From Disposable to Reusable -New Plate Making System Lowers Printing Cost with Reduced Impact on Environment-

MITSURU TABUCHI*1
HIROAKI IKEDA*1
FUMINORI FURUYASHIKI*2

This paper introduces a new reusable plate system that can save material cost and reduce environmental impact by writing and erasing images repeatedly. This system comprises an anodized aluminum plate with high printability and a thermosensitive polymer, assuring the high quality and high durability required in commercial offset printing. In addition, by installing the reusable plate system close to the printing press, an integrated plate making and printing process is realized, and the work flow of the entire process is made more efficient.

1. Introduction

To meet market demands for lower cost and shorter delivery terms, the printing industry has recently been adopting new ideas such as a CTP (computer-to-plate) system capable of making plates directly by laser from image data, work flow for efficient management of production control, and a digital system.

Another new technology is Computer to Press capable of making plates and printing in one system by combining the hitherto different processes. However, in this Computer to Press for imaging directly on the printing plate and printing on the printing press, the press is small and low in speed, and thus differs from the large high-speed offset printing presses used in commercial printing.

Accordingly, Computer to Press has the following problems.

- Expensive laser imaging devices must be installed in each printing unit, making the initial investment cost very high.
- The printing machine must be stopped during plate making, lowering the operation factor of the printing machine.
- Existing plates on the market for Computer to Press are higher in cost than other plates for CTP or PS.
- The environments (vibration, dust, etc.) of the printing press give rise to various problems in plate making work, and the plate making quality is limited.

The reusable plate system introduced in this paper, which is intended to realize integration of plate making and printing process by overcoming the above problems, is a versatile printing system applicable to diversified printing processes.

Accordingly, by installing the reusable plate system near the printing press, integration of plate making and printing process is realized without lowering the productivity of the printing press, and the efficiency of work flow is improved.

Plate recycling effects are not limited to reduction of plate material cost. Since the aluminum material can be used repeatedly, supposing that 100 plates are made per day, the annual consumption of aluminum material is dramatically reduced to 50 kg from about 1 000 kg, which contributes greatly to reducing impact on the environment. This paper describes the basic performance of the new plate making system, together with the future output of this technology.

2. Principle of plate recycling process

The plate recycling process is as explained with reference to **Fig. 1**.

(1) Preparation of material

The material for the printing plate needs to have sufficient durability to withstand repeated making and high printing quality, and an anodized aluminum with excellent retention of water is used. For recycling, this aluminum plate 0.1 to 0.3 mm in thickness must be transported between the printing press and the plate making machine, but because of its thinness it is likely to be deformed or flawed during transportation. Accordingly, the aluminum plate is installed on a sleeve which can be mounted on the plate cylinder of the printing press, and the aluminum plate is conveyed together with the sleeve. This prevents deformation or creation of flaws in the plate material that could occur at the time of exchange of printing press and plate making machine, and satisfactory printability equivalent to that in the existing PS and CTP is realized.

*1 Hiroshima Research & Development Center, Technical Headquarters
*2 SOCIO DIAMOND SYSTEMS CO., LTD.

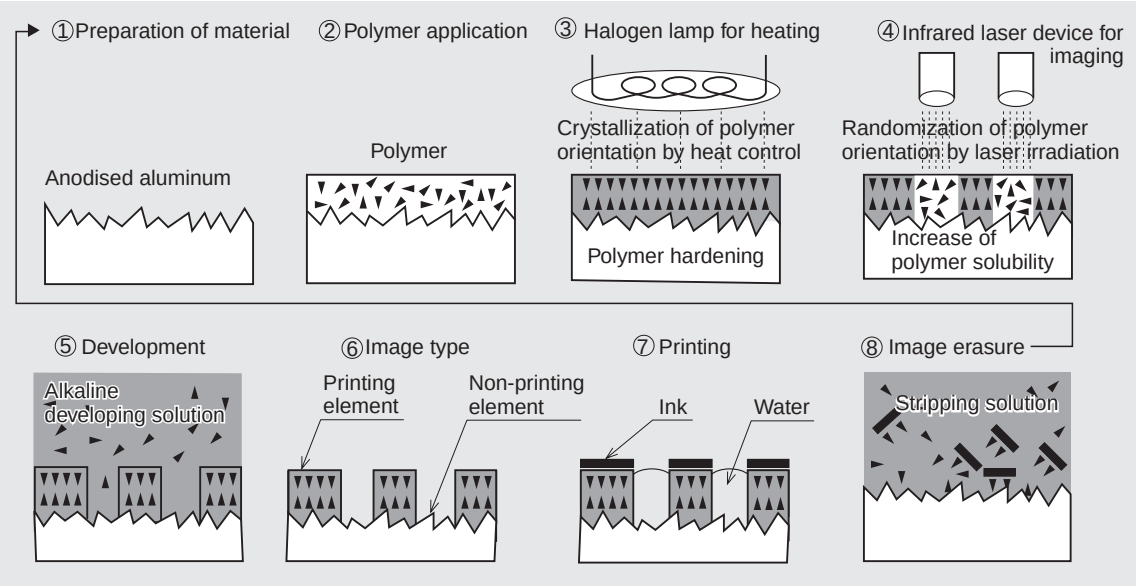

Fig. 1 Plate recycling process Through positive polymer using orientation control technology by heat, both high print durability and ease of erasure for recycling are achieved.

(2) Polymer application

As material for printing image, liquid polymer is applied on the aluminum plate which is integrated with the sleeve. Printing element material is required to have print durability for the printing plate and ease of erasing images for recycling, and a positive polymer is used because it facilitates control of the film strength of printing images and forming of images independently. The polymer can be handled in room light, and does not require any special storage facility.

(3) Heating

Polymer orientation is crystallized by temperature control of the plate through heating with a halogen lamp, and a printing area layer with excellent print durability of high hardness and very low solubility is formed.

(4) Imaging

By emitting infrared laser radiation to the portion corresponding to non-printing area, the polymer is instantly heated to a high temperature and its orientation is randomized, thereby increasing the solubility for developing solution of the polymer. By using a light absorbing dye for the polymer, the material is designed to obtain a high absorption characteristic of laser oscillation wavelength of 830 nm.

(5) Development

By alkaline developing solution, the polymer in the non-printing area is dissolved and removed, and the image in laser writing is developed, thus completing the plate making process as printing plate.

(6) Printing

As in conventional plate composition, the same print setting as in existing offset printing is possible, and commercial ink and dampening water can be used.

(7) Erasure of image

By using the alkaline aqueous solution as stripping solution, the polymer in the printing area can be dissolved, the ink on the polymer is simultaneously stripped from the plate surface, and the printing area can be removed efficiently. Further, by washing in water, the erasure waste liquid on the plate surface can be removed, and the same state as that of the grain plate in initial state can be obtained. After this process is finished, preparation of the next plate is completed.

3. Construction and specifications of reusable plate system

This section refers to the construction of the concept machine shown in **Fig. 2**, RPS-X1 (reusable plate system). The RPS-X1 consists of three stations for (1) image erasure, (2) polymer coating and drying, and (3) imaging and developing. The printing plate moves sequentially through these stations in its sleeve envelope, and undergoes plate making and recycling process.

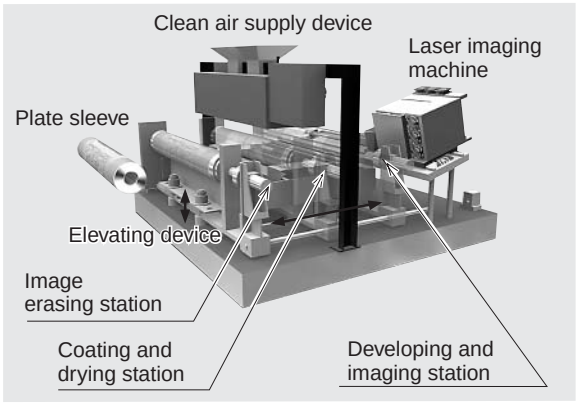

Fig. 2 Outline of concept machine RPS-X1
Consisting of three stations, the printing plate is sequentially processed, regenerated and completed in each process.

The processing devices of the system are installed on an elevating stage which moves up and down. The elevating stage moves in accordance with the diameter size of the printing plate, and each processing device is set in an appropriate position to the plate surface, so that it is applicable to a plate sleeve of a different diameter.

Conventionally, the plate making device is installed in a prepress room with a relatively favorable environment, but in this system it is installed in a printing shop. Accordingly, a clean air supply facility is required and installed to prevent dust deposits which are the main causes of plate making defects.

The printing plate is used when mounted on a plate sleeve. As shown in **Fig. 3**, the plate sleeve can be detached from the plate cylinder of the printing press in the axial direction. After being detached from the printing press, the plate sleeve is installed in the RPS-X1, and the plate is regenerated and mounted again on the printing press. Since the printing sleeve is made of lightweight resin, it can be easily handled and carried. Handling of the printing plate is thus very easy in the plate recycling process.

The main specifications are shown in **Table 1**. The printing plate can be used repeatedly in a cumulative total of 500 000 plates until the performance deteriorates due to abrasion of the grain plate of the material. By minimizing accumulation of erasure residue, it has been verified that the plate can be reused up to 20 times.

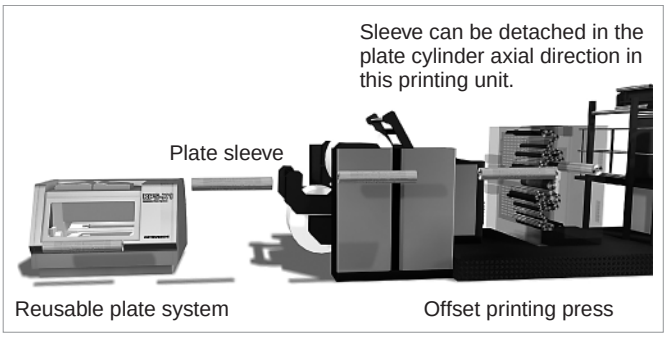

Fig. 3 Handling of printing plate by sleeve
By use of a lightweight sleeve, the plate sleeve can be easily handled and carried between the printing press and plate making machine.

Table 1 Basic specifications of RPS-X1

Main body size (mm)	H 1 600 x W 2 300 x D 2 200
Main body weight (kg)	1 500
System	One-cylinder system
Printing element material	Thermal polymer
Non-printing element material	Aluminum grain plate
Image resolution (dpi)	2 400
Print durability	More than 100 000 copies/image
Number of times of remaking	20 times (cumulative prints: within 500 000 copies)

As a result, while maintaining the productivity of the conventional offset printing press, a superior system is realized that is applicable to small lots of 25 000 copies on average. It can also reduce the printing material cost and improve the efficiency of work flow.

4. Performance verification result

(1) Number of times of regeneration

Fig. 4 shows print samples of first print and print after 20 times of plate making. The image is a standard offset print of 2400 dpi, 175 lpi, and after 20 times, the print quality is unchanged, and it has been confirmed that no image deterioration results from repeated making.

(2) Print durability

In the printing plate after 20 times of recycling, the durability was tested at a printing speed of 60 000 copies/hour. Taking a sample from each copy of printing, changes of dot percentage were measured, and no decline of dot percentage due to abrasion of image area was found in either highlight or shadow area.

In the halftone dot on paper of highlight area where the effects of abrasion are likely to appear, no dot loss or skip were observed as shown in **Fig. 5**, and the same print durability as in ordinary CTP material was confirmed.

Fig. 4 Print samples
After 20 times of repeated plate making, no deterioration was found in print quality (2 400 dpi, 175 lpi).

Fig. 5 Harftone dot on paper (5% area) in durability test
No dot loss or skip were observed in highlight area showing a first sign of deterioration of print durability.

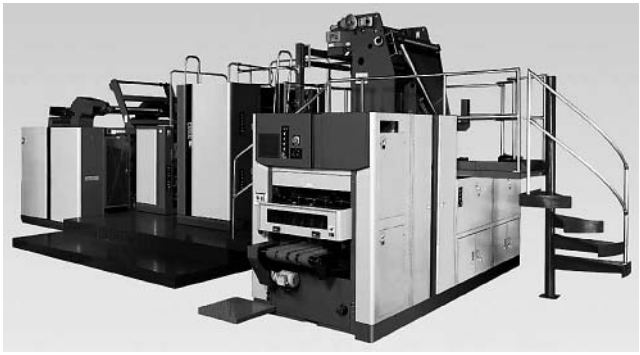

Fig. 6 Concept model of variable printing length offset printing press MAX-V
May 2004, appearance of MAX-V shown at business fair. Waste of paper is reduced by variable printing length.

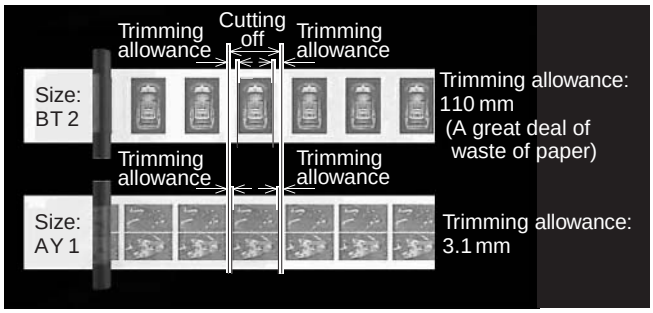

Fig. 7 Reduction of waste of paper by variable printing length
By cutting off according to image size, excessive trimming allowance is eliminated and waste of paper is reduced.

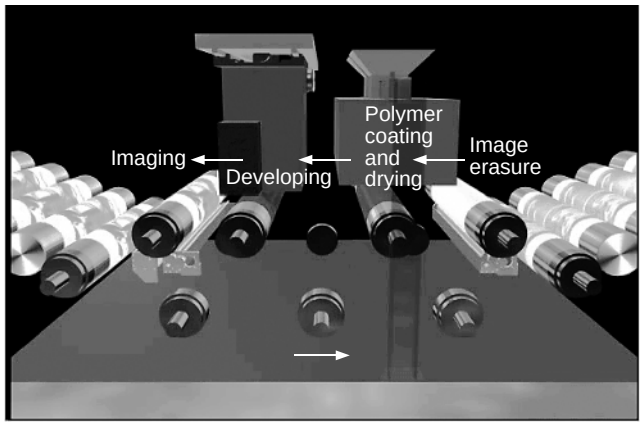

Fig. 8 Multicylinder system
By simultaneous and parallel processing of plate making steps, productivity of the plate making process is improved.

5. Concept and future outlook

Plate recycling technology has realized reduction of plate material cost and lowering of impact on the environment while maintaining the conventional level of printing productivity, and the new system is suited to printing needs of small lots in the present diversified applications.

From the viewpoint of realizing reduction of cost, lowering of environmental impact and shortening of process, the following specific future applications are being considered.

(1) Use in web offset printing press of variable printing length

The reusable plate making system, which is regarded as part of a system ranging from plate making to printing, is being developed at present to realize a combined system with commercial web offset printing press of variable printing length as shown in **Fig. 6** (MAX-V concept machine).

In web offset printing, the print size is limited and, depending on the pattern size, waste of paper may be increased, but by varying the diameter of the plate sleeve, flexibility is possible with changes in printing length. As a result, one printing press can handle printing jobs of multiple sizes, and waste of paper is reduced as shown in **Fig. 7**.

The reusable plate system is applicable to changes in plate sleeve diameter, and in a system combined with MAX-V, waste is eliminated and running costs are reduced substantially.

(2) Enhanced productivity with multicylinder system

The concept machine RPS-X1 is designed to make plates sequentially, but an effective method of improving the making speed is to make plates simultaneously in parallel processes. This is realized by the multicylinder system shown in **Fig. 8**.

(3) Future outlook

Conventional photography is being replaced by digital cameras, the printing process is being replaced by the digital system that is applicable to versatile printing needs. The object of this development, which is not limited to digital concept for printing data or printing process control, is to realize an integrated process of plate making and printing.

Accordingly, through technical development of reusable plate materials and development of a reusable plate system realizing the plate recycling process, the concept has been realized. Henceforth, continuous efforts will be concentrated on development of a total printing system that envisages efficiency and versatility of printing information including creation of printing information and after-treatment of printed materials.


Mitsuru Tabuchi


Hiroaki Ikeda


Fuminori Furuyashiki