

LESSON TEN

PRINTING PROCESSES

Lithography and Offset

The introduction to this course made clear that we are concerned in our study only with what is called letterpress printing — that is, printing from raised letters, plates, etc. You as a printer or student-printer should, however, know what the other methods of printing are and for what they are used.

Lithography makes use of the unwillingness of oil and water to mix. Instead of a printing form of raised characters, the plate is absolutely flat, and formerly was a smooth slab of a certain kind of limestone, which takes grease and water equally well.

The stone or plate is given a coating which it absorbs just sufficiently to give a surface on which the design or lettering may be drawn, traced or transferred. The coating takes water but repels ink. The lines of the design repel water, but take ink, so that when the ink rollers pass over the stone only the design is inked. The rest of the plate is kept damp. Before printing, the design is very slightly etched into the stone, but not enough to make any material difference in the height-to-paper of any part of it. Lithography is used for a wide variety of label, picture and calendar printing, but the larger part of it is offset lithography, a later development of the older stone method. Zinc and aluminum plates have also superseded stones for ordinary lithography, to a large extent.

From straight lithography has developed offset printing, in which the design is not printed directly on the paper, but instead on a rubber cylinder, which in turn transfers it to the stock being printed. Offset is a big industry.

Another offshoot is the smaller equipment such as the Multilith, which uses the same principle. The cheapest offset presses, such as are found in some factory offices, cost several thousand dollars, so they do not compete with letterpress printing unless quite a fair volume of certain kinds of work is available.

Copperplate and Steel-plate Engraving

In letterpress printing our printing surface (type, cuts) is raised. Copperplate and steelplate engraving uses the exact opposite — the lines or letters to be printed are engraved or cut into the plate. Ink is squeezed into the depressions, and the polished surface of the plate wiped to make sure no ink will remain on it.

Copperplate engraving is used for high grade announcements, invitations, cards; to some extent for stationery, and for other work in which cost is a minor consideration. Steel plates, hardened after being engraved, are also used, for instance on U. S. paper money and postage stamps, as well as bonds.

Printing is done on everything from a hand inked machine looking superficially like a proof press for short runs, to the big rotary curved plate machines used in the Bureau of Engraving and Printing, Washington, for postage stamps. The paper is slightly dampened for printing, as it must be forced down into the depressions of the plate. It is, therefore, often possible to distinguish between engraving and raised letterpress printing (thermography) by examining the back side of the sheet or card. It should not, however, be confused with embossing done with dies. The latter usually has a much more pronounced lift on one side and depression on the other, although such embossing is

sometimes done in connection with engraving by using a countersunk die.

In the days before the halftone, many very fine steel and copper-plate engraved portraits and other pictures were used in the better grade of books, but other processes have pretty well superseded them.

Rotogravure

This process, which travels or has travelled under a number of different names — rotary photo-gravure, gravure, etc., is nearer related to engraving than letterpress printing. All processes using recessed instead of raised printing surfaces go under the general name of intaglio. This is one of them.

Printing is done from a copper cylinder on which the design is etched, and by means of photography all sorts of work may be reproduced. In fact, camera equipment for this process is as important as the press itself. The public is most familiar with it in colored sections (not the comic) of Sunday newspapers and in various picture and movie magazines.

Halftones for letterpress printing get their shaded effects from larger or smaller dots. Gravure uses the same size depressions or dots all over, but they are of varying depth, thus capable of holding varying quantities of ink when on the press. A doctor blade wipes off the surface of the plate before printing, since printing comes only from the depressions, same as on copperplate engraving.

Collotype

Collotype is a photo-gelatin process closely related to lithography, in that it uses the principle that grease and water repel each other. However, the gelatin surface of the plate is treated to a glycerine solution, which, like water, is repellent to ink, rather than water

itself. No screen, dots, or other devices are used for shading, the surface of the gelatin itself providing gradations. The result is the nearest to a photographic reproduction obtainable by any printing process.

Collotype plates do not have the durability of most other kinds, and they are, therefore, used on comparatively short runs for very high grade work. Collotype printing is a highly specialized branch of typography, with relatively few firms in the business.

Lithography, offset and collotype all come under the general heading of planography — processes which use plates which are practically flat, as contrasted to our own letterpress (relief plates) and intaglio, (gravure, rotogravure, copperplate and steelplate engraving).

There are numerous modifications of the various processes, which need not be described here.

The Various Kinds of

Plates and Cuts

The new printer or student is apt to have a very hazy idea of cuts, plates, slugs, etc. Slugs, as explained elsewhere, are strips of metal six points or more thick — similar to leads, except that leads are one or two points thick. However, linotype or other machine composition materials are called slugs when made up in line form.

The word cut also seems to give trouble. A cut is any kind of block or plate which has on it a design which may be used to print from. It is an abbreviation of the old term woodcut, a survival from the days when there was very little else that a printer could use for illustrative purposes. Nowadays the word is used indiscriminately on halftones, line etchings, electrotypes therefrom, and anything else of that nature.

Some beginners erroneously use the word cut to describe an elec-

trotype or stereotype of a form of type.

Stereotypes, Electrotypes and Plastic Plates

Stereotypes, like electros, are duplicates of a form made up of type, cuts or both. They are made by taking a cast of the form with a matrix or mat under heavy pressure, from which mat a casting is made. The metal is usually harder than linotype, but softer than foundry type. Newspapers, except for small ones, make stereotypes from which they run their editions. As many duplicates as desired can be produced, so that the paper can be run on several presses at once.

Up to 1839 stereotyping was the only cheap method of duplicating forms, and it had wide application in the book business, among others. In that year electrotyping was introduced in both England and America. At first the process was quite slow, since plating was done by batteries, later generators were used which greatly speeded up the process.

Just as in the case of stereotyping, to make an electrotype requires a form of type, cuts, or both. The face of the form is coated with black lead (plumbago) and a wax impression made. The black lead prevents the wax from sticking to the form. It also acts as a conductor of electricity on the wax when the latter is hung in the plating or electrotyping solution. Wax, being a non-conductor, would prevent the process from working.

The wax impression, then, is hung in the plating tank with anodes or bars of pure copper, which, through electrolytic action, takes copper from the bars and deposits on the wax impression — the thickness of the plate depending on the voltage of the current and the length of time the

wax is left in the tank. When the proper thickness has been plated, the case, as it is called, is removed from the solution, the wax melted out with hot water, and after a number of operations not necessary to detail here, the copper shell acquires a lead-tin-antimony backing and a wood base, unless it is to be used on a patent base, in which case it is beveled and delivered without the wood. In all there are about 20 operations to make an electrotype.

Thermoplastics are gradually supplanting wax in electrotyping, and a silver spray is coming into use to eliminate plumbago, but the general process is unchanged.

As you can see from this, neither electrotypes nor stereotypes can be made until a form is set up, or an original etching or other engraving is made for the pattern.

Other Duplicate Plates

Plastic plates are being used to some extent by printers and by periodicals whose publishers wish to print them in several places at once, the lightness of the material making it possible to ship them by air. In such cases high plate cost is not a deterring factor. Rubber and other composition plates have also had a certain amount of vogue in the last few years, but they are expensive.

Plastic plates are also widely used in place of metal electros, as they are light, strong, durable and competitive in price.

Line Etchings

Zinc or line etchings are one of the most common forms of original cut. These and halftones, make up the big bulk of original cuts for ordinary printing. Line etchings can be made from pen-and-ink sketches, and most types of illustrations which do not have shading.

Both line etchings and halftones come under the head of photoen-

graving, a specialized business which is very seldom included in a printing plant unless it publishes a daily newspaper. Speed rather than quality or cost is usually the aim of newspaper work. The printer finds it more economical to buy his cuts.



A Line Etching

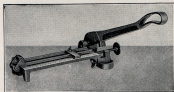
Line etchings are made by transferring the design to a plate photographically, then eating away (etching) those parts of the plate which are not required to print, leaving the design or cut on the metal (zinc, copper, magnesium or alloy). It is then mounted type high if it is to be printed from. Frequently duplicate plates are used, and the original etching saved so that it can be used for more copies later, without being subjected to wear on the press.

In planning on cuts it is important to remember that red, deep yellow and green photograph black. Black lettering on a red background, for instance, will make a solid blank — no visible lettering. On the other hand, light blue will not photograph at all. All original work should, if possible, be done in black on white, preferably india ink on drawing board.

Halftones

Photographs, wash drawings, pencil shadings, and other work which have grey tones and deviations from plain blacks and whites cannot be reproduced by a straight zinc etching. These middle tones must be broken up into dots, larger or smaller, but even the largest of them minute. The half-

tone process accomplishes this. Examine any halftone picture with a magnifying glass, and you will see that the dark areas are made by dots which are so big that they run together. The lighter the area, the smaller the dots, which leaves more white space between them. The eye surveys the picture without a magnifying glass, and gets the over-all



Fine Screen Halftone

picture of light, shade and solid without the dots being particularly noticed.



*Halftone with background cut out
(Course Screen)*

In addition to normal halftones, we show an enlargement of a portion of one. The very smallest dots are referred to as highlight dots; the areas which appear solid, with little holes in them, are called

shadow dots. The part with the shadow dots prints darkest, of course, while the area of highlight dots prints lightest. The variation between these two extremes gives the various gradations from light to dark.

This breaking up of the photograph or wash drawing into dots is accomplished by putting a lined glass screen between the camera and the picture. If the halftone is to be used on newspaper, a coarse screen with comparatively big dots is used, because a cut with fine dots would make a muddy reproduction on the rough, absorbent surface. On a good enamelled paper a halftone with fine dots is preferred, because the smaller the dots, the better the reproduction will be. A 65 or an 85 screen cut (65 to 85 lines each way to the square inch, respectively) may be used for poor paper, with a 120 or 133 screen for work on better paper. These are common screens, but many others are used, including even finer than 133.

Having been broken up into dots, the cut can be etched, in a manner similar to an ordinary line etching. Zinc, magnesium or alloy plates are commonly used for the coarse screens, and copper for the fine ones.

The original drawing or photograph for line etchings and halftones should be at least as large or larger than the desired cut size, but not more than six times bigger, for economical costs. The original should be in direct proportional shape to the intended cut, because the engraver cannot

change the length in relation to the breadth without very fancy and expensive manipulation which not all are equipped to perform. In other words, if a drawing, 4x6 inches, is to be made into a cut, say 3 inches long, the width would have to be 2 inches, or if it is to be 3 inches wide, the length would of necessity be reduced by one-quarter, also, or 1½ inches, making it 4½ inches long.

Do not forget that 10 square inches and 10 inches square are two different dimensions. A cut 10 inches square is 100 square inches in area, or ten times as large as a cut containing 10 square inches.

Remember also that when a drawing is to be reduced in size, reducing the AREA by one-quarter, for instance, is quite different from reducing the length and width by one-quarter. A drawing 4x6, if reduced by one-quarter in length and width, will be 3x4½, or 13½ square inches, whereas if



- 1 Draw lines A-B-C-D around copy
- 2 Draw diagonal line A-C
- 3 Measure desired width A-1
- 4 Draw a vertical line 1-2 up from point 1 on diagonal A-C

The proper way to get proportion of reductions

it is reduced in AREA by one-quarter, the result is 18 square inches, and dimensions of approximately 3½x5¼.



A small section of a greatly enlarged Halftone

Instructions to an engraver should be very explicit on these points, to prevent mistakes or delay.

Combinations of line etching and halftone can be made, but usually cost two or three times as much as an ordinary line etching (line cut). This can usually be avoided if the customer knows this and has his art work prepared accordingly. Benday shading, mentioned on page 7 is often a good alternative. Grey or other pattern shading can be indicated by the artist, who uses a piece of tissue over the top of the picture to indicate what areas shall be shaded. The engraver carries on from this. The shading cannot be put on the drawing itself, it must be on separate tissue, or simply indicated on the tissue.

Cleaning Halftone Cuts

Did you ever put a penny in vinegar to make it as bright as new? The same principle may be applied to cleaning halftone cuts with good results, because they have a copper surface. Instead of using common vinegar, however, it is best to purchase a little acetic acid (vinegar's near relative) obtainable at drug stores and most paint stores. First put salt on the cut, and pour a little acid on. Rub the cut vigorously with a good stiff brush, getting the bristles down into all the crevices between the dots of the screen. Wash out the acid and salt with warm water, being sure to do an absolutely thorough job, so that the chemical action will go no further. You will then have a cut that will print as good or better than new—in fact, some printers do this to new ones because they claim the finer parts of the cut come out to much better advantage if so treated.

Color Plates

For colored illustrations in line etching technique, a separate cut is made for each color, with the

raised or printing portions on each corresponding to the portion which is to be printed in that particular color.

The making of color plates from colored photographs, paintings, etc., is a much more complicated process, because not only must each color be separated so as to provide plates for the separate colors, but normally they are reproduced by the four color process — that is, only four different plates and printings must take care of all the colors and tints. There will be a plate each for red, yellow, blue and black. Combinations of dots in these four colors must create in the eye images in brown, purple, green, etc., as well as the normal blues, yellows and reds with all their variations.

Such plates are made photographically, color screens separating the parts required for each plate. Hairline register and better is required, and unless each plate is identical in size with the rest it will not be possible to get satisfactory results. Shrinking or swelling of the paper between printings of colors is enough by itself to throw the whole job out of gear. Of late years air conditioning has helped to keep four color process printing from being the headache it used to be.

Much color work is, of course, done with line etchings, one for each color. One or more plates of a set may be a solid color or tint block. Careful register is required, but that is not so serious a problem as it is with four color process work. Aside from ordinary tint blocks or solid colors, there are various pattern, dot and screen effects which may be used by the engraver when making the plates, or which the artist can put on with screens or films before the work is given to the engraver. The crudest form of these may be seen in the colored comic section of Sunday newspa-

pers. Such effects are made with what are called bendy screens, after the man who originated them. The term is so common that the name is no longer capitalized or divided.

Tint Blocks: Linoleum

Blocks, Etc.

Many different kinds of type high blocks can be and are used for tint blocks or background colors. Included are wood, rubber, composition, plastic, metal and linoleum. Printers can and often do make their own simple shapes from the softer of these materials, such as plastic, rubber or linoleum. A



A Linoleum Block Cut

person who is at all handy with a pen or brush can make very effective decorations or simple illustrations. Linoleum block cutting is taught in many art classes.

The Printer's DICTIONARY

Dash—Horizontal lines (—) used both between words and between lines of type. Not to be confused with hyphens (-). Also made in ornamental and fancy styles for use in separating parts of printed matter.

Dead Matter—Type in a form or otherwise which has been used, and is ready to put back into the case, or to throw into the melting pot. A form which has been run one or more times, and is being kept for future re-runs is NOT dead matter.

Deckle Edge—The rough, feathery edge on some kinds of paper. A genuine deckle edge is caused by the process of making the paper. The paper comes from the machines in a continuous strip, the outer edges of which are deckled. Hand-made paper has a deckle on all four sides, being made in sheets instead of continuous strips. The popularity of deckle edges for some work has caused paper companies to make paper with an artificial deckle, much of which is easy to detect if the appearance of the true deckle edge is known.

Dele—Abbreviation of delete—see below.

Delete—Verb meaning "take out," as used by proofreaders. See the list of proofreaders' marks in Lesson 3.

Descender—That part of lower case letters lying below the common line of the type's body. The letters y, p, q, etc., have descenders.

Detergent—Cleaning solution or preparation for making such a solution.

Devil—The printer's devil is the boy in the shop who does the odd jobs and runs the errands. Like all boys, (and grown-ups, for that matter) printer's devils have their failings, hence the lack of respect implied in the term.

Dextrin—Substance used in making gum for envelopes, stamps, labels, etc., a starchy adhesive made from the sap of certain plants.

Die-cut—Cut out paper or cardboard through use of metal (steel or brass) either in rectangular circular or any fancy shape. Die-cutting may be done on a printing press with steel cutting rule.

Dieresis—Accent mark consisting of two dots (as in *ö* of *coöperate*) to indicate pronunciation.

Die Sunk—A panel, such as on wedding announcements or pan-

elled cards, made with a die or block.

Die-stamping—Printing and embossing through use of dies which make an embossed impression, and which also, by means of ink forced into the depressions of the die, print the words or design as well. All plate engraving is a species of die stamping, although on cards, stationery, etc., the embossing may not be very prominent.

Diphthong—A vowel sound made up of two identifiable vowel sounds immediately following each other and pronounced in one syllable, as: of in point, ox in house.

Display—That portion of a job, which is given prominence by the use of larger type, or with the use of white space around it, etc.

Distribution—The return of type, leads, furniture and all material used in a printed job to their proper places in the cases, etc.

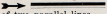
Ditto—Sign meaning "same as above" (").

Dodger—A handbill, usually printed on cheap paper.

Dotted Rule—Rule with dotted face (.....).

Double Dagger—A reference mark (‡), put up in the fonts of auxiliary characters.

Double Leaded—Work spaced between the lines with two 2-point leads.

Double Rule—Rule having a face (like this)  consisting of two parallel lines.

Drawsheet—The top tympan sheet on the press.

Drier—A substance used in inks to make them dry faster.

Dummy—A general layout for a booklet or folder, or a preliminary sketch of any printed matter.

Dump—Place where type matter and forms are put which have been used and are ready to be redistributed to their proper places.

Dwell—The short pause made by the form when in contact with the paper, on a platen power press.

E

Edition—Each separate printing of a newspaper, magazine, book or any printed job in which some alteration has been made, is an edition. In book printing they may be referred to as impressions or printings, especially when there are no alterations.

Editor—In addition to the commonly understood definition, there is that one which defines as an editor any one who prepares or revises (that is, edits) matter for publication or printing. You will sometimes hear, "That will require a little editing," which usually means changing through revision, modification, abridgment, etc. Going back to the more common definition: in old days the editor usually was supreme, often publisher as well, but nowadays the publisher is often the owner, a separate person from the editor, who is often a hired man or employee. In some organizations even the publisher may be a salaried employee.

Editorial Matter or Editorial Contents—Not to be confused with the editorials or the editorial page of a publication. A publisher or printer when speaking of the editorial matter refers to all of the contents except advertisements, in other words, that part which the editors furnish as contrasted with that part which the advertising department sells to advertisers.

Eggshell—A finish on some book papers, which as the term implies, resembles eggshell. Such paper is often spoken of as antique finish. It is used very generally for book printing and for some magazine work. It should not, however, be confused with newsprint, which is much cheaper, and which is used in some of the cheaper "pulp" and fiction magazines.

Ellipsis—Indication, usually in the form of several periods (. . .) to indicate omission of a word, sentence, or more from the original manuscript. Also used in stories to indicate a lapse of time.

(To be continued)