitted to adjacent area. As a result difference in temperature between heated and not heated elements on the head is clear and this is why even smaller dot can be stably printed. Offset-like texture of the printout thus comes from our ink ribbon technology.



Heat Control Technology ETCC (Energizing Timing Correction Controller)

Energy Correction LSI Indispensable for High Image Quality and High Speed Printing

A thermal head has scores to several thousands of heating elements. In order to realize quality printing at high speed, we must control individual heating element while correcting both ambient temperature and heat reserved on the head (heating-up affected by print history), and ETCC is used for real-time arithmetic processing of the correction. Especially for the purpose of high print quality, precise estimation of complicated thermal characteristics of the head is essential, which requires certain gate numbers on LSI as shown in the figure. The more gate LSI has, the more sophisticated control and the higher print quality the head attains. The latest ETCC calculates appropriate head temperature by monitoring an area of 13 x 3 dots printed immediate before.



Color Match Technology

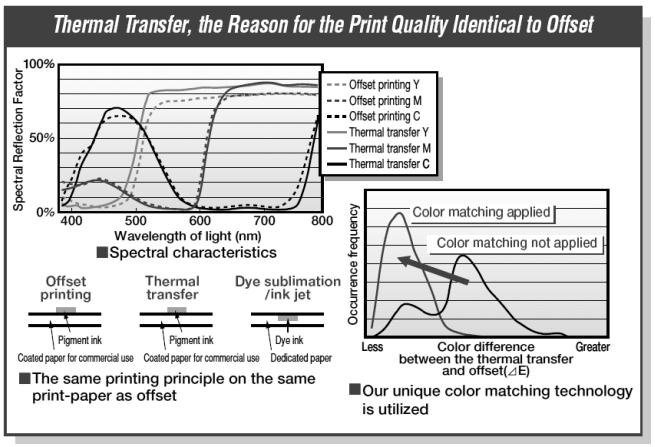
Reasons for Offset-like Finishing on the ALPS' Thermal Transfer Technology

Pigmented Ink

Color reproduction range is identical with that of offset printing and spectral characteristics are also similar.

Paper and Ink Stay on the Paper

Similarity in applicable print paper and ink transfer condition between thermal transfer printing and offset brings close finishing and similar reflection characteristics of printed image. Since color tone is one of the key factors, efforts are made through our unique color matching technique to minimize color difference.



Retransfer Technology

Print on Hard Media

One of the disadvantages of the thermal transfer printer was difficulty of printing on hard media, such as CD, thicker plastic card and so on. Since, the thermal head is flat surface, which cannot be adjusted with uneven surface on the hard media that will be shown missing dot printing.

In order to solve the missing dot issue and expanding the application, we established the retransfer technology on the ALPS Micro Dry™ Printing Technology. The Retransfer Technology is a printing technique to enable the print on any material by applying the retransfer sheet. Print the image on the retransfer sheet first, then transfers those images to the target media. The retransfer film is composed of the base film, the release layer, and the hard over courting layer. The hard over courting layers provide high-level durability for Abrasion, Fade and Chemical.

The image can be easily transferred to various media such as hard media, CD, CD-R, DVD, and Plastic CARD assumed to be difficult up to now by using this method. It is possible to print high quality color image with adding the gold metallic, silver metallic and white by the above-mentioned technology.

Security Print Technology

Security Print Function By Thermal Transfer Printer

We have achieved development of following security functions corresponding to the market trend.

- The micro character printing 0.8pt
  Cannot be recognized with the human eyes.
  Can be printed with ALPS 1200dpi Micro DOS Head.
- Foil Gold and foil silver print
- UV luminescence ink
- Hologram transcript

The security print function is a unique printing technique to the thermal transfer printer.

Application Progressing of Thermal Transfer Technology

The evolution of those thermal transfer printing has begun to expand the applications, which ware impossible with the ordinary thermal transfer technology.

Full-Color Label Print

There are wide variety of the material for the labels such as paper, synthesized paper, and the film. Also, there are wide range of adhesives are using for label.

Therefore, there is a limitation of printing on those label using existing ink jet and the laser printer .

It can be said that the thermal transfer printer is the most suitable technology that can be printed on those wide variety label materials. Also, offset like color quality and spot-color printing can be provided by ALPS Micro Dry™ Printing Technology.

Print on Plastic Card, CD, CD-R, and DVD

Make high quality printing on Plastic Card, ID card, CD, and hard media such as DVD by using the Retransfer Technology.

Application to Hot Stamp and Inn Molding

Hot stamping and Inn molding are using printed transfer film printed by flexo and the gravure printing sitting at other site.

In order to replace those hot stamping and Inn molding film from those by flexo and the gravure printing to thermal transfer printing, developing the ink ribbon capable of high temperature, and it's transfer technology.

Print on Flexible Packaging Film

Various functionality films such as film for packaging and shrink film are used in the packaging application.

These are printed with the flexo, the screen, and gravure. In this area, can be used ALPS thermal transfer printing with high quality printing, metallic/foil and opaque white printing capable printing on those films.

Conclusion

The life cycle of the commodity is getting shorter, and it tends to a smaller lot with many varieties. In addition, increasing a demand for personalization in the each application area.

In order to provide the solution for those, we have to have On-Demand Printing Technology capable to replace flexo, the screen, and gravure printing method. We are going to continue the technology development to meet the customer's "On-Demand Printing Needs".

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Biography

Yoshi Oyamada has worked at Alps Electric Co., Ltd. since 1982, working for the marketing of ALPS Thermal Transfer Technology. He has been worked for the marketing of the ALPS Micro Dry ™ Printer in both of Japan and US. He is printer' product manager at Alps Electric (USA) He is focusing on the business development for industrial-use application. Any question: yoshi. oyamada@alps.com