The History of Printing

The history of printing is also a history of people, culture and trade. Technological changes come as they are needed and as people are ready for them. Cultures rise to their day in the sun and fall into decline, sometimes suffering a long darkness. Printing began as all things begin: a thousand efforts, with no goal in sight, no big picture, combined in a thousand ways to effect a thousand ends. The history of printing could as well be the history of civilization.

A good starting place for this brief history of the Black Art is in China, under Indian influence, where printing finds its first expression in improvements on writing.

The invention of the writing brush made from hair is attributed to General Meng Tien, in the third century BC. This allowed writing to be done on silk rather than with bamboo pens on strips of bamboo. Bamboo is heavy, bulky and awkward, but for all its virtues, silk is expensive. Paper, a cheaper writing material made from macerated mulberry bark, hemp, and old rags was invented by Ts"ai Lun, in 105 AD.

Seals originated in Babylonia, and their impressions were for millennia stamped into wax or clay as a sort of "lock and key" indication of authenticity. This in turn harks back to a simpler process of authentication: in China, a contract was written in duplicate on a piece of bamboo, which was then broken in half, and one end retained by each party. The fitting together of the broken ends provided authentication. There is some evidence that seal technology penetrated China via Alexander the Great"s (356-323 BC) extensive empire, and that Hellenistic influence created an increased demand for private and imperial seals. Seal impressions stamped in ink on paper arose in China around AD 500, and provided the transition that culminates in printing from carved wooden blocks.

Seal impressions were made using vermilion, much favored by Buddhist monks. A permanent black ink suitable for brush writing was invented by Wei Tan (d. 251 AD). The ink which we now know as Chinese or India ink was made by placing a number of wicks in a vessel full of oil, while over this was placed a funnel-like cover of iron. When this was well coated with soot, the lampblack was brushed off and collected on paper. It was then mixed with a solution of gum or gluten, and, when reduced to the consistency of paste, was put into small moulds. The ink was sold in sticks or elongated cubes. To prepare it for writing, it was rubbed in water on a smooth ink stone.

Rubbings of inscriptions carved in stone also originated in China, and provided the technological and philosophical transition necessary to the invention of printing. In 175 AD, a fear that inexact copying would lead to the loss of important cultural writings led Ts"ai Yung (133-192 AD) to write the scholarly revision and corrections leading to a text of the Six Classics. This authorized version was written in his own hand on stones outside the gates of the state academy. The stone was then carved, and exact copies were made in the tens of thousands by the process of placing paper over the inscription and rubbing it with ink. The printing of books by making rubbings from incised stone carvings continued, and parallels the printing of books from wooden blocks carved in relief.

The stencil and pounce, seemingly developed in or about the seventh century, were means of reproduction of which Buddhist monks were especially fond. For the pounce, a design was first drawn with a brush, and then outlined with needle pricks. The pattern was then laid on a new surface, and a small bag filled with colored chalk tapped lightly against the holes, thus transferring the design, which could then be traced and painted accurately. Stencils were used to color blockprinted images.

Relief printing originated during the reign of Ming Huang (712-756 AD). Small stamped figures of Buddha mark the transition from the seal impression to the woodcut. The only difference between these Buddha figures and true woodcuts, other than the primitive workmanship, is that the figures are quite small, and hence were evidently made by hand pressure like the impressions from seals. Surviving stamps have handles for this purpose. When the idea occurred to some inventive genius to turn his stamp upside down, rub it with an inked brush, lay the paper over it and rub the back, the way was open for making impressions of any size desired, and for such improvement of technique has made the new invention a force in the advancement of civilization.

Found among the hidden manuscripts of the Caves of the Thousand Buddhas, near Tun-huang, was The Diamond Sutra, printed from blocks in 868 by Wang Chieh on behalf of his parents. This, the oldest extant printed book, shows an advanced technique behind which there must have been a long evolution.

The time was right, travellers and traders in plenty went back and forth, but there is no evidence that moveable type or type-casting technology spread from the Orient to the Occident. Movable type did not catch on in the East for the simple reason that as many as 30,000 Chinese ideograms are needed--some much more than others--so that a complete font might run to the hundreds of thousands of discrete elements. It is simpler just to cut a block with all the characters on it for each separate page. Movable type made from clay and later from tin was invented by Pi Sheng (1041-1048), but does not seem to have survived his demise. Movable type made from wood appeared in China, c. 1313, but again left no lasting impression. The type mold--and with it the use of cast metal type--was invented in Korea in 1392 and used extensively, but there is no evidence of technological transfer.

The Hand-Press Era (ca. 1440-1800)

While printing using wood blocks had been around some time in China and the Islamic world, and was introduced into Europe in the late middle ages, the invention of the printing press with moveable type seems to have been a Western invention. Producing block prints, one for each page, was a laborious process, and the resulting block was, of course, only capable of printing the page for which it had been designed.

It was the innovation of Johannes Gutenberg, a 15th-century German goldsmith, to combine the principle of the letter press - raised letters that would take ink for impression onto a sheet - and combine it with a screw-driven press and re-usable and interchangeable pieces of metal type. A press was required because significant pressure had to be exerted upon the paper to impress the ink strongly and cleanly onto it. Gutenberg adapted existing presses for oil, wine, or linen which exerted pressure slowly; he provided his printing press with a more rapid mechanism, so that sheets might be printed quickly and in bulk.

Metallic moveable type was durable, flexible, and relatively easy to produce; its introduction vastly reduced the time and expense required to set a page for printing. Gutenberg's invention was only possible because he also developed a means of producing molds and matrices that could produce large quantities of metallic type; he also developed both an alloy suitable for type and a high-quality ink.

Gutenberg seems to have begun to experiment with the hand-press in the late 1430s and 1440s; by the mid-1450s, he was demonstrating the capabilities of his invention through the production of his famous and beautiful "42-line Bible."

Printing spread rapidly throughout Europe following the success of Gutenberg: the first press appeared in 1464 in Italy, and presses in Switzerland, France, the Netherlands, Spain, and Hungary followed within little more than a decade. William Caxton, the first English printer, brought a press that he had established at Bruges to England in 1476.

Germany dominated European printing through most of the last quarter of the 15th century, but Venetian presses began to establish their excellence from about 1470, introducing an elegant form of Roman or "Humanist" type that soon challenged the "gothic" or black letter type used in Germany. Meanwhile, printers began to experiment with the inclusion of illustrations in printed books, beginning with the use of woodcuts from the 1460s. Over the course of the next century, intaglio illustrations - etchings and engravings - were added as "plates," printed separately from the book and then added during the process of binding.

By the end of the 15th century, there were an estimated 1700 presses in 300 towns throughout Europe, and up to 15 million "incunabula" - the earliest printed books - had been produced and distributed. Printing most truly came of age, however, from 1517 with the advent of the Reformation. A precondition of Protestantism was access by a broad audience to relatively cheap Bibles translated into the vernacular: it was printing that made this possible.

At the same time, the utility of print for the broad distribution of polemical pamphlets and controversial literature became apparent to both sides of the great religious debates that now raged across Europe: print provided a cheap and effective medium for popular propaganda. By the mid-1520s, the writings of Martin Luther were available in hundreds of inexpensive editions throughout Europe.


ANORE ET STVDIO ELVCIDANDAE

DISPVTATIO DE VIRTVTE INDVLGEN.

By the mid-16th century, the pattern for the continued development of the printing trade had been set. Printed books reinforced trends towards the expansion of literacy by providing inexpensive reading materials, while this expanding market for books, pamphlets, and broadsides fed the slow but steady growth of the printing trade. Governments and churches, recognizing the power of the printed word, sought to control it with limited success through censorship and regulation; unsurprisingly, during times of social and political turmoil which tended to be accompanied by a relaxation of such efforts the production of printed works really exploded; the sudden outburst of popular and often highly subversive print publications during the English Civil Wars of the 1640s is a salient example.

Gutenberg's wooden hand-press was a remarkably resilient and enduring invention. It remained in use throughout the West virtually unchanged in its essentials for over 350 years, the centerpiece and mainspring of a steadily growing culture of literacy and information. Its social impact was incalculable: it connected disparate cultures and populations, educated, informed, entertained, and even liberated an ever-growing reading public. In a sense, the hand-press was finally rendered obsolete by its own success, for by the end of the 18th century, the demand for print materials had exceeded the capacity of the old technology to produce them cheaply and efficiently.

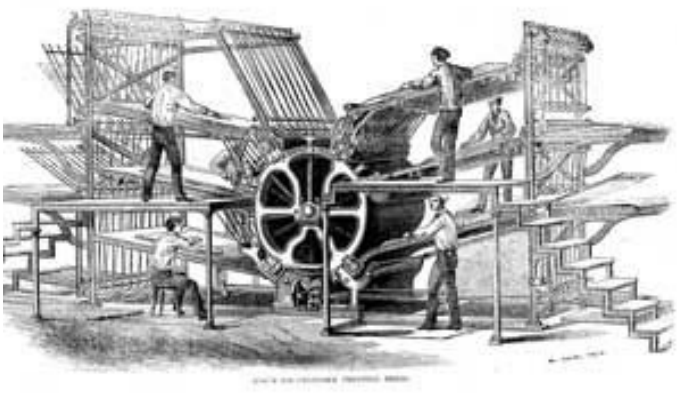
In response to this demand, printers looked to harness the methods of the Industrial Revolution. The new technologies required outlays of capital and organizational methods that increased the size and complexity of printing houses: the old printing house, which might feature no more than two presses, was displaced by larger, more streamlined and efficiently organized workshops. Printing, from being a "trade," was to become an "industry."

The Machine-Press Era (ca. 1800-1950)

As dramatic as the technological changes introduced into printing in the last two centuries seem, the fundamentals of printing changed only slowly. For most of the 19th century, type was still cast and set by hand, and it was not until the mid-20th century that printing began to shift from letterpress - the impressing of inked type upon paper - to the large scale implementation of other methods of setting type or illustration onto paper surfaces.

The earliest practical developments improved existing technology. The introduction of the iron press in 1798 responded to the need for sharper impressions that would do justice to newer and finer type fonts now available. Lord Stanhope's iron press added the power of the lever to the conventional screw mechanisms, producing a much sharper impression. It, along with other new iron presses such as the Columbian (1817) and Albion (1822), had largely displaced wooden presses by the 1820s. These significantly improved the quality of printing; they did not, however, address the need for a higher or speedier output.

The basic problem was that the new iron presses still involved using both horizontal motion (as the letterpress moves beneath the platen) and vertical motion (as the platen exerts pressure down). It was more efficient to combine these through the use of cylinder presses that rolled over a flatbed holding the paper. Friederich Koenig produced a steam-driven press in 1811 that combined a flatbed with letterpress plates loaded onto a cylinder. In 1814, a Koenig press was printing The Timesof London at a rate of about 1,100 one-sided sheets per hour. By 1827, improvements to the flat-bed cylinder press had raised the rate of printing to 5,000 impressions per hour.



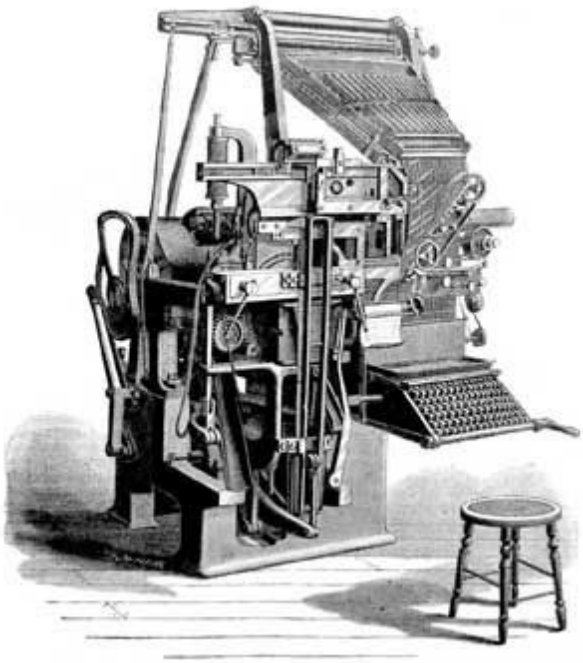
The next logical improvement was to replace the flatbed with an additional cylinder so that paper could be continuously fed to the cylindrical plate. This was accomplished by Richard Hoe in 1845. Even more efficiency was introduced in 1865 by William Bullock, who replaced individual sheets with rolls of paper, so that there was a continual feed of paper into the press. Using this principle, the Walter press employed by The Times in 1866 could produce 25,000 sheets, printed on both sides, every hour, a one hundred-fold increase over the rate of production of a typical wooden handpress.

Another innovation that introduced efficiency into the printing process was the shift towards printing from plates rather than directly from set type. Pages were still set in the old manner, with individual pieces of type chosen and arranged by a compositor, but a mold was then made of the resulting letterpress, which in turn was used to create a plate that would perform the actual work of printing. This saved wear and tear on the expensive type, which could be broken up and immediately reused, while the plates (or the molds) could be stored cheaply and easily for future printing. The process of producing plates in this way was called "stereotyping."

Experiments in stereotyping date from the early 18th century, but it was the enlarged print runs of the 19th century that made the process financially worthwhile. Stereotyping from plaster moulds became common in the 1820s, but within two decades, these were being replaced by flexible moulds made from compressed laminated paper called "flong." Because the mold or "matrix" could be used to cast curved plates, this system could be combined with a printing cylinder; by 1886, The Times of London was doing just this.

It is no coincidence that so many of the new innovations in printing technology were pioneered by the newspaper industry, and by the premier newspaper in the world, the London Times in particular: the nineteenth century saw a massive increase in the readership of newspapers, magazines, and serials. Newspapers and periodicals, of course, particularly required methods of printing that were fast, cheap, and efficient, and so it was these, particularly in Britain and America, that tended to drive technological change.

One bottleneck that continued to slow the process was composition, the process of actually setting a text into type. For much of the 19th century, this continued to be done slowly and laboriously by hand, letter by letter. Type itself remained expensive until the production of an effective type-casting machine in 1883. This was quickly followed by the invention of the Linotype machine in 1886, which combined composing, justifying, and casting of type into a single operation, producing a complete line of type in one piece cast in lead. Composing was also facilitated by the development of Monotype, which cast individual pieces of type as needed using a keyboard that recorded the specifications for justification and type on a perforated roll of paper.



THE LINOTYPE MACHINE, TO SUPERSEDE TYPESETTING.

New methods of producing high-quality paper by machine began to supersede hand-made paper by the 1820s. This, with the introduction of wood pulp paper in 1844, had an enormous impact upon availability and price: by the end of 19th century, the

price of paper (previously the main expense of any book) had dropped about 10 fold. Book binding also became mechanized, and publishers began to produce trade editions for a mass market. The introduction of the paperback in 1935 by Penguin made books more affordable than ever before.

In the late 20th century, the advent of "desktop publishing" made print cheaper and more accessible than at any previous time in history. Yet it has been paralleled by a slow but steady erosion of the place of the printed book by the "e-book." Rumours of the death of print are, however, greatly exaggerated: a well-known joke is that the second book printed by Gutenberg predicted the death of the publishing industry. Print will survive, not just in the great publishing houses, but also in the innumerable small presses the world over, where printers continue to use traditional methods and take pride in the Art of Printing.

Printing Process

Each printing process can be divided into three major steps: prepress, press, and postpress.

Prepress operations encompass that series of steps during which the idea for a printed image is converted into an image carrier such as a plate, cylinder, or screen. Prepress operations include composition and typesetting, graphic arts photography, image assembly, and image carrier preparation. Press refers to actual printing operations. Postpress primarily involves the assembly of printed materials and consists of binding and finishing operations.

Within each process, a variety of chemicals are used, depending on the types of operation involved. Prepress operations typically involve photoprocessing chemicals and solutions. Inks and cleaning solvents are the major types of chemicals used during press operations. Depending on the finishing work required, postpress operations can use large amounts of adhesives. This is especially true where the production of books and directories is involved. Of all the chemicals used in a typical printing plant, inks and organic cleaning solvents are the categories used in the largest quantities. Many of the chemicals used in the printing industry are potential hazards to human health and the environment.

Prepress Operations

Introduction

Prepress consists of those operations required to convert the original idea, such as a photo or sketch, for a printed image into a printing plate or other image carrier. Prepress steps include composition and typesetting, graphic arts photography, image assembly, color separation, and image carrier preparation. With the exception of image carrier preparation, the prepress process is similar for the five major printing processes. Plateless process do most of the prepress steps using a computer.

Typesetting and Composition

During composition, text, photographs and artwork are assembled to produce a "rough layout" of the desired printed image. The rough layout is a detailed guide used in the preparation of the paste-up or camera ready copy from which an image carrier can be produced.

Traditionally, rough layouts and pasteups were composed by hand using: drafting boards; light tables; various paste-up tools such as technical pens, rulers, and cutting tools; and adhesives. The text used in the paste-up was typeset and printed mechanically. However, composition has changed dramatically with the advent of computers. Both type and artwork can be generated and edited using computers. Computer systems can be equipped with both optical character recognition and photographic image scanners and digitizers so that pretyped material and photographic images can easily be incorporated into the document being composed. With the systems now available, the computer can directly drive the typesetting and image carrier preparation processes once the page or entire document is laid out and ready for printing.

Typesetting operations assemble the type characters into pages. There are a number of methods of typesetting including manual assembly of pieces of metal type (letterpress), mechanical assembly of lines of type, and phototypesetting. Until the 1950s, the majority of typesetting was performed using the Linotype machine which produces a "slug" or line of type from molten metal. Similar machines produced single characters of type. Today phototypesetting devices have almost completely replaced manual and mechanical methods of typesetting.

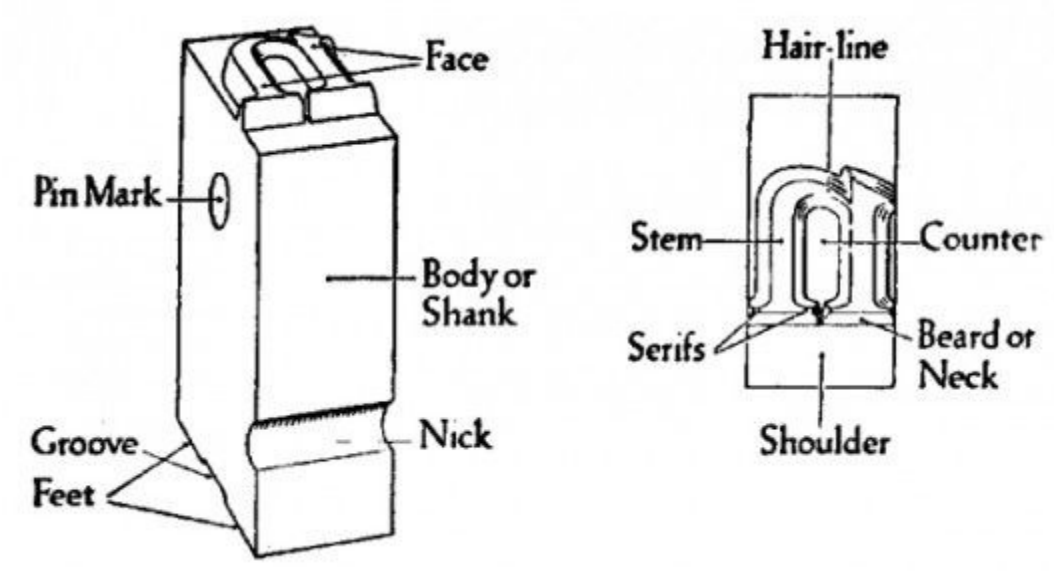
Phototypesetting devices, first demonstrated in the late nineteenth century, were introduced commercially in the early 1950s. They rapidly overtook the Linotype and similar machines in importance. In phototypesetting, individual type characters or symbols are exposed onto photographic film or paper. In early mechanical phototypesetting units, entire fonts of characters were stored as negatives on film. In the later generations of computer-driven phototypesetters, the image is generated electronically, and, in the latest generation of units, a laser is used to project the image onto the photographic film or paper. Phototypesetting produces high contrast, high resolution images ideal for printing purposes. Other computer driven output devices, which include strike-on, line, ink-jet, and laser printers are used extensively in-plant printing applications.

Hand Composing

In traditional typography, a font is a particular size, weight and style of a typeface. Each font was a matched set of metal type, one piece (called a "sort") for each glyph, and a typeface comprised a range of fonts that shared an overall design.

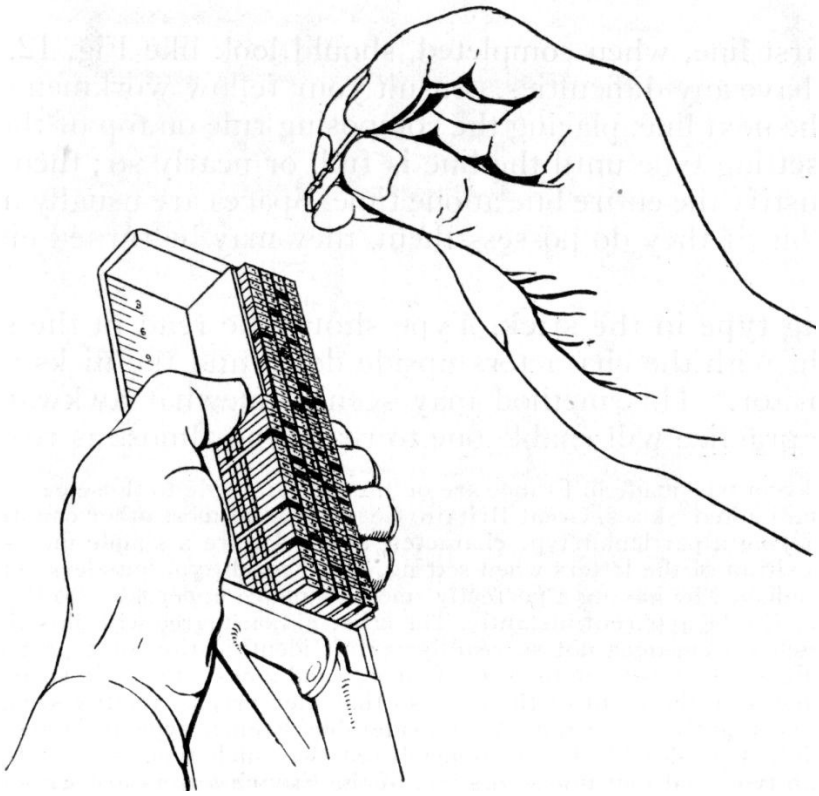
In modern usage, with the advent of digital typography, "font" is frequently synonymous with "typeface". In particular, the use of "vector" or "outline" fonts means that different sizes of a typeface can be dynamically generated from one design. Each style may still be in a separate "font file"

The word font is deriveed from Middle French fonte "[something that has been] melted; a casting". The term refers to the process of casting metal type at a type foundry.



In a manual printing house the word "font" would refer to a complete set of metal type that would be used to typeset an entire page. Unlike a digital typeface it would not include a single definition of each character, but commonly used characters (such as vowels and periods) would have more physical type-pieces included. A font when bought new would often be sold as (for example in a Roman alphabet) 12pt 14A 34a, meaning that it would be a size 12-point font containing 14 uppercase 'A's, and 34 lowercase 'A's.

The rest of the characters would be provided in quantities appropriate for the distribution of letters in that language. Some metal type characters required in typesetting, such as dashes, spaces and line-height spacers, were not part of a specific font, but were generic pieces which could be used with any font. Line spacing is still often called "leading", because the strips used for line spacing were made of lead. The reason for this spacing strip being made from "lead" was because lead was a softer metal than the traditional forged metal type pieces and would compress more easily when "locked-up" in the printing "chase"



10 Steps to Perfect Typesetting

1. Count your sorts! Make sure you have enough type in the case before you start.
2. Hold the composing stick properly. Set type by holding the composing stick in your left hand and nestling it in your curled fingers with your thumb over the last piece of type set. Let gravity help keep the type from spilling out.
3. Slugs should rattle. Start your composing stick with a lead or a slug just slightly shorter than the length of the line. Make sure it rattles back and forth in the stick. If it doesn't rattle, then trim it with the slug cutter. Put leading between each line of type. If you're setting lines that will be separated once they are taken out of the stick, be sure to put at least two leads between each line, that way your type will be contained when you move it.
4. Use em quads. Start and end each line with an em quad. This is so your form doesn't fall apart as easily. It will take some planning, as you'll have to determine your longest line, and then add 2 ems to it.
5. Nicks up. Lay the type into the stick with the nick facing up, in the same order as it's normally read. By doing the above, it will be set properly: upside down but still left-to-right.
6. Spacing material. Use spacing material the same size as the type. If none can be found, it is possible, but not ideal, to use material from the next point size down. If you're using monotype, there may be special word spacing material provided. Use generic spacing material to fill out the line. Be extremely careful not to mix up the two.
7. Snug lines. It is essential that every line is snug and has an equal amount of tension. Use coppers and brasses when thicker spacing material isn't quite enough. Don't put several coppers or brasses right next to one another; they make the line too springy. Also, when centering or filling out a line of type, put

the smaller spacing material on the inside. When fine tuning the line tension, do not force brasses or coppers in, but instead remove your final quad, add these smaller pieces and replace the quad. This will keep the thin spaces from getting bent.

8. Use the same composing stick for the duration of the project. Each one varies slightly. It's very important that all your lines are exactly the same length! If you are using a stick with a continuous slide setting, set your stick using a piece of furniture the length of your line plus one brass space.
9. Make a note of which type case you're setting from!
10. Be very patient.

Spacing Material

Spacing material is lower than type high. It includes the space between lines (leads and slugs), between words (word spacing), and the space that allows the lines to fit their line length in the composing stick (quads, coppers & brasses).

Leads are usually two points thick, but often can be found in one- and three- point thicknesses. Slugs are either six or twelve points thick. Leads and slugs are usually found pre-cut to pica and half-pica lengths.

Other spacing material is used to provide the blank space at the ends of paragraphs, between words, and for indentations. They are based in the em, which is the square of the type body of any size of type.

Coppers and brasses are used to fill in the line to adequate tightness when larger spacing material is too big. Coppers are 1/2 point thick, and brasses are 1 point thick.

Storing a Form

Once you have 3-4 lines of set type in your composing stick, you need to move it to a galley before continuing with your next line. You might have room for another line or two, but the composing sticks have acquired with age a tendency to slightly bow out towards the top, making your lines slightly longer. Even a difference as small as 1 point in size can cause problems when it comes time to lock up your form on press. For this reason it is important that all your lines are of the same pica length and snugness.

Removing Type from the Composing Stick

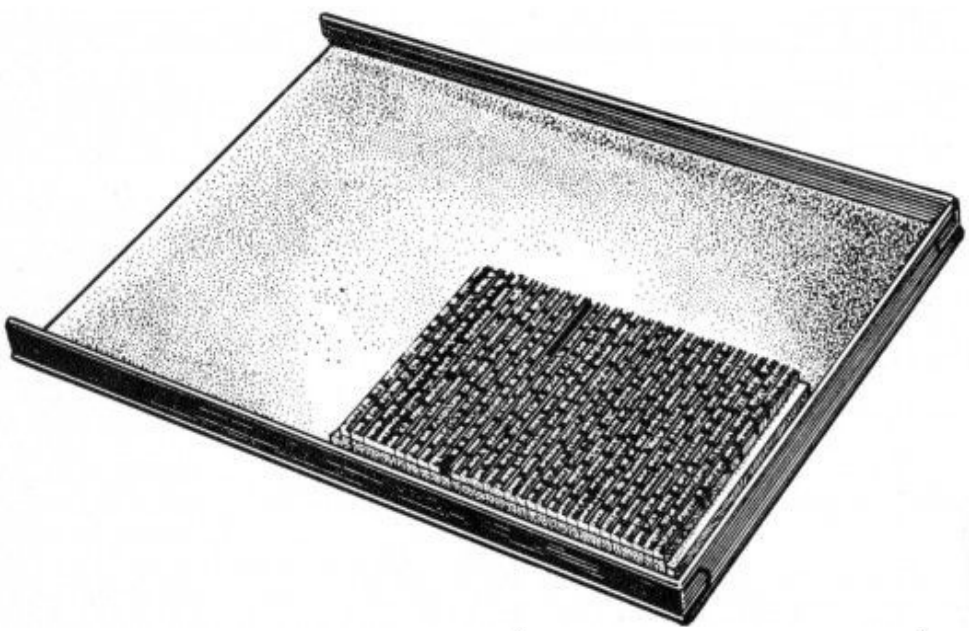
It is best to do this at a slant top surface, as gravity is in your favor, but you can also do it on a flat surface. Both get easier with practice. Set the galley down and set the composing stick on top of it. Remember to place leading after your last line.

Unlock the knee of the composing stick. Be careful not to mix the knee of your stick up with that of another stick. Gripping and squeezing the lines of type with your fingers (thumb and index pinch the top and bottom of the form, middle fingers press

on sides), gently slide the type out of the composing stick and onto the galley, down to an end corner so that it is supported by the galley on 2 sides. You are now ready to tie up your type.

Tying Up a Type Form

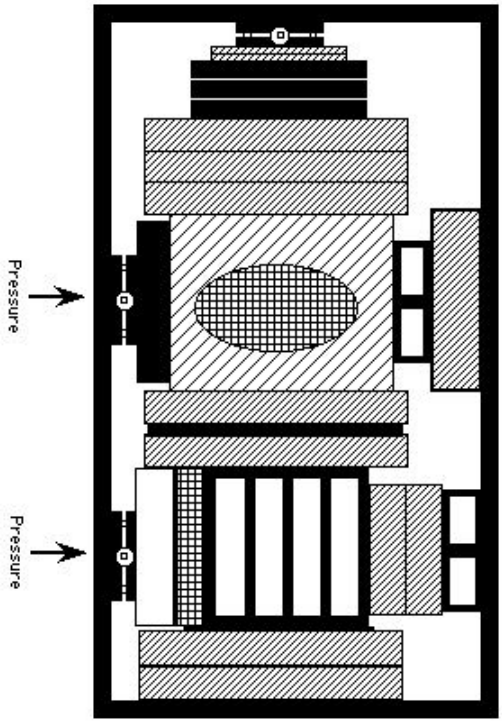
When lines of type are moved from the composing stick to the galley, precautions must be taken to prevent the type from falling over. String or page cord is wrapped around the type form 3 or 4 times and then the loose end is tucked into the other string, both to keep the binding tight and to ensure easy release when untying the form. The string is left around the form and kept on a galley until it is ready to be locked up for printing. At this point, you are ready to pull a proof of a galley of type using a galley proofing press.



IMPOSING

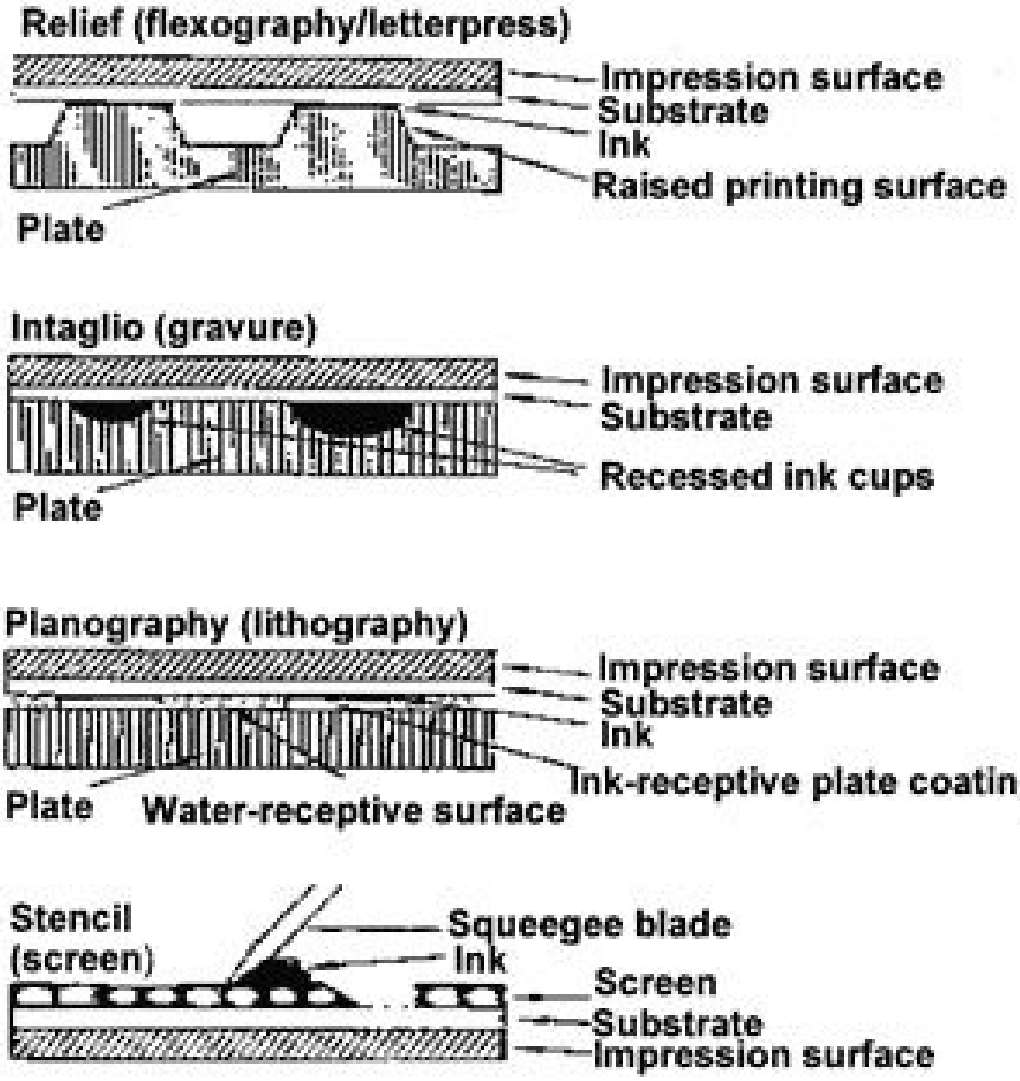
As the type comes out of the stick, it should be put on the ir you want it to print, with all of the different parts in thi appear on the card. Once this has been arranged, the type i so that it's held in place. The pressure on each side of the type must be equal, and you must be sure that none of the furniture binds against any other so that pressure is inadvertently lessened. It helps to think in rectangles.

When the furniture and type form one coherent rectangle, put in the quoins and tighten them a little. then plane the type, using the mallet and planer gently! Then screw up the quoins, firmly, but not so hard that it strains your hands. This done, the forme is ready for proofing; but for this we need some ink.



Press Operations

Types of Printing



The main methods of printing are

- Letterpress or Relief
- Flexography
- Gravure
- Lithography
- Screen Printing
- Digital Printing

Letterpress is the oldest and fastest diminishing method used today. Developed centuries ago by the Chinese it is still used to print newspapers, labels, etc. Its

quality, however, is not that of the other main processes and tends to print mid to low quality.

Flexography is a newer printing process developed during the mid 1900's. Flexography has found wide application in printing for food packaging with plastics and non-absorbent stock. It is also used to print envelopes, newspapers, pressure sensitive labels, etc.

Gravure is another old printing process used to print packaging, magazines, wallpaper, gift wrap, etc. The major advantage of Gravure is that it can print very long runs due to its configuration. Sear advertising, for example, can count into the millions of printed pieces. Unlike offset, Gravure uses a metal printing cylinder can handle these types of long jobs without wearing out the printing cylinder. Money and postage stamps are also printed using a form of Gravure (Intaglio).

Offset Lithography was developed during the late 1800's in Germany and has become a very popular printing process. Offset Lithography is used to print newspapers, magazines, advertising, business forms, direct mail, etc. Offset is the most widely used printing process used today.

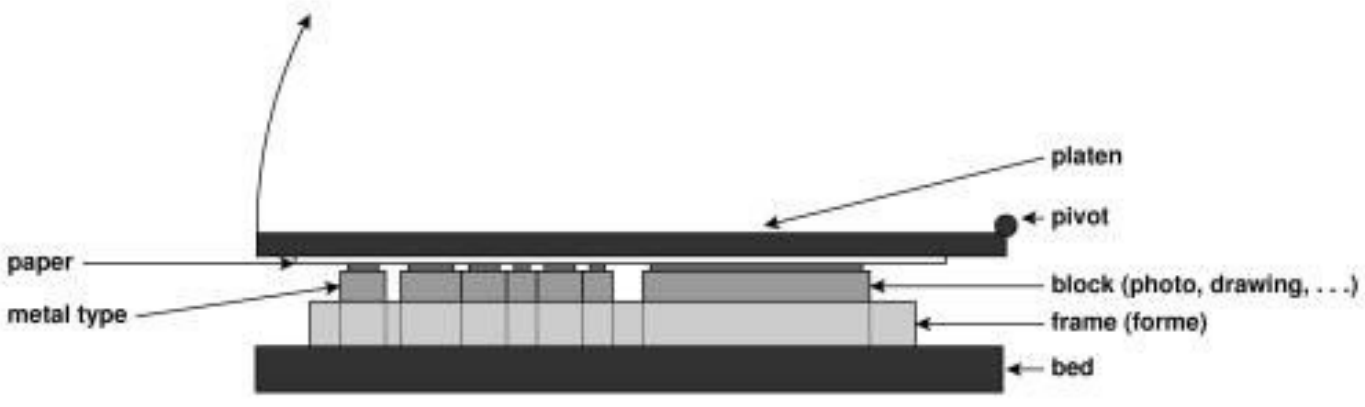
Letterpress or Relief printing

Letterpress printing is a technique of relief printing using a printing press. A worker composes and locks movable type into the bed of a press, inks it, and presses paper against it to transfer the ink from the type.

In practice, letterpress also includes other forms of relief printing with printing presses, such as wood engravings, photo-etched zinc "cuts" (plates), and linoleum blocks, which can be used alongside metal type in a single operation, as well as stereotypes and electrotypes of type and blocks. With certain letterpress units it is also possible to join movable type with slugs cast using hot metal typesetting.

Letterpress printing was the normal form of printing text from its invention by Johannes Gutenberg in the mid-15th century until the 19th century and remained in wide use for books and other uses until the second half of the 20th century.

Letterpress printing remained the primary way to print and distribute information until the twentieth century, when offset printing was developed, which largely supplanted its role in printing books and newspapers. More recently, letterpress printing has seen a revival in an artisanal form.



In about 1440, Johannes Gutenberg is credited with the invention of modern movable type printing from individually cast, reusable letters set together in a form (frame or chase). He also invented a wooden printing press, based on the extant wine press, where the type surface was inked with leather covered ink balls and paper laid carefully on top by hand, then slid under a padded surface and pressure applied from above by a large threaded screw.

Letterpress Equipment Design

There are three different types of letterpress printing devices in use today: platen, flat-bed, and rotary presses. The two most common types of letterpress presses, the unit-design perfecting rotary press and the rotary letterpress typically used for magazine printing.

1. Rotary Letterpress Printing

There are two types of rotary letterpresses, sheet-fed and web-fed. Web-fed rotary presses are the most popular type of letter press printing. Sheetfed rotary presses are also declining in use; in fact these sheetfed rotary presses are no longer manufactured in the U.S. Like all rotary presses, rotary letterpress requires curved image carrying plates. The most popular types of plates used are stereotype, electrotype, and molded plastic or rubber. When printing on coated papers, rotary presses use heat-set inks and are equipped with dryers, usually the high-velocity hot air type.

Web-fed rotary letterpress presses are used primarily for printing newspapers. These presses are designed to print both sides of the web simultaneously. Typically, they can print up to four pages across the web; however, some of the new presses can print up to six pages across a 90-inch web. Rotary letterpress is also used for long-run commercial, packaging, book, and magazine printing.

2. Platen type Letterpress Printing

A platen press is made up of two flat surfaces called the bed and the platen. The platen provides a smooth backing for the paper or other substrate that is to be printed. The raised plate (image to be printed) is locked onto a flat surface. The plate is inked, the substrate is then placed on another flat surface called the bed and pressed against the inked plate producing the impression.

The platen and bed carry both the paper and the type form. The press then opens and closes like a clam shell. Platen printing is typically used for short runs such as invitations, name cards, and stationary. Larger platen presses are used for die-cutting and embossing. Some platen presses are arranged with the bed and platen in the vertical plane.

The plate is inked with an inking roller that transfers ink from an inking plate to the image carrier. Ink is placed on the inking plate by an ink fountain roller. The platen style press has been widely used in printing small-town newspapers since the late

1800s. The printing area is usually limited to a maximum of 18 inches by 24 inches. These presses are also used to print letterhead, billheads, forms, posters, announcements, and many other types of printed products, as well as for imprinting, embossing, and hot-leaf stamping.

3. Flat Bed Cylinder Letterpress Printing

Flat-bed cylinder presses use either vertical or horizontal beds. The plate is locked to a bed which passes over an inking roller and then against the substrate. The substrate passes around an impression cylinder on its way from the feed stack to the delivery stack. Another way of describing this is that a single revolution of the cylinder moves over the bed while in a vertical position so that both the bed holding the substrate and cylinder move up and down in a reciprocating motion. Ink is supplied to the plate cylinder by an inking roller and an ink fountain. The presses can print either one or two-color impressions. Flat-bed cylinder presses, which operate in a manner similar to the platen press, will print stock as large as 42 inches by 56 inches.

Flat-bed cylinder presses operate very slowly, having a production rate of not more than 5,000 impressions per hour. As a result, much of the printing formerly done on this type of press is now done using rotary letterpress or lithography. The horizontal bed press, the slower of the two types of flat-bed cylinder press, is no longer used in many places

Gravure or Intaglio printing

Gravure printing is an intaglio printing technique, where the image to be printed is made up of small depressions in the surface of the printing plate. The cells are filled with ink and the excess is scraped off the surface with a doctor blade, then a rubber-covered roller presses paper onto the surface of the plate and into contact with the ink in the cells. The printing plates are usually made from copper and may be produced by digital engraving or laser etching.

Gravure printing is used for long, high-quality print runs such as magazines, mail-order catalogues, packaging, and printing onto fabric and wallpaper. It is also used for printing postage stamps and decorative plastic laminates, such as kitchen worktops.

The gravure process has its origins in the early seventeenth century when the intaglio printing process was developed to replace woodcuts in illustrating the best books of the time. In early intaglio printing, illustrations were etched on metal, inked, and pressed on paper. Gravure, still also known as intaglio printing, makes use of the ability of ink to adhere to a slight scratch or depression on a polished metal plate.

Gravure plate making

- Chemical Etching
- Electromechanically Engraved
- Direct Digital Engraving.

There are three processes used for making gravure cylinders. The first is for conventional gravure using chemical etching that produces cells of the same size or area with varying depths. The second is Electromechanically engraved cylinders.

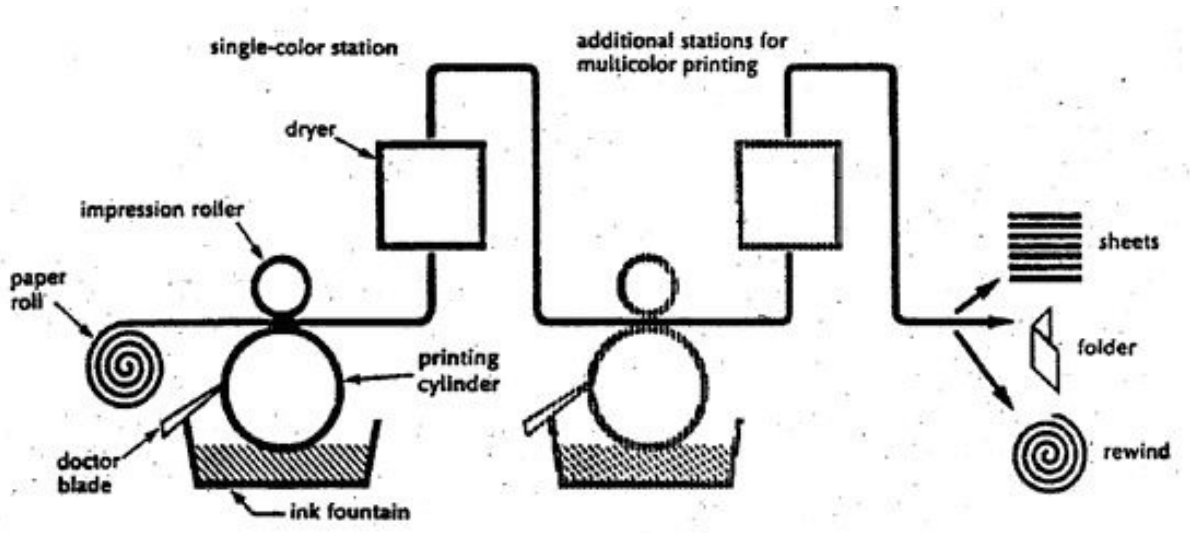
In electromechanically engraved cylinder making, the image or copy is wrapped around a scanning cylinder. The scanning head moves across the scanning cylinder which sends impulses to a computer. The computer signals a pneumatic head, which contains a diamond stylus, when and where to make a cell in the copper cylinder. The diamond stylus cuts an inverted pyramid shaped cell into the copper cylinder. Engraved cells may be up to 200 microns wide and up to 50 microns deep.

Chemical etching is hardly used now, but the process involves applying iron chloride solution of varying strengths over carbon tissue that has been sensitized to light by submerging it in a bath of potassium bichromate and water. The carbon tissue is a water-sensitive, fibrous paper that has been coated with a smooth gelatin resist.

In summary the gelatin resist is made to adhere to the cylinder. The cylinder is then exposed to UV light to harden the gelatin resist and then rinsed with plain water. Finally the etching technician applies the ferric chloride etchant which creates the printing cells on the cylinder.

Electromechanically engraved cells hold a lot less ink, yet print quality is equal to or better than chemically etched cylinders. In fact, an Electromechanically engraved cell holds approximately 30% less ink than a chemically engraved cell.

Recently direct digital engraving has become widespread. With this process the image can be created and manipulated using an image handling computer. Therefore, the steps of creating, copying, and rescanning film, and the loss of quality inherent in these steps, can be avoided



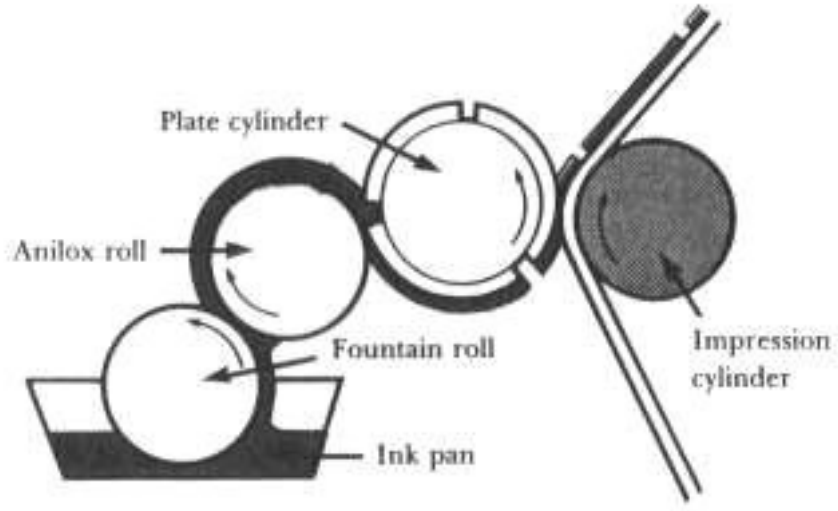
Flexography

Flexographic presses are capable of producing good quality impressions on many different substrates and is the least expensive and simplest of the printing processes used for decorating and packaging printing. The use of flexographic printing presses is on the rise,There are two primary reasons for this:

1) it is a relatively simple operation;

2) it is easily adapted to the use of water-based inks.

Publication flexography is used mainly in the production of newspaper, comics, directories, newspaper inserts, and catalogs. Packaging flexography is used for the production of folding cartons, labels, and packaging materials. Large quantities of inks are used during normal runs on flexographic presses; however, some printers are able to recycle a majority of their spent inks and wash waters. Major chemicals used in flexography include platemaking solution, water and solvent based inks, and blanket/roller cleaning solvents.



The major unit operations in a flexographic printing operation are:

- Image preparation
- Platemaking
- Printing
- Finishing

Image Preparation

Components of the image are manually assembled and positioned in a printing flat when a camera is used. This process is called stripping. When art/copy is scanned or digitally captured the image is assembled by the computer with special software.

A simple proof (brown print) is prepared to check for position and accuracy. When color is involved, a color proof is submitted to the customer for approval.

Platemaking

The photomechanical plate making method begins with making an engraving. This is accomplished by exposing a metal plate through a negative and processing the exposed plate in an acid bath. The metal engraved plate is used to make a master which is molded out of bakelite board. The engraving is placed in a mold press. The mold is produced by applying heat & pressure to the mold material (bakelite board), which can be either plastic or glass, against the engraving under controlled temperature and pressure. The bakelite board fills the engraving on the metal plate. When its cooled you end up with a master mold for the plastic or rubber compound that will be pressed into the mold under pressure and elevated temperature to produce the flexible printing plate with raised areas that will transfer the ink.

The second method of flexo plate making is relief plates. This utilizes a solid or liquid photopolymer. The sheet of photopolymer is exposed to light through a negative. The unexposed areas are then washed away with solvent or water wash. This is fast becoming the most common method of making plates.

The process differs depending on whether solid sheets of photopolymer or liquid photopolymer are used, though the two processes are similar in general outline. In both processes the plates are made in ultraviolet exposure units. A negative of the job is placed between the photopolymer and the ultraviolet light source. The photopolymer sheet or liquid is then exposed to ultraviolet light, hardening the image area. Lastly, the plate is processed to remove the unhardened non-image area. Photopolymer plates are replacing rubber plates because they offer superior quality and performance at a lower cost.

Flexographic printing plates may be made by laser engraving, which is called direct digital platemaking. In this process an image is scanned or computer generated. Then a computer-guided laser etches the image onto the printing plate.

Printing

There are different types of printing methods in flexographic printing they are classified according to the working or the printing method which they use. They are

1. STACK TYPE

The stack press is characterized by one or more stacks of printing stations arranged vertically on either side of the press frame. Each stack has its own plate cylinder which prints one color of a multicolor impression. All stations are driven from a common gear train. Stack presses are easy to set up and can print both sides of the web in one pass. They can be integrated with winders, unwinders, cutters, creasers, and coating equipment. They are very popular for milk carton printing. A drawback of stack presses is their poor registration; the image position on every printed sheet is not as consistent as in many other printing processes.

2. CENTRAL IMPRESSION CYLINDER (CIC)

Central impression cylinder (CIC), like the common impression rotary letterpress, use a single impression cylinder mounted in the press frame. Two to eight color printing stations surround the central impression cylinder. Each station consists of an ink pan, fountain roller, anilox roll, doctor blade, and plate cylinder. As the web enters the press it comes into contact with the impression cylinder and remains in contact until it leaves the press. The result is precise registration which allows CIC presses to produce very good color impressions. CIC presses are used extensively for printing flexible films.

3. IN LINE

In Line flexo printing is similar to a unit type rotary press or the stacked press except the printing stations are arranged in a horizontal line. They are all driven by a common line shaft and may be coupled to folders, cutters, and other postpress equipment. These presses are used for printing bags, corrugated board, folding boxes, and similar products.

4. NEWSPAPER FLEXOGRAPHIC PRESSES

A newspaper flexographic press consists of multiple printing units, each unit consisting of two printing stations arranged back-to-back in a common frame. The use of paired stations allows both sides of the web to be printed in one pass. Multiple printing stations are required to print the many pages that make up a typical newspaper. Single and double color decks, stacked units, or 4-, 5-, or 6-color units are sometimes positioned above those units where the publisher wants to provide single or multiple spot color, spot color for both sides of the web, or process color, respectively

Lithography

Lithographic printing is well suited for printing both text and illustrations in short to medium length runs of up to 1,000,000 impressions. Typical products printed with offset printing processes include:

- General commercial printing Quick printing
- Newspapers Books
- Business Forms Financial and Legal Documents
- Offset Lithographic Printing Process Overview

Lithography is an "offset" printing technique. Ink is not applied directly from the printing plate (or cylinder) to the substrate as it is in gravure, flexography and letterpress. Ink is applied to the printing plate to form the "image" (such as text or artwork to be printed) and then transferred or "offset to a rubber "blanket". The image on the blanket is then transferred to the substrate (typically paper or paperboard) to produce the printed product.

All offset presses have three printing cylinders, as well as the inking and dampening systems. The plate cylinder, the blanket cylinder and the impression cylinder.

Lithography uses a planographic plate, a type of plate on which the image areas are neither raised nor indented (depressed) in relation to the non-image areas. Instead the image and non-image areas, both on essentially the same plane of the printing plate, are defined by deferring physiochemical properties.

Lithography is based on the principal that oil and water do not mix. Lithographic plates undergo chemical treatment that render the image area of the plate oleophilic (oil-loving) and therefore ink-receptive and the non-image area hydrophilic (water-loving). During printing, fountain (dampening) solution, which consists primarily of water with small quantities of isopropyl alcohol and other additives to lower surface tension and control pH, is first applied in a thin layer to the printing plate and migrates to the hydrophilic non-image areas of the printing plate. Ink is then applied to the plate and migrates to the oleophilic image areas. Since the ink and water essentially do not mix, the fountain solution prevents ink from migrating to the non-image areas of the plate.

Preparation of Lithographic Printing Plates

Image preparation begins with camera-ready (mechanical) art/copy or electronically produced art supplied by the customer. Images are captured for printing by camera, scanner or computer. Components of the image are manually assembled and positioned in a printing flat when a camera is used. This process is called stripping. When art/copy is scanned or digitally captured the image is assembled by the computer with special software. A simple proof (brown print) is prepared to check for position and accuracy. When color is involved, a color proof is submitted to the customer for approval.

PROCESSING OF LITHOGRAPHIC PRINTING PLATES

There are eight different types of litho plates common to the commercial printing industry: Diazo, Photopolymer, Silver Halide, Electrophotographic (Electrostatic), Bimetal, Waterless, Thermal, and Ablation. The predominant surface plate in use today is termed a "presensitized" plate. Most printers will primarily use one or two types of plates. It is highly unlikely that you would encounter a printer that could use a few of each type of plate nor is it easy for them to switch to a different type of plate due to equipment, expense and application reasons.

Diazo plates are coated with organic compounds and are developed with a special solvent. They have a shelf life of about one year. These are used for print runs of about 150,000 impressions.

Photopolymer plates are coated with organic compounds which are very inert and abrasion resistant. This makes them last much longer than diazo plates. They are used for print runs of up to 250,000 impressions

Silver halide plates use photosensitive coatings similar to photographic film, except that the silver halide emulsions are slower and for color reproduction are coated on anodized aluminum. The processing solutions contain silver which must be recovered with the proper equipment before being discharged to the sewer. Film based silver halide plates are used for single color printing and metal based silver halide plates are used in computer-to-plate systems.

Electrostatic plates are based on the principle of the electrostatic copier. There are two types, inorganic photoconductors on a drum and the second is organic photo conductor on a substrate. These are used mostly in quick printing jobs of 100,000 impressions or less.

Bimetal plates use presensitized polymer coatings. There are two types of bimetal plates; copper plated on stainless steel or aluminum and chromium plated on copper. These are the most expensive, but rugged plates and are used for very long print runs. In fact they are capable of print runs in the millions.

Waterless plates, used on waterless presses only, consist of ink on aluminum for the printing areas and a silicone rubber for the non-image areas. These systems require special inks and high grade paper to avoid debris accumulating on the blanket.

Ablation plates are imaged by digital data and requires no chemical processing. These plates are digitally imaged by selectively burning tiny holes in thin coatings of a polyester or metal base. These types of plate are used on the new computer to plate imaging systems and the brand new computer to press system. The cost of equipment and materials is high and the technology is relatively new.

Heat sensitive plates are exposed by infrared diodes in special imagesetter and processed in water based chemistry. This a relatively new technology and requires the printer to invest in new equipment that can be quite costly.

Screen Printing

Screen printing is arguably the most versatile of all printing processes. It can be used to print on a wide variety of substrates, including paper, paperboard, plastics, glass, metals, fabrics, and many other materials. including paper, plastics, glass, metals, nylon and cotton. Some common products from the screen printing industry include posters, labels, decals, signage, and all types of textiles and electronic circuit boards. The advantage of screen printing over other print processes is that the press can print on substrates of any shape, thickness and size.

A significant characteristic of screen printing is that a greater thickness of the ink can be applied to the substrate than is possible with other printing techniques. This allows for some very interesting effects that are not possible using other printing methods. Because of the simplicity of the application process, a wider range of inks and dyes are available for use in screen printing than for use in any other printing process.

Screen printing consists of three elements: the screen which is the image carrier; the squeegee; and ink. The screen printing process uses a porous mesh stretched

tightly over a frame made of wood or metal. Proper tension is essential to accurate color registration. The mesh is made of porous fabric or stainless steel mesh. A stencil is produced on the screen either manually or photochemically. The stencil defines the image to be printed in other printing technologies this would be referred to as the image plate.

Screen printing ink is applied to the substrate by placing the screen over the material. Ink with a paint-like consistency is placed onto the top of the screen. Ink is then forced through the fine mesh openings using a squeegee that is drawn across the screen, applying pressure thereby forcing the ink through the open areas of the screen. Ink will pass through only in areas where no stencil is applied, thus forming an image on the printing substrate. The diameter of the threads and the thread count of the mesh will determine how much ink is deposited onto the substrates.

Screen Preparation

Screen preparation includes a number of steps. First the customer provides the screen printer with objects, photographs, text, ideas, or concepts of what they wish to have printed. The printer must then transfer a "picture" of the artwork to be printed into an "image" (a picture on film) which can then be processed and eventually used to prepare the screen stencil.

Once the artwork is transferred to a positive image that will be chemically processed onto the screen fabric (applying the emulsion or stencil) and eventually mounted onto a screen frame that is then attached to the printing press and production begins.

Frames

There are two types of screen frames, metal and wood. Metal frames, both static (solid) and retentionable, have become the industry standard. Retentionables do not require the use of adhesive products.

Metal frames have been replaced by wood because they do not warp from water like wood frames do. The most commonly used types of wood are cedar and pine. Pine is preferred because it is more water resistant while it is light weight.

Metal screens are made out of aluminum or steel. Aluminum is commonly preferred because it is light weight, yet sturdy. There are some applications where steel is preferred such as very large printing frames used for long printing runs.

Fabric Types

Today commercial screen printing primarily uses 4 types of fabric for making screens, silk, cotton organdie, nylon, and polyester. Silk was the original material used to make screens for screen printing. By far the most widely used fabric is monofilament polyester followed by multifilament polyester and nylon.

- Silk - multifilament weave
    - loses taughtness with frequent use

    - reclaiming chemicals containing bleach or chlorinated solvents destroy the silk
    - today silk is primarily used for printing art, not commercial use as before
- Cotton Organdie - multifilament weave
    - same disadvantages as silk
- Nylon - multifilament or monofilament
    - good for stretching
    - compared to polyester, lacks stability
    - less rigid than polyester
    - unsuitable for closely registered colors
- Polyester - multifilament or monofilament (calendared monofilament polyester, metallized monofilament polyester)
    - primary material used in commercial screen printing
    - Polyester is strong and stable when stretched
- Other screen materials - carbonized polyester
    - glass
    - wire mesh
    - stainless steel

Screens made of the same material can differ in thread diameter, number of threads-per-inch, and choice of mono- or multifilament fibers. The need for various characteristics such as wearability and dimensional stability will help determine the fabric selected for a particular screen printing job. Diameter of mesh thread and number of threads per inch determine the amount of ink transferred to the substrate during the printing process (Buonicore and SPAI 1991).

Screen mesh

Screen mesh refers to the number of threads per inch of fabric. The more numerous the threads per inch the finer the screen.

Finer mesh will deposit a thinner ink deposit. This is a desirable affect when printing a very fine detail and halftones. Typically a fabric should be 200-260 threads per inch. Water based inks work best on finer mesh. These are generally used in graphic and industrial printing.

Course mesh will deposit a heavier ink deposit. This type of screen is used on flatter, open shapes. Typically a course screen mesh will be 160-180 threads per inch. These are generally used in textile printing.

"Emulsion" or "Stencils"

The words emulsion and stencil are used interchangeably in screenprinting.

Applying the emulsion is the chemical process of transferring image to a screen. The function of the emulsion (or stencil) is to cover the non-printing area of the screen. The stencil process works due to the use of a light sensitive material that hardens when exposed to ultraviolet light. The stencil material must be of a material that is impermeable to the screen printing ink.

Materials used for stencils include plain paper, shellac or lacquer coated paper, lacquer film, photographic film, and light-sensitive emulsions. Stencil types available include: hand-cut film, photographic film, direct coating, direct/indirect photostencil, and wet-direct photostencil.

The stencil is composed of either a liquid product that is poured onto the screen mesh or a film product. There are two types of photographic film, presensitized and unsensitized, available for use in the preparation of stencils. Presensitized film is ready to use as purchased, while unsensitized film must first be treated with a photosensitization solution.

In preparing the stencil, the film is exposed to a positive film image in a vacuum frame. It is then developed in a solution that renders the unexposed image areas soluble in water. The soluble areas are removed and the remaining film is bonded to the screen fabric.

Stencil application processes

There are four stencil application processes, hand cut, direct stencil and indirect stencil (application of a film):

Hand Cut

A hand-cut film stencil is made by hand cutting the image areas from a lacquer film sheet on a paper backing. A liquid adhesive is then used to bond the stencil to the screen fabric. Once the adhesive has dried, the film's paper backing sheet is removed.

Direct Stencil

In the direct coating process, a light-sensitive emulsion is applied to the entire screen using a scoop coater and allowed to dry. The screen is then exposed to a film positive image. The non-image areas of the emulsion harden upon exposure. However, the coating in the unexposed image areas remains soluble and is removed with a spray of warm water. Several coats of the light-sensitive material are applied and smoothed to achieve a long wearing screen.

Some of the characteristics of direct stencils are:

- Most are water soluble
- Wear better than indirect stencils
- Cheaper to produce than indirect stencils
- Two different types of direct stencil solution
- Water-resistant stencil solution
- Solvent-resistant stencil solution

Within direct stencil processes yellow and orange colored fabric is used for the screen mesh. The color prevents light from bouncing when the stencil is exposed to UV. If light bounces or scatters the exposure is uneven.

Indirect Stencil

The preparation of indirect stencils combines elements of both the photographic film and the direct coating methods. An unsensitized photographic film is laminated to the screen and then sensitized by the direct application of a photosensitive emulsion. The exposed stencil is processed in a manner similar to that used in the preparation of stencils produced by the photographic film and the direct coating methods. The indirect process produces highly durable stencils that are used in applications where high print quality is required.

Indirect Stencil process consists of using a coated acetate film which is cut into the exact shape of the artwork and adhered to the screen using water then is dried by heat. Some of the characteristics of Indirect Stencils are:

- Produce excellent definition & finer detail
- Best for Water-based ink printing
- More difficult to remove from screen mesh, requires high pressure water rinse.

Wet Direct Photostencil

A recent development in stencil preparation is the wet-direct photostencil process. To prepare a stencil using this process, a film positive is held in direct contact with a wet photopolymer emulsion. The emulsion hardens when exposed to UV light. The unexposed areas of emulsion are then removed yielding a very durable, high quality screen.

Screen Printing Prepress Screen Making Emulsion Application

- Clean & Degrease Screen Mesh
- putting tooth on mesh

The screen must first be thoroughly cleaned and degreased prior to applying emulsion (stencil). If not, the film stencil will not properly adhere to the screen resulting in parts of the stencil coming loose during printing and thus spoiling the finished product. The screen is then cleaned with warm water and cleaner/degreaser. Then, a pumice-based abrasive is used. These steps act to remove grease from the surface and roughens it so that the film stencil adheres well. This is called "putting tooth" on the mesh.

- Apply emulsion/stencil

The process of exposing indirect and direct stencils is the same. A light-proof positive is made on a sheet of clear acetate to act as the positive image area of the screen. This is placed over the light-sensitive coating. A timed exposure to UV light is then made. The UV light hardens only the exposed parts of the film coating (negative areas); the areas of emulsion concealed beneath the positive image remain soft. A simple developer is then used to further harden the exposed parts of

the film stencil. On washing the emulsion with warm water, the soft areas of film emulsion start to dissolve, finally disappearing to leave a negative stencil that is the exact opposite of the positive image. When printed, the result will be the exact likeness to the original positive image / artwork.

Emulsion Types

- Water resistant emulsions
- Solvent based ink
- UV curable ink
- Water based ink - w/ chemical curing
- Solvent resistant emulsions
- Water based ink
- UV curable ink

Water resistant emulsions are used in Direct Stencil processes and capillary film processes. Stencil or emulsion which is water-soluble is incompatible with water based ink. Solvent-based and UV curable inks can be used with water-resistant emulsions

Chemical curing of water-resistant emulsions using a HCl based solution can improve resistance to water and therefore can be used with water based inks. Screens made with water resistant emulsions are more difficult to reclaim/remove the stencil than solvent-resistant, but are very inexpensive. It also adds an extra step and use of additional chemicals.

Solvent resistant emulsions cam be used along with water based inks. Although solvent resistant emulsions are most compatible with water based ink systems, the use of solvent-resistant emulsions and water based inks cause the emulsion to quickly erode and create pin-holes. In order to avoid this problem screen printers can opt for water resistant emulsions with chemical curing.

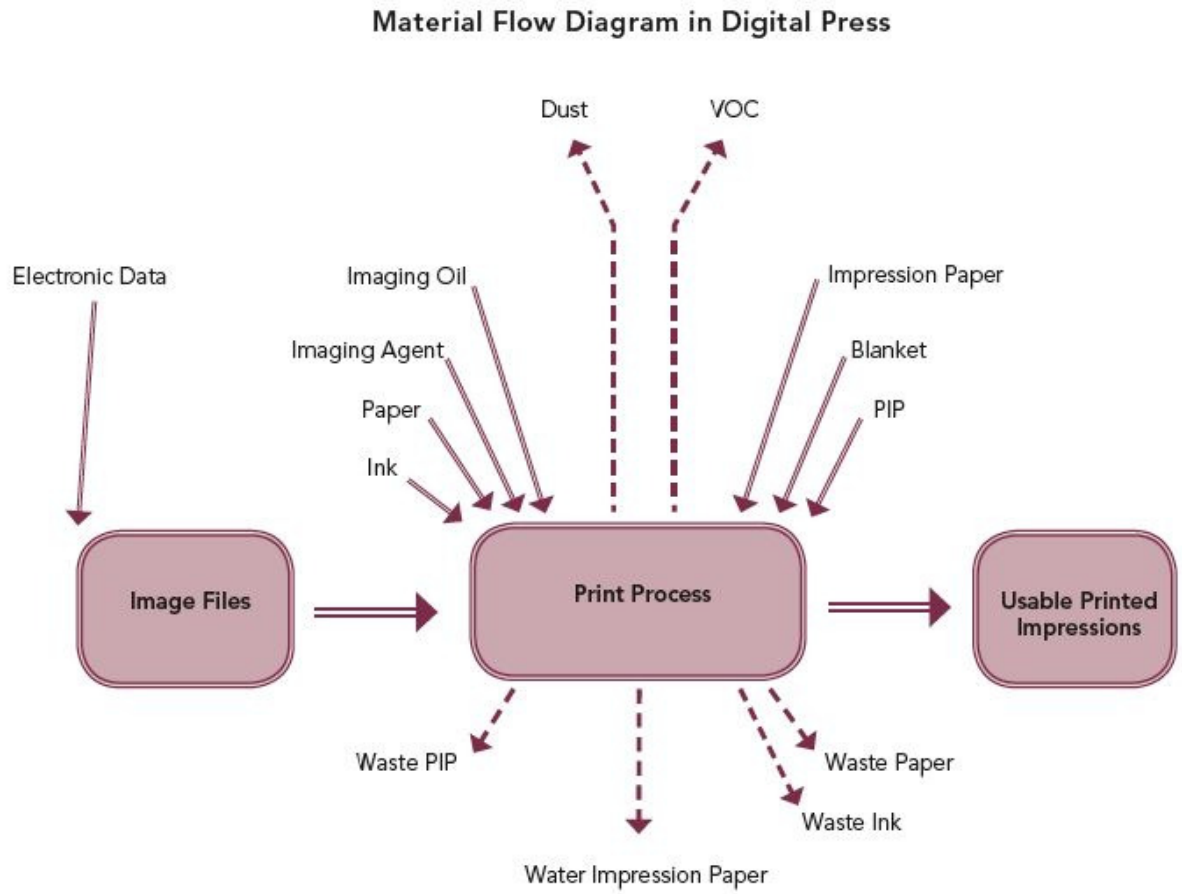
Digital Printing

The most important electronic processes are xerographic and laser printing. With one major exception, xerographic and laser printers operate on similar principals. In both processes an image is recorded on a drum in the form of an electrostatic charge. The electrostatic charge is then transferred to a sheet of some material, generally paper. A conductive fine dry powder, the toner, is then spread on the paper. The toner is attracted to the electrostatically charged areas of the paper, thereby converting the electrostatic image into a visual one. The paper is then heat treated to melt and affix the toner to the paper

Laser printing and xerography differ in how the image is inputted and how the electrostatic image is formed on the drum. In xerography, light reflected off a hard copy of the text or pictorial image (e.g., a printed or illustrated page) is projected on to the drum though a camera lens. In laser printing the image is inputted in digital form from a computer. A laser is then used to project the image onto the drum.

The input and output capabilities of electronic printing continue to improve. For example, raster image processing has made the integration of text and graphic images much easier. (Until recently, most computer output devices formed text and graphic images as a series of dots. With raster image processing, the image is formed as a series of lines.) The resolution of laser printers is good but still falls far short of the resolution achieved with phototypesetters. To produce high quality reproductions of fine type and halftone screen images, a resolution of at least 1,500 line per inch is required. However, in 1990, the highest resolution laser printers could achieve was a density of 1,200 X 600 dots per inch (dpi) while most achieved resolutions of only 300 X 300 dpi.

Currently, electronic printing is used primarily for short-run in-plant and quick printing. Another use is for the production of proof copies of printed materials which will be printed using one of the traditional printing technologies. These proof copies are much less expensive than phototypeset proofs. In desktop publishing, electronic printing is often used to produce a camera ready copy of a document that is then printed using one of the traditional printing technologies. According to Michael Bruno, the current markets for desktop publishing include demand publishing, book review copies, college texts, workbooks, technical manuals, and parts catalogs.



Post Printing processes

CUTTING

The machine typically used for cutting large web-type substrates into individual pages or sheets is called a guillotine cutter or "paper cutter". These machines are built in many sizes, capacities, and configurations. In general, however, the cutter consists of a flat bed or table that holds the stack of paper to be cut. At the rear of the cutter the stack of paper rests against the fence or back guide which is adjustable. The fence allows the operator to accurately position the paper for the specified cut. The side guides or walls of the cutter are at exact right angles to the bed. A clamp is lowered into contact with the top of the paper stack to hold the stack in place while it is cut. The cutting blade itself is normally powered by an electric engine operating a hydraulic pump. However, manual lever cutters are also still in use.

To assist the operator in handling large reams of paper which can weigh as much as 200 pounds, some tables are designed to blow air through small openings in the bed of the table. The air lifts the stack of paper slightly providing a near frictionless surface on which to move the paper stack.

The cutter operator uses a cutting layout to guide the cutting operation. Typically, the layout is one sheet from the printing job that has been ruled to show the location and order of the cuts to be made. Though cutting is generally considered a postpress operation, most lithographic and gravure web presses have integrated cutters as well as equipment to perform related operations such as slicing and perforating.

FOLDING

Folding largely completes postpress operations for certain products such as simple folded pamphlets. Other products are folded into bunches, known as signatures, of from 16 to 32 pages. Multiple signatures are then assembled and bound into books and magazines. Though folding is generally considered a postpress operation, most lithographic and gravure web presses are equipped with folders.

Three different folders are used in modern print shops. They range in complexity from the bone folder to the buckle folder. Bone folders have been used for centuries and are made of either bone or plastic. These folders are simple shaped pieces of bone or plastic that are passed over the fold to form a sharp crease. Today, they continue to be used, but only for small, very high quality jobs.

Knife folders use a thin knife to force the paper between two rollers that are counter-rotating. This forces the paper to be folded at the point where the knife contacts it. A fold gauge and a moveable side bar are used to position the paper in the machine before the knife forces the paper between the rollers. The rollers have knurled surfaces that grip the paper and crease it. The paper then passes out of the folder and on to a gathering station. Several paper paths, knives and roller sets can be stacked to create several folds on the same sheet as it passes from one folding station to another.

Buckle folders differ from knife folders in that the sheet is made to buckle and pass between the two rotating rollers of its own accord. In a buckle folder, drive rollers

cause the sheet to pass between a set of closely spaced folding plates. When the sheet comes in contact with the sheet gauge, the drive rollers continue to drive the paper causing it to buckle over and then pass between the folding rollers.

ASSEMBLY

The assembly process brings all of the printed and non-printed elements of the final product together prior to binding. Assembly usually includes three steps: gathering, collating, and inserting. Gathering is the process of placing signatures next to one another. (A signature is a bunch of printed sheets ranging from 16 to 32 pages.) Typically, gathering is used for assembling books that have page thicknesses of at least 3/8 inch. Collating is the process of gathering together individual sheets of paper instead of signatures. Inserting is the process of combining signatures by placing or "inserting" one inside another. Inserting is normally used for pieces whose final thickness will be less than one-half inch.

Assembly processes can be manual, semiautomatic or fully automatic. In manual assembly operations, workers hand assemble pieces from stacks of sheets or signatures laid out on tables.

Sheets or signatures are picked up from the stacks in the correct order and either gathered, collated, or inserted to form bindery units. Some printers use circular revolving tables to assist in this process. However, due to the high cost of labor, manual assembly is used only for small jobs.

Semiautomatic assembly is completely automated except that stacks of sheets or signatures must be manually loaded into the feeder units. During semiautomatic inserting, operators at each feeder station open signatures and place them at the "saddlebar" on a moving conveyer. The number of stations on the machine is determined by the number of signatures in the completed publication. Completed units are removed at the end of the conveyer and passed on to the bindery.

Automatic assemblers are similar to semiautomatic units except that a machine and not a person delivers the sheets or signatures to the feeder station and places them on the conveyor. In order to improve efficiency, automatic assemblers are typically placed in line with bindery equipment.

BINDING

Binding is categorized by the method used to hold units of printed material together. The three most commonly used methods are adhesive binding, side binding, and saddle binding. Three types of covers are available to complete the binding process: self-covers, soft-covers, and casebound covers.

BINDING METHODS

Adhesive binding, also known as padding, is the simplest form of binding. It is used for note pads and paperback books, among other products. In the adhesive binding process, a pile of paper is clamped securely together in a press. A liquid glue is then

applied with a brush to the binding edge. The glue most commonly used in binding is a water-soluble latex that becomes impervious to water when it dries.

For note pads, the glue used is flexible and will easily release an individual sheet of paper when the sheet is pulled away from the binding. Adhesive bindings are also used for paperback books, but these bindings must be strong enough to prevent pages from pulling out during normal use. For paperback book binding, a hot-melt glue with much greater adhesive strength than a water-soluble latex is applied. A piece of gauze-like material is inserted into the glue to provide added strength.

In side binding, a fastening device is passed at a right angle through a pile of paper. Stapling is an example of a simple form of side binding. The three other types of side binding are mechanical, loose-leaf, and side-sewn binding.

A common example of a form of mechanical binding is the metal spiral notebook. In this method of binding, a series of holes are punched or drilled through the pages and cover and then a wire is then run through the holes. Mechanical binding is generally considered as permanent; however, plastic spiral bindings are available that can be removed without either tearing the pages or destroying the binding material. Mechanical binding generally requires some manual labor.

Looseleaf bindings generally allow for the removal and addition of pages. This type of binding includes the well known three-ring binder.

Side-sewn binding involves drilling an odd number of holes in the binding edge of the unit and then clamping the unit to prevent it from moving. A needle and thread is then passed through each hole proceeding from one end of the book to the other and then back again to the beginning point. This type of stitch is called a buck-stitch. The thread is tied off to finish the process. Both semiautomatic and automatic machines are widely used to perform side-stitching. The main disadvantage of this type of binding is that the book will not lie flat when opened.

In saddle binding one or more signatures are fastened along their folded edge of the unit. The term saddle binding comes from an open signature's resemblance to an inverted riding saddle. Saddle binding is used extensively for news magazines where wire stitches are placed in the fold of the signatures. Most saddle stitching is performed automatically in-line during the postpress operations. Large manually operated staplers are used for small printing jobs.

Another saddle binding process called Smythe sewing is a center sewing process. It is considered to be the highest quality fastening method used today and will produce a book that will lie almost flat.

COVERS

Self-covers are made from the same material as the body of the printed product. Newspapers are the most common example of a printed product that uses self-covers. Soft covers are made from paper or paper fiber material that is somewhat heavier or more substantial than the paper used for the body of the publication. This type of cover provides only slight protection for the contents. Unlike self-cover, soft

covers almost never contain part of the message or text of the publication. A typical example of the soft cover is found on paper-back books. These covers are usually cut flush with the inside pages and attached to the signatures by glue, though they can also be sewn in place.

Casebound covers are the rigid covers generally associated with high-quality bound books. This method of covering is considerably more complicated than any of the other methods. Signatures are trimmed by a three-knife trimming machine to produce three different lengths of signature. This forms a rounded front (open) edge to give the finished book an attractive appearance and provides a back edge shape that is compatible with that of the cover. A backing is applied by clamping the book in place and splaying or mushrooming out the fastened edges of the signatures. This makes the rounding operation permanent and produces a ridge for the casebound cover.

Gauze and strips of paper are then glued to the back edge in a process called lining-up. The gauze is known as "crash" and the paper strips are called "backing paper." These parts are eventually glued to the case for improved strength and stability. Headbands are applied to the head and tail of the book for decorative purposes. The case is made of two pieces of thick board, called binder's board, that is glued to the covering cloth or leather. The covering material can be printed either before or after gluing by hot-stamping or screen methods. The final step in case binding consists of applying end sheets to attach the case to the body of the book.

IN-LINE FINISHING

Historically, the finishing operations described above were labor-intensive operations handled either in-house or by trade shops. Even when performed in-house, finishing operations generally were not integrated with the presses or with each other. Today, web presses are often linked directly to computer controlled in-line finishing equipment. Equipment is available to perform virtually all major post-press operations including cutting, folding, perforating, trimming, and stitching. In-line finishing equipment can also be used to prepare materials for mailing. The computer can store and provide addresses to ink-jet or label printers, which then address each publication in zip code order.

One of the most important results of computer in-line finishing is the introduction of demographic binding, the selective assembly of a publication based on any one or more of a number of factors including geographic area, family structure, income, or interests. For example, an advertisement will appear only in those copies of a magazine intended for distribution in the advertisers selling area. Demographic binding has proven to be a successful marketing tool and is already widely used, especially by major magazines.

One comparison found that the use of in-line finishing equipment can reduce the number of operators and helpers required for an off-line finishing operation by almost half, while at least doubling the rate of production

Glossary

Printers had a language; they still have. Not for long, of course. It's pleasant to know and use these old words that are still precise, useful, and the everyday language of working printers.

ASCENDER

That part of the character that extends above the x height of the fount (as in the lowercase b).

ASCENDER

That part of the character that extends above the x height of the fount (as in the lowercase b).

BASELINE

The imaginary line that characters rest on in a line of text; it runs along the base of the x-height, and is crossed by descenders.

BEARD

The space on a type between the bottom of the x-height and the upper edge of the shank or body. This space comprises the shoulder on which the face rests and the bevel by which it is raised from it, and is the area in which the descenders of lower-case letters extrude.

BED

The table of a printing press on which the forme of type is placed for printing.

BELLY

The front or nick side of a type.

BIBLIOGRAPHY

The study of any kind of written matter as a physical object.

BINDING

A difficulty arising when locking up type, caused by using furniture which is longer or wider than the type, so that it 'binds' at the ends.

BLEED

When an element, usually an illustration, prints to the edge of the paper.

BLOCK

In the hand press period, a block of wood with a relief carving on it used for printing pictures. In the machine press period, an engraved or etched zinc or copper plate used for printing illustrations in books. A line block reproduces only lines, dots, and black surfaces; a half-tone block reproduces tones or shades by means of dots, which, the closer together they are, appear to reproduce deeper shades.

BODKIN

A pointed steel tool used to lever up type when correcting.

BODY

Or body-size. The measurement of thickness from back to front of a type, slug, lead, or rule, etc; it governs how big a letter looks on the page. Measured in points.

BOLD FACE

Bold face is type with a conspicuous black, heavy appearance, but based on the same basic type design as its medium weight in the same fount.

BRASS RULES

Also known simply as 'rules': strips of brass, type high, used to print lines.

BROADSIDE

Originally a sheet of paper printed on one side only; commonly used for royal proclamations, then for subversive publications and cheap mass-circulation poems and ballads, so eventually the word came to mean also simply the kind of material that was normally printed on it: a broadside ballad, or simply a broadside.

CASTING OFF

Estimating the number of pages that copy will occupy when set up in type, as the basis for the printing cost estimate. The number of words in the copy is judged, and the format and size of page and measure are also established for this purpose.

CATCHWORD

The word written underneath the last line of each page or section of a hand printed book, which is also the word with which the next page or section commences. Its purpose was to guide the binder. Used in England roughly 1530-1800, usually on every page.

CENTRE

A type line is centred when it is placed in the centre of the page, i.e. with an equal margin on each side, that margin being greater than that of the rest of the text.

CHAIN LINES

The vertical lines on handmade paper, which run parallel to the shorter side of the sheet.

CHASE

A steel or cast-iron frame into which type and furniture are locked for printing.

CHEEK

The sides of the press that enclose the platen and its screw or lever mechanism are called 'cheeks'.

COFFIN

The part of the press that is run to and fro under the platen and out again so that printing can take place.

COLLATION

The physical makeup or format of a book, as described in a standardised formula.

COLOPHON

The inscription, usually placed at the end of early printed books, giving the name of the printer, title, place and date of printing.

COMPOSING STICK

The shallow adjustable tray, about 10 lines of 12 point type in depth, that the compositor uses to set type. It looks like this.

CONDENSED

A face of type that is narrower than the normal face.

CONJUGATE LEAVES

Any two leaves of a book which together form one piece of paper.

COPY

The document (manuscript, typescript, printed book) from which the printer sets up his type. Also known as printer's copy.

CROPPED

A book is cropped when its margins have been trimmed for the purposes of binding or rebinding.

CYLINDER PRESS

A printing press in which the forme is carried on a flat bed under a paper bearing cylinder for an impression to be made at the point of contact. There were: stop-cylinder machines, in which the cylinder is stationary during the return of the bed; two-revolution machines, in which the cylinder revolves continuously, making one rev. during the impression and one while the bed returns, being raised at the same time to clear the forme and receive the next sheet; and single-revolution machines which operate in the same way except that the machine makes half a rev. for each movement of the bed.

DECKLE

The wooden (usually) border of a paper-making mould, which confines the paper pulp to the mould. The pulp, or stuff, flows between the frame and the deckle, causing a deckle-edge.

DESCENDER

The portion of lower case letters, i.e. g,j,q,p,y, that projects below the main body of the letter.

DISTRIBUTE

Type is distributed (or dissed) when it is returned to the case after printing.

DPI

Dots per inch. The measurement of the degree of delicacy of reproduction, or resolution, of a halftone picture or a dot matrix or laser printer. (About 150/300 dpi respectively, but you can get expensive versions of each that have a much higher (=better) dpi). Top quality graphic printing comes in at 1000 dpi.

DUCK'S BEAK

Originally a duck's beak was a piece of heavy paper or card, a small rectangle in shape. A v-shaped cut was made in it, and the v folded outwards. The non-v bit of the card is then pasted and attached to the tympans so that the protruding v would steady and hold in the edges of the paper to be printed. This was used mainly for fine and delicate printing; for most work press-points only were used. My use of the term in the Christmas card manual is an affectation. So it goes.

EDITION

An edition consists of all the copies of a book printed at any time or times from

substantially the same setting of type, and includes all the various impressions, issues, and states which may have derived from that setting. 'Substantially the same setting of type' is usually taken to imply that if less than half the type has been reset, then any impression taken from it is part of the same edition.

In the hand press period editions are easy to identify, because two settings, even if one is designedly an imitation of the other, are going to differ considerably in small details: thus the spacing and the random pattern of damaged types will differ from edition to edition. But in the modern period the new technology has made the definition rather obsolete: a single keyboarding of the copy can then be kept on disc forever, taking up little room (and certainly not keeping occupied massive amounts of expensive lead type, as in the hand press period) and then be printed out in any form, typeface, format, or whatever, that you may want.

ELECTROTYPE

A duplicate printing forme made in a galvanic bath by precipitating copper on a matrix. The matrix is made by taking a mould, often in wax, from the original printing forme. The mould is treated with graphite to make it conduct electricity. The mould is treated with graphite to make it conduct electricity. The duplicate forme (usually called an 'electro') was used for reprints, and often for the entire run, the original metal serving only to produce the mould.

EM

1) Short for 'em quad': a square piece of spacing material. So a 10 point em would be 10 points square.
2) Also the unit of typographical measurement for which the 12 point em is the basis. This unit is used for computing the area of a printed page no matter what size of type is used for setting the text; thus if the area is twenty ems wide and thirty ems deep the width is 240 points and the depth 360 points. There are approximately six ems to an inch. Also known as pica-em or just pica (pronounced piker) because before the point system became widely used different sizes of type had names, and twelve-point was known as pica.

EM QUAD

The unit of spacing material, always less than type height and of course square: an em-quad of 10-point type is always 10 points by 10 points. Used to indent paragraphs, among other things.

EN

Half of an em. A compositor's output in terms of type set is measured in ens per hour.

ERRATUM

An author's or printer's error, only discovered after the book has been printed. If noticed in time, this can be corrected in an errata list, which, depending on when it is

noticed, can either be set up and worked off with the prelims, or else separately printed, cut off, and pasted into the book.

FACE

The printing surface of any type character; also, the group or family to which any particular type-design belongs: as, bold-face.

FEET

The grooved base on which a type stands, plural because of the groove. Type not standing squarely is said to be 'off its feet'.

FIGURE

An illustration forming part of a page of text with which it is printed from a block imposed together with the type.

FLAT BED

Said of a press having the printing forme on a flat as opposed to a curved surface: thus, flat bed cylinder press means flat forme, cylindrical platen; flat bed web press: flat forme, continuous roll (web) of paper--as opposed to printing from distinct sheets.

FLONG

Alternate layers of blotting paper and tissue paper used for moulds in stereotyping. Particularly for a rotary machine where the forme must be curved.

FLUSH

Adjective: either 'flush left' or 'flush right'. To set text flush left is to set it with the beginnings of the lines all at the left margin, but the ends of the lines not reaching the right; flush right means that the ends of the lines all line up against the right margin, but the beginnings are ragged, and do not reach the left margin. You also her printers use the expressions 'range left' and 'range right', meaning the same thing. If the lines are straight both on the right and the left, like a normal printed page, the type is said to be 'justified'.

FOLIATED

The leaves rather than the pages numbered. Expressed as: f.1, f.2, ff.6-8, f.10v (= verso = page 20); f.10r (= recto = page 19).

FORMAT

Loosely, the shape and size of a page; specifically, the way the paper is folded in order to make the shape and size. So if the sheet is folded once, the format is folio (2°); twice, quarto (4°); three times, octavo (8°); four times, sixteenmo (16°); and so on, up to (but not often) sixty-fourmo (64°).

Nowadays, format means: the general shape and appearance of a page, including its margins,type columns, etc; also the combination of instructions for reproducing it, stored in a computer's memory for future use.

FORME

Type matter and blocks assembled into pages and locked up in a chase ready for printing.

FOUL CASE

Type in the wrong box in a case.

FOUNT

A complete set of type characters of the same design and size, e.g. including upper and lower case, numerals, punctuation marks, etc. Pronounced 'font', and spelled 'font' by Americans and Desk Top Publishing programs.

FRISKET

A rectangular metal frame, hinged at one end to attach it to the tympans; it folds over the tympans when printing takes place. It is covered with paper. The paper is cut to allow the type to print through it; the remaining paper protects the paper to be printed.

FRONT MATTER

= preliminaries.

FULL PRESS

When printing was done in hand presses, two men operated them with one applying the ink, the other putting in the sheet and pulling the impression; when one man did all this, it was called working at half-press; when two, full-press.

FURNITURE

Lengths of wood or metal less than type height used in a forme for making margins and filling blank areas of a page.

GALLEY

1) the steel or wooden tray in which composed type was put before being imposed. Hand press compositors set by the page; the long galley which didn't divide into pages until the imposing stage was a 19c innovation. 2) proofs taken from long galleys are known as galley-proofs or just galleys, which means long slips of paper bearing a proof of unpaged type.

GATHERING

The sheet or sheets folded according to format intended to be sewn together. With, but distinct from, the other gatherings to make up the bound book. Also known as a quire or signature, though strictly the latter comprises the gathering plus any inserts, plates, etc. that are intended to go in but are not part of the original folding.

GUTTER

The space near the spine (the right side on left-hand pages, the left on right-hand pages) comprising both the space allowed for binding in a double-sided publication and the margin.

HAIRLINE

The thinnest rule you can get from your equipment. On a 300 dpi laser printer, it is one 300th of an inch.

HALFTONE

A continuous tone image that has been photographically converted to a pettern of very small dots.

HEADLINE

Loosely, the title of the book as printed at the top of every page of text. When the headline indicates the contents of the page, it is known as a running head. Strictly, headline refers to forme, not page, and means all the type and quads composing the typographical unit that will print the heading at the top of the page.

HEAP

The pile of printed or waiting-to-be-printed sheets of paper. The latter is known as the white paper heap.

HOLOGRAPH

MS in author's own hand, also known as autograph (both are both nouns and adjectives: a holograph, a holograph MS.

HYPHENATION

Adding hyphens to columns of text allowing words to 'break' across the end of a line, so that excessive amounts of white space aren't left between words in justified type and the right hand margin of unjustified type is not too ragged. DTP programs have automatic hyphenation programs, but they have also to have a list of words that you have to be careful about hyphenating. 'Arsenal', for instance, is not hyphenated in books printed in the UK.

IMPOSITION

The arranging of pages in a chase in a particular sequence so that when the printed sheet is folded the pages will be consecutive; also includes adding the furniture and quoins and locking up the type into a forme.

IMPRESSION

An impression is all the copies of an edition printed at any one time.

In the early hand press period it was normal to redistribute type after a book had been printed, owing to type shortages, so impression is normally identical with edition. Increasingly during the 18c. popular pamphlets (i.e. of five sheets or less) including plays, were kept in standing type for later reprinting in a second or third or further impression. Different impressions are hard to distinguish, but it may be done by corrections in successive impressions. In the absence of any typographical distinction, the best clue is to be found in the paper used.

ISSUE

An issue is all the copies of that part of an edition which is identifiable as a distinct consciously planned publishing unit.

The criteria for a distinct issue are that the book must differ in some typographical way from copies of the edition first put on the market, yet be composed largely of sheets derived from the original typesetting; and that the copies forming another issue must be a purposeful publishing unit removed from the original issue either in time (reissue), or, much more rarely, in form (separate issue). Reissue normally involves a new or altered title-page and may involve either a new title page added to bring old sheets up to date, or collections of separate pieces reissued with a new general title. Reissue implies the re-issuing of the same old sheets in a different form (i.e. with a new title page), usually to stimulate flagging sales, perhaps by pretending that the reissue is a new edition; ideally it implies the withdrawal of the previous issue from sale.

Examples of separate issue: the alteration of title pages to suit the issue of a book simultaneously in two or more different forms; the reimposition of the type pages to produce copies in different formats (since the type is reimposed this has often been designated as a distinct edition; but since it is the same type, it should more properly be called new issue (re-imposed); impressions on special paper distinguished from ordinary copies by added, deleted, or substituted material.

ITALIC

A variation of typeface in which letters slope forward. True italic typefaces are specially designed, as opposed to oblique faces, which are just slanted versions of the regular face.

JUSTIFY

Type is justified when all of the lines are of the same length, producing a straight left hand margin. It is done by varying the spacing between the words.

KERNING

The process of moving together letters that would normally look too far apart. Used especially in large type sizes and with certain letter pairs (such as the capitals A and T).

LANDSCAPE

Page orientation where the two longer edges of the paper are at the top and bottom. If the shorter edges are at top and bottom, the term is 'portrait'.

LEADER

A row of dots or dashes used to separate items in tables (as in a list of contents, often).

LEADING, or LEADS (rhymes with 'bedding'. Or 'beds'.

Thin strips of quad-high metal spacing material used to separate lines of type. If a page is said to be 'leaded two points' it means that there is a two point (=2/72nds of an inch) space between the bottom of one line and the top of the next. Cf linespacing.

LEAF

A book is normally composed of sheets of paper, folded to make gatherings or quires, and bound together. Each gathering is composed of an even number of leaves, joined together in the spine of the book (ie at the fold). A leaf consists of two pages, which are known as the recto and verso (ie front and back) of the leaf.

LIGATURE

Two or more letters joined together and usually cast on one body.

LINESPACING

The distance from the baseline of one line to the baseline of the line below it. Technically, it is the amount of leading plus the point size of the type.

LINOTYPE

A machine for setting and casting type in units of one line known as slugs. Faster than monotype but slower to correct, since for any correction the whole line must be reset. In this country used commonly for newspapers, much less commonly for printed books. More commonly for the latter in America. The first effective substitute for composing by hand; developed slowly through the 1880's, beginning to come into common use 1890 onwards. An operator can produce consistent speeds of 6,000

Ens an hour, distribution being no problem since the type was simply melted down (hand press, perhaps an extremely variable 1,000 ens an hour include distribution). For comparison, 2,750 ens = 500 words = two typed quarto pages (very roughly).

MAKE-READY

The complicated and skilled business of putting the forme in the right place on the bed and packing the tympan so that the best possible impression is obtained.

MEASURE

The width (measured in ems) to which a line or column of type is set or a lino-slug is cast. The width to which a setting rule is set.

MEDIUM

The weight of type-face midway between light and bold; normally used for the body of the book.

MONOTYPE

The other important hot-metal composing machine. The operation of a keyboard produces a spool with punched holes in it, which when fed into a caster instructs it to cast individual types and spaces in a series of justified lines. The end product is indistinguishable from brand-new hand-set type. Mono machines began to be mass produced in 1901, but because of technical difficulties and slowness relative to line (since it involved two distinct operations to lino's one) it wasn't until the 1920's that most large printing houses in Britain were using monotype.

MS

Common abbreviation for 'manuscript'.

NICK

The groove in the body of type cast as an aid to placing it the right way up in the stick.

OFF ITS FEET

Said of type that is not perfectly vertical in the stick or on the STONE.

OFFSET

When recently printed paper prints on to another sheet of paper because the ink is still wet, it is said to 'offset' or 'set off' on to that sheet.

OPENING

Any two facing pages, not necessarily conjugate.

ORNAMENT

A generic term for any of the kinds of decoration that printers use along with type--borders, flowers, rules, etc.

ORPHAN

A single line of type from the bottom of a paragraph left alone at the top of a column or page. Undesirable.

OVERLAY

Packing the tympan sheet very selectively with torn pieces of paper to increase pressure in selected areas of the printing surface in order to improve the quality of printing.

PERFECT

To perfect a sheet is to print the other side, one side already having been machined; the sheet is then said to be perfect (adj.). A perfecting press is one that prints both sides of the paper simultaneously. You would also say "work the reiteration" if you wanted to say print the other side-or at least you would if you lived in the hand press period. Nowadays printers say "back it up".

PICA

The old name for 12-point type; hence came to be synonymous with em.

PIE

Composed type which has been spilled and indiscriminately mixed (pied). To be avoided.

PITCH

The width of characters, or the number of characters fitting into a horizontal inch. To say '10-pitch' means that there are ten characters to the inch.

PLANE

To plane the type is to put a flat board, a PLANER, on top of the set type on the stone and hit it rather gently with a mallet. This to make sure that all the type is the same height.

PLATEN

The heavy flat plate which on a hand press pressed the paper against the inked type. A platen press is any press that operates by such a method, including therefore all hand presses (as opposed to a cylinder press).

POINT

The smallest unit of measurement used by printers: one 72nd of an inch. There are 12 points in an em and 6 ems in an inch.

PRELIMS

Properly, preliminary matter, the pages of a book that precede a text. A handy way of distinguishing between a first and second edition of a hand printed book is that in a first edition the prelims were usually printed after the rest of the book, and therefore are not included and otherwise undistinguishable in point of primacy, the one with the irregular signature run would be first.

PRINTING PRESS

Gutenborg's invention consisted of taking two techniques from two different spheres of activity and combining them to invent a third. From coining he took the idea of using a punch to make a matrix in which lead-alloy type could be cast in large quantities, each identical; and from the wine-press he took a means whereby firm even pressure could be applied quickly in order to print from this type. Both of these inventions - cast type and the wooden press making impressions with a combination of lever and screw - lasted unchanged except in minor details for 450 years, until 1800. Refinements to the hand press were introduced after this date: the Stanhope, which augmented the power of the lever; the Columbia, which replaced the screw with another lever; and the Albion, which replaced the screw with a toggle mechanism. All of these were mechanically more efficient and, since they were made of iron, more precise, but they were only successful in making more delicate and sharper impressions; they didn't make the output any faster than the original wooden common press. Much greater speeds were achieved with various kinds of machine presses usually based on the cylinder (i.e. mangle) and therefore long runs and massively selling books and newspapers; the social and cultural consequences of this are obvious. Only in the last ten years has it been possible to produce a machine, based on an entirely different principle from Gutengberg's original invention of letterpress printing, that combines the original virtues of small runs and small investment with the later achievement of fast production: this is the offset-litho press.

PROVENANCE

To investigate the provenance of a book or MS is to look into its origins, i.e. its history to its present whereabouts.

QUADS

Blank types cast less than type height, in standard point sizes, used as spacing material. Usual size are en, em, 2-3m, 3-em, and 4-em quads.

QUOIN

Pron. coin. Metal or wooden wedges placed between the outer furniture and the sides of a chase in order to lock the type and blocks in it during printing.

RAGGED

A ragged right hand margin occurs when type has been set unjustified; the lines are irregular in length and do not all reach the right margin.

RECTO

The right hand pages of a book, which bear the odd numbers; the versos are the left-hand, even numbered pages.

REGISTER

The exact correspondence in position of the printed area on the two sides of a leaf. Also known as 'registration'.

REGLET

Strips of oil-soaked wood used as inter-linear spacing material 3/4 inch high and 6- to 18-point thick.

REVISE

A further proof embodying corrections made by the author and/or reader and/or compositor to the first proof.

RIVERS

Unsightly white channels running through the lines of a printed page, caused when interword spacing material is set too wide.

ROTARY PRESS

A machine for printing from a revolving cylindrical forme to which paper is usually fed from a reel (if not, it is sheet-fed).

ROUNCE

The handle of the small windlass under the bed of the press that is used to run the carriage, with type on it, under the platen to be printed.

RULE

Strip of brass or type metal, type high, cast in point sizes. Used for printing straight lines. Now used to mean a line of any width, varying from a hairline to a wide dark bar. A SETTING RULE, however, means a brass (usually) rule used by the compositor to help set type: it sets the MEASURE, and is put on top of each set line of type in turn so that the new line to be set will not bind against the previous line.

RUNNING HEAD

Texts that repeats at the top (ie in the headline) of successive pages: the name of a chapter, for instance, or the title of a book.

SERIF

Cross-stroke at the ends of the strokes of letters, deriving originally from the finishing strokes made by the stone-cutter's chisel. Said to assist legibility because the letters seem more joined together in serif type; sans serif type is usually used only for technical manuals and display work.

SET

The width of a type body.

SET SOLID

Type set without leads between the lines is set solid.

SET-OFF

The transference of ink from the freshly inked impression on a printed sheet to the underside of the next sheet to be laid on it in a pile.

SHANK

The sides of the type or sort.

SHEET

The piece of paper on which printing takes place, before it is folded to form a gathering of two or more leaves, is called a sheet.

SHOULDER

the platform of a shank of type from which the face rises, i.e. the non-printing area surrounding the face.

SLUG

A line of type characters cast in one piece by a linotype machine.

SORT

A specific letter.

STANDING TYPE

Type which has been printed and which instead of being dissed is kept standing for reprints.

STEREOTYPE

a printing plate made by taking an impression from set-up type, or another plate, in a mould of plaster of Paris, papier mache, or flong; stereotype metal is then poured into the mould to form the printing plate.

STINT

The amount of copy allotted to each compositor.

STONE

Table bearing a stone slab or metal plate at which type is imposed.

STUB

The narrow margin which remains in a book when a cancel has been removed, and on to which a corrected leaf (cancellans) is fixed.

STUFF

This is the name given to the pulp of water and rag used to make paper.

TAKE

The amount of copy taken by a compositor to set up in type at any one time.

TYMPAN(S)

The tympans are two rectangular metal frames clipped together, each covered with tough paper or some stronger substance (canvas, for instance), and sandwiching packing material. They are hinged at one end to the bed of the press and at the other to the frisket. The paper to be printed is placed on the tympans.

WATER-MARK

When a sheet of paper is made by hand, it is normal to put a small raised wire pattern in the middle of one half of the mould. This presses into the stuff as the paper is made, and so the resulting sheet is thinner at where the wire pattern has pressed, forming an image that can be seen when the sheet is held up to the light. The water-mark was usually used as a trade-mark by the paper maker. This is imitated in modern machine-made papers, usually for decoration, or, in the case of banknotes, to deter forgers, who would have to make the paper themselves in order to imitate the distinctive watermark.

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WHITE SPACE or WHITE PAPER

AN area of type in the FORME or COMPOSING STICK that will not print; that is less than type high.

WIDOW

A single line of type from the top of a paragraph left alone at the bottom of a column or page. Undesirable.

X-HEIGHT

The height of lower case letters, excluding ascenders and descenders, i.e. the height of a lower-case x.