Platemaking Procedures for LITHOGRAPHY

By R. J. BURNETT

AT the present time, paper, presensitised, aluminium, anodised aluminium, zinc, bi- and trimetallic plates are available for use in offset printing. Selecting the right plate for the right job naturally calls for a knowledge of their individual printing qualities and characteristics. The factor determining choice may be one of cheapness, simplicity in processing, high quality of image reproduction, or an ability to stand up to long runs. Plate selection will also be influenced by the nature of the printing plant available *eg* machine size and the scope of platemaking facilities, though these factors do not relate to individual plate printing qualities.

Litho platemaking methods may be divided into two main categories: (1) Where the establishment of the ink-receptive image areas is achieved by exposing through a negative on to the light sensitised surface of a printing plate, the exposed areas of the light sensitive coating becoming the actual printing image base and (2) Where a positive is exposed to a light sensitised plate. This method is often referred to as a 'reversal' process, in that the exposed coating areas form a hard stencil resist surrounding the non-exposed areas. These non-exposed areas once dissolved are made chemically ink-receptive and become the printing image area.

In both these basic methods of platemaking, the negative or positive is secured in close contact against the applied light sensitive coating on the plate surface. Exposure to light hardens the coating beneath the transparent parts of the negative or positive. The opaque areas on the photographic transparency used prevent light action on the coating beneath; these coating areas, being unexposed, are unhardened. These unexposed areas are developed (dissolved) from the plate. Methods of development, including solutions used, vary with the type of light sensitive coating – as do the subsequent treatments necessary to the establishing of the image and non-printing areas on the plate.

It would be appropriate, at this point, to mention one recently introduced exception to these two major techniques – the positive working presensitised plate where exposure to light causes a breakdown in the composition of the light sensitive diazo compound coating. However, it is preferable to discuss this and other presensitised plates in a later article.

Light sensitive coatings consisting of a colloid, sensitising agent and preservative are coated and dried on to the plate surface. Briefly, colloids are substances of large molecular structure which can coagulate to a thin continuous film. Egg albumen, casein, arabic gum and polyvinyl alcohol are the main colloidal substances used in litho platemaking. Mixed in their correct ratios with ammonium dichromate (the light sensitising agent), these solutions when coated and dried on to the plate surface become, upon exposure to actinic light, hard and insoluble. Exposure to actinic light (blue spectral wavelengths in the region of 350 millimicrons) besides insolublising the coating, also creates a colour change. To date, the sensitivity of dichromated colloids to light remains something of a phenomenon – insofar as the chemical change which occurs cannot be expressed as a chemical equation. In actual practice, the 'speed' of the coating used is relative to the amount of light required to harden the coating properly. Expressed simply, a coating which requires a shorter exposure than another is considered to be 'faster'. Variations in atmospheric conditions affect the speed of dichromated colloidal solutions, the higher the temperature and relative humidity the faster the coating and the shorter the exposure. This important factor makes the installation of air-conditioning in the platemaking department an essential step towards standardising platemaking procedure. Such plant is preferably regulated to readings in the region of 68–70°F and 50–55 per cent RH.

A whirler is used to coat the light sensitive solution on to the plate surface. Having been first chemically cleaned (prepped) the plate is clamped to the plate support. In this position, water is flowed over the plate and the motorised plate support set in motion. The plate clamped to the support revolves (whirls). The water is turned off and with a minimum of surface water on the plate, the light sensitive coating is poured on to the centre of the revolving plate. Centrifugal action evenly distributes a film of coating over the plate's surfaces. Closing the whirler lid, to avoid dust spoiling the coating, the heating elements and electric fan are switched on. Thus the coating is finally dried on to the plate. Before coating plates, care must be taken to filter the light sensitive solution. In pouring the coating, air bubbles should be avoided as these form uncoated areas on the plate on bursting. The whirler in the illustration has a coating arm, at the end of which there is

a coating container with pouring tap to eliminate, as far as possible, human error in pouring on the coating. Finally, the speed of the revolving plate is regulated by a rheostat, the faster the speed the thinner the film of coating obtained. Primarily the thickness of coating required is dependent on the nature of the plate surface – the smoother the surface the thinner the coating required.

When dry, the coated plate is placed on the rubberised support of a printing down frame, which is connected to a vacuum suction pump. Once the negative or positive is positioned (emulsion side of transparency to coating) in the required printing position, the glass frame is lowered and locked. Switching on of the suction pump creates a vacuum within the frame; the raised rubber beading surrounding the rubberised plate support forming an air tight seal. This vacuum brings the plate, transparency and glass frame into close contact ready for exposure.

Having achieved the necessary close contact between the transparency and coated surface of the printing plate; the exposing light source (arc) and printing down frame are fixed in their relative exposing positions. A variety of exposing light sources, all capable of emitting the requisite amount of blue light

Above right, a Lithotex whirler, used for coating plate surfaces with light sensitive solution; above left, a printing down frame with glass in raised position; and below, a plate being exposed

emission, are employed in the trade *eg* arc lamps, mercury vapour, fluorescent and ultra violet lamps. It should be noted that pure ultra violet light will not penetrate the thick plate glass used in most printing down frames. Where ultra-violet lamps are used a transparent plastic sheet is often substituted for the usual plate glass to overcome this difficulty.

A number of variables affect the length of exposure time ultimately decided upon. When dealing with the chemical structure of the dichromated colloidal coatings the effect of fluctuating atmospherics was shown to influence exposure times. Additional factors affecting exposure are (1) the dichromate-colloidal ratio of the coating, (2) thickness of coating film, (3) power of exposing lamp and (4) distance between exposing unit and the plate being exposed. When it is realised that in addition to these variables there are others, such as quality of the photographic transparency, dark reaction, etc – it would suggest that deciding upon an exposure time is an extremely complex problem.

It is fortunate that when a fixed control is applied to all the materials and apparatus used, it is found in practice to be relatively easy to arrive at a given exposure time under the given conditions.

Test exposures having been made, the reproduced image on the plate (after processing) is compared against the photographic transparency used. The length of exposure, which has most faithfully reproduced in size and definition the halftone dots or lines on the test negative or positive is usually adopted as a standard time.

It is after exposure that the variation in methods used in the different processes occurs. An outlined description of the commonly used albumen and deep-etch plates will serve to show the difference in developing and after treatment methods.

In the albumen process a negative is exposed to a light sensitive coating, in which egg albumen is the colloidal vehicle. On a negative the image – or work areas – is transparent allowing the light action to harden the coating beneath these areas during exposure. After exposure a thin film of non-drying liquid ink is applied and smoothed down over the surface of the plate. Development of the inked-up plate is carried out under running water and is assisted by gently swabbing with cottonwool. The unexposed, unhardened albumen coating, being soluble in water, swells loosening its hold on the metal surface of the plate. These unexposed areas together with their covering ink film are swabbed off the plate leaving the insolublised (exposed) image areas, complete with adhering ink film, firmly established on the printing plate surface.

Having established the ink receptive albumen based printing areas, the plate is dried and chalked. At this stage the metal surfaces of non-printing areas, being still chemically clean, are sensitive to ink. In order that during the printing run these non-printing areas will more readily accept water – thus repelling ink – the platemaker desensitises these metal areas by applying a plate etch. Generally the plate etches most commonly used are acidified arabic gum solutions (*p*H 2·5–3). The acid content of the etch in freeing the carboxyl and hydroxyl groups of the arabic gum produces a tightly adhering water acceptive (desensitised) surface on the metal surface. Etching the plate to increase the wettability of the non-printing areas is an absolute essential, without which the grease and water separation of printing from non-printing areas would not be a practical proposition.

Finally the dried down plate etch is washed off and the entire plate surface is covered with a smooth thin film of arabic gum (10° Baumé). This preserves the plate against damage in handling and against oxidation. Processing completed the finished albumen plate is ready for machine printing.

In contrast to albumen, the deep-etch process is a reversal process, and more platemaking operations are required in producing deep-etch plates. The printing areas of deep-etch plates are lacquer based and recessed whereas those of albumen plates are hardened albumen adhering to the plate surface. Exposure in the deep-etch process results in a hardening of the coating in the non-printing areas. This creates a hard gum stencil which surrounds the unexposed printing areas, which were shielded during exposure by the opaque image areas on the positive.

After exposure of the deep-etch plate, it is necessary to use a high density saturated salt solution (40° Baumé) to dissolve develop the unexposed gum in the image/printing areas. The light sensitive gum coating (14° Baumé), even when hardened by exposure, remains water-soluble, making a water development, if not impossible, most impractical. In developing the gum from the printing areas a soft bristle brush or felt pad is used to work the developing solution over the plate. Development is complete when all traces of gum coating have been removed from the unexposed image areas, the developing solution then being squeegeed off the plate. The plate at this stage has a hard gum stencil surrounding the now visible metal in the printing areas. The next step in the process requires the platemaker to recess (deep-etch) these visible metal image areas.

Deep-etching the plate may take from one to three minutes depending on the acid-reaction of the printing metal and acid content of deep-etch solution used. As with developing it is necessary to use a saturated salt solution (45° Baumé) to avoid a breakdown in the background gum stencil. This of course is the operation which gives the process its name. Yet, it must be noted that the term 'deep-etch' refers to a relatively small depth which is estimated at between two to three ten thousandths part of an inch (0·0002–3-inch)! Nevertheless, slight though this recessed printing image may be, it reduces the amount of friction on the printing image during running on the press.

Upon completion of the deep etching step, all traces of the chemical solutions used must be removed and the plate made thoroughly clean.

Cleaning off the plate is accomplished by several applications of anhydrous spirits *eg* alcohol, methylated spirits, isopropyl alcohol, etc. These water-free spirits are repeatedly swabbed over and squeegeed off until the plate is sufficiently cleaned. The purpose here, is to ensure proper adhesion between the lacquer base and the metal in the printing areas.

Lacquer base is a vinyl resin liquid solution which when applied and smoothed down into the recessed image areas dies to a tough thin film. Combining the advantageous properties of high ink-receptivity with an ability to withstand the acids used in the lithographic process, this lacquer base forms a durable printing image base. Lacquer base applied, the plate is inked up and given a dusting with a protective coating of chalk.

Inking-in is a simple operation. The platemaker covers and smoothes down a thin film of non-drying liquid ink over the work areas of the plate and dusting with chalk. It only remains to remove the hardened gum stencil from the non-printing areas.

Gum stencil removal is perhaps best achieved by immersing the plate in hot water (90°F) and scrubbing off using a a bristle brush. After removal of the gum stencil, the plate can be wiped down, and, if no deletions or additions are required, gummed up ready for machine printing. Unlike the albumen process there is no real need in the deep-etch process to use a plate etch to increase the wettability of non-printing metal surfaces. This has already been accomplished by virtue of using a gum arabic light sensitive coating – the presence of the gum desensitising the plate.

It is the inability of albumen plates to produce long runs which fathered the invention and introduction of the deep-etch plate during the 'thirties. This need for a more durable printing plate, able to withstand mechanical abrasion on the press, was met by the recessed lacquer based image of the deep-etch plate. The actual print impression from a recessed (deep-etched) image is sharper (better definition) than that from a surface (albumen) one – the latter having a tendency to 'squash'.

Produced from positive transparencies a better control and evaluation of tonal values can be made during the reproduction and deep-etch platemaking processes. Deep-etch plates then, are better suited for higher quality and longer run printing orders. But of course the albumen plate justifies its continued use in the industry, in that it is a relatively cheap reproduction and platemaking process quite suitable for many short run jobs.

Anodised, bi-metallic and presensitised platemaking procedures will be dealt with in a subsequent article. ◇