week::one
Printing Techniques & Processes

Two Basic Printing Techniques

Printing Presses

- Use an *image carrier* to produce images.
  - These carriers often take the form of printing plates.
- Image is *static*—the last print is exactly the same as the first.
- Ideal for producing large quantities of a publication.
- Examples:
  - Offset printing, letterpress, screen printing, gravure & flexography.

Printers

- Do not use an image carrier.
- Image is *dynamic*—each impression can be different from the next.
- Allows for *variable data printing*—that is, the changing of content in a publication during printing.
  - Think mail merge on a large scale.
- The term *digital printing* generally uses the techniques found in printers, but does so at a cost and speed that comes close to printing press methods.
- Examples:
  - Laser printers (xerography), ink jet printers, and digital presses.

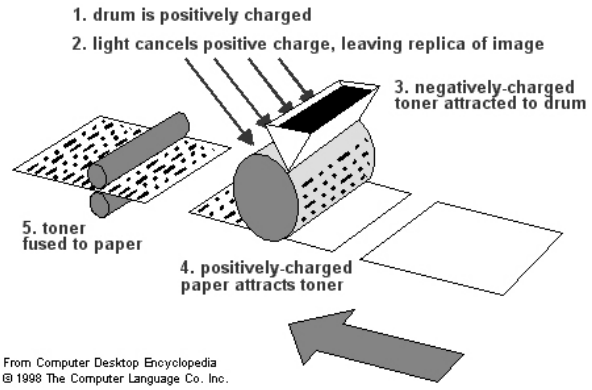
Xerography

Overview

- The electro-photographic process.
- Used in laser printers and copiers.
- Uses toner with an electrical charge to create the image.
- Does not use an image carrier.
- Unlike ink, toner sits on top of the paper.

Process

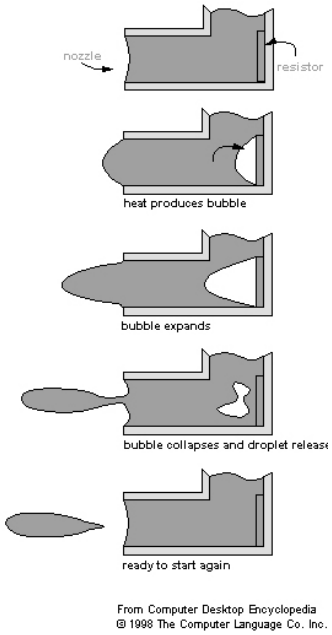
- An electrical charge is applied to a conductor drum.
- A laser removes the charge from the non-printing areas of the drum; Toner (charged in opposite of the drum) adheres to the charged areas.
- The toner is transferred to the paper, which also has the same (but more powerful) charge applied to it.
- Toner is bond to the paper using heat and pressure applied by rollers in the fuser.



Ink Jet

Overview

- Drop-on-demand process.
- Ink is absorbed into the paper.
- Requires special paper to achieve the best quality.
- Does not use an image carrier.
- Very expensive compared to other printing methods.
  - By some calculations, ink for the cheap home printers cost $3,000 a gallon.
- Sidenote: Many of the key discoveries and research into ink jet printing happened in Corvallis in the late ‘80s/early ‘90s. HP was a big client of the design firm I worked for back in those days.



Used In

- Home and office printers.
- Small-run jobs where quality is critical.
- Large format printing & digital proofs.
- Product labels where information changes from print-to-print (addresses, expiration dates, etc.).

Process

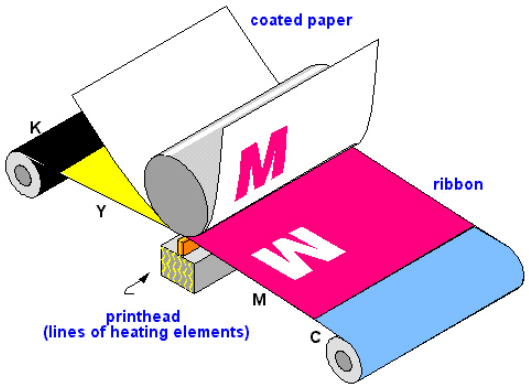
- In **piezoelectric** ink jet printers, the vibration of crystals causes ink to shoot onto the paper.
- In **thermal** ink jet printers, ink is heated very quickly, which causes a vapor bubble to form and shoot ink onto the paper.

Dye Sublimation

- AKA: Dye thermal transfer printer

Overview

- One of the few true continuous-tone printing technologies.
- Can produce true photographic-quality images.
- Is not as good at printing line art images and text.
- Is very expensive by any measure.
- Can print on many types of paper.
- Not used as much anymore—ink jet printers surpass it in quality in some categories—but some new photo printers do use the technology.



Process

- Uses a ribbon of color wax or paraffin that is heated in the areas that transfer to the paper.
- Dye Sublimation printers can vary the amount of color that can be placed at a specific area of the paper, creating true-color images.
- Unused parts of the ribbon are wasted.

Offset Printing

Overview

- Most common type of commercial printing.
- Is an *indirect* method of printing.
  - The image is transferred to a blanket before being transferred to the paper (hence, the name *offset*).
- Offset printing using an *image carrier*—one for each color ink.
- The most cost-effective way to print runs of 500 or more.
- Prints are generally made on one side at a time.
  - When an offset press can print on both sides at the same time, it is called **perfecting**.
  - Print shops can purchase a perfecting unit for their press, allowing for duplex printing with just one pass.

Sheet-fed Offset

- Individual sheets of paper are fed through the press.
- Offers the highest-quality printing of any printing method.
  - Line screens between 133–200lpi
  - Thicker paper stocks
  - High total ink limits, providing for high ink densities and rich-looking output.
  - Many off-press finishing options.
- Good for runs between 500 and 50,000 units.

Web-fed Offset

- Paper is fed to the printer on huge, continuous rolls of paper.
- Very fast printing.
- Offers OK-to-good quality printing.
  - Line screens between 60–150lpi
  - Paper must be thinner
  - Lower total ink limits, sometimes resulting in washed-out imagery
  - Lots of online (on-press) options, including folding, glue binding, and stapling.
  - Often the piece that comes off the press is the finished product, including binding, collating and stapling. One example is the newspaper.
- Good for runs between 15,000 and 1,000,000 units.
- Often a heater is used at the end of printing to reduce ink drying times.
  - When a heater is used on a Web press, it's called **heatset**.
  - On newsprint presses, no heater is used, which is called **coldset**.

Printing Plates

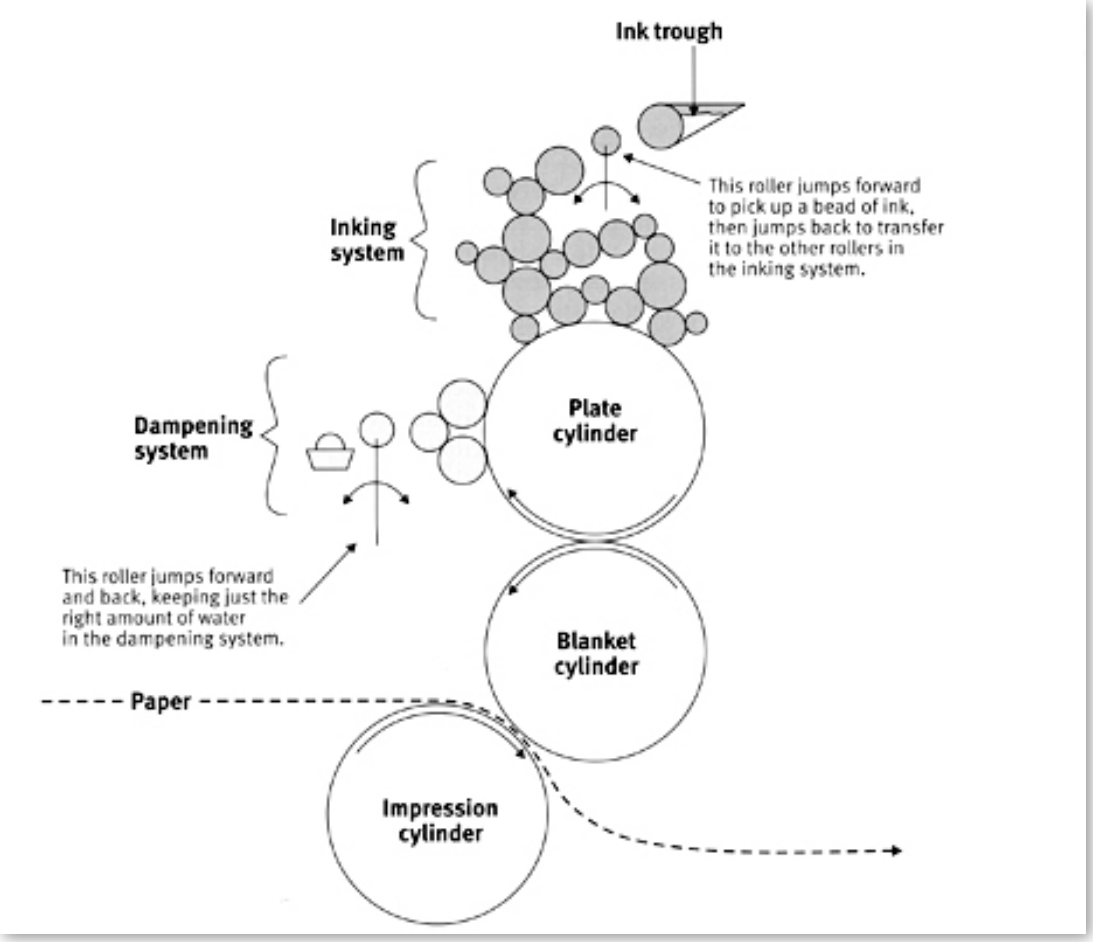
- Printing plates are placed directly on the press and are the sole source of artwork in the printing process.
- Printing plates can be generated using a number of methods:
  - **Film Imagesetter:** Film is produced, then exposed to a metal plate using a photographic process.
  - **Direct-to-Plate:** A platesetter creates plates directly from digital files. A laser is used to etch the plate directly from the PostScript information sent from the design application. No film is made.
  - **Direct-to-Press:** Printing plates are still made, but they are made directly on the printing press. There is no need for film processing or a separate platesetter. (This term also refers to a printer-type process of printing a digital file directly to a digital press).

The Printing Unit

- The part of the printing press that transfers the ink to the paper.
- Composed of three key cylinders: **Plate**, **Blanket**, and **Impression**.

Plate cylinder	Holds the printing plate. Ink is added to the plate, and ink only adheres to the printing surfaces.
Blanket cylinder	The ink is transferred from the plate to a blanket made of rubber. The blanket is necessary since it comes in direct contact with the paper. Pressure is applied to it by the impression cylinder.
Impression cylinder	Presses the paper against the rubber blanket, keeping the paper as close as possible to ensure a clean transfer of ink.

- Printing Unit Diagram:



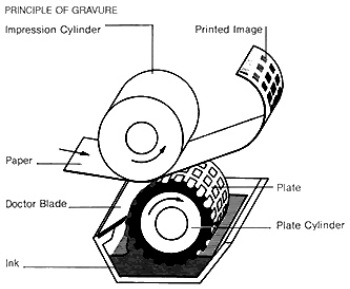
Digital Presses

Overview

- Uses modified inks and NO image carrier.
- Combines the best of on-demand printing from ink jet technology (no image carrier) and high-speed, almost-high-quality printing with ink from offset.
- Do not (yet) completely replace offset printers, but becoming more and more mainstream.

Gravure Printing

Overview



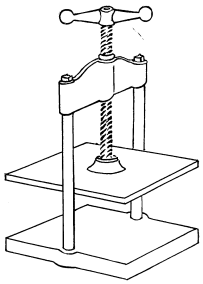
- An old but still used method of printing.
- Expensive, but can pay off with extremely-large press runs (100,000+).
- Often how currency is printed.
- Gravure is always web-fed and is very fast.

Process

- Similar to letterpress, but inverted.
- The ink fills the recessed areas of a **printing form**, and is transferred directly to the paper from the form.
  - This is different from the indirect method used in offset printing.

Letterpress

Overview



- The *original* method of printing.
- Uses differences in elevation of the printing source to produce an image.
- The source itself is inked between impressions.
- Can leave a physical impression on the paper.
- Is still used for specialty purposes (invitations, business cards, etc.).

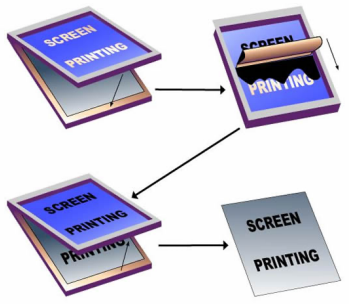
Flexographic

Overview

- Similar to letterpress, but more modern.
- Unlike Gravure, ink is placed on the raised surfaces of the printing plate.
- Can print on almost anything.
- Uses a rubber or plastic surface and a direct printing method.

Screen Printing

Overview



- Ink is pressed through cloth by a doctor blade as the blade is pulled across the fabric.
- Is very similar to printing with Spot colors—separations are key here.
- Used in clothing (logo t-shirts in particular), promotional items, and other specialty products.
- Chemeketa offers a number of excellent courses in screen printing.

Print Technique Comparison

- From *A Guide to Graphic Print Production* (page 329); Johansson, Lundberg, & Ryberg, Wiley & Sons.

	XERO-GRAPHIC	INKJET	DYE SUBLIMATION	FOTO-GRAPHIC	SHEET-FED OFFSET	WEB-FED OFFSET	LETTERPRESS PRINTING	GRAVURE PRINTING	SCREEN PRINTING	FLEXOGRAPHIC PRINTING
Image Carrier	None	None	None	None	Plate	Plate	Stamp-like form	Engraved cylinder	Screen cloth	Flexographic forms
Print runs	1–1000 copies	1–20 copies	1–5 copies	1–5 copies	500–50000 copies	15000–1000000 copies	50–500 copies	100 000→ copies	10–200 copies	50→ copies
Format	A4–A3	A4 →	A4–A2	A6–A1	A3–Eurosize		A3			
Resolution/ Screen Frequency	Up to 1200 dpi	Up to 9600 dpi	Up to 2400 dpi	300–600 dpi	Up to 200 lpi	Up to 150 lpi	No rasters	Up to 200 lpi	Up to 100 lpi	Up to 150 lpi
Print Carrier	Paper, Overhead-film	Paper, textile, plastic	Paper, plastic, shrink wrap	Photo-paper	Paper, cardboard	Paper	Paper	Special engraving paper	Cloth, paper, metal, plastic, glass	Plastic
Variable data	Parts of a page can vary	Prints out page by page	Prints out page by page							
Print Carrier Format	Sheet or roll	Sheet or roll	Sheet	Roll	Sheet	Roll	Sheet	Roll	Flat and cylindrical forms	Flat for uneven forms
Print characteristics	Limited quality	Large tonal range	Large tonal range	High quality	High quality	Risk of misregi-stration	Creates a relief	Rasterizes objects and text	Can't show light tones	Can't show light tones