THE APPLICATIONS OF LITHOGRAPHY TO THE DECORATING OF METAL CANS

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ABSTRACT

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TO THE DECORATING OF METAL CANS

By Stephen P. Wolf

This thesis has been concerned with the applications of the lithographic printing process to the decoration of metal cans. The lithographic process is used extensively in the United States and other parts of the world in decorating on metal substrates. Metal decorating is a highly specialized process.

It has been the purpose of this thesis to research the lithographic process as it has applied to the decorating of metal cans. Considered were conventional lithography and dry offset lithography. The merits and disadvantages of each was discussed. Also covered was the form in which these substrates were decorated, including flat sheet and in the round. Discussion of substrates, inks, coatings and other materials essential to the process were included.

In addition, the lithographic trade union and its relationship with other graphic arts craft unions was examined. Of main concern was the merger between the lithographers and the photoengravers and the effect of the merger on collective bargaining.

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TABLE OF CONTENTS

METAL DECORATING AND THE CAN INDUSTRY

Introduction. The growth of the metal decorating field in the can industry is due to the general increase in the consumption of all products. In packaging today, the prime word is convenience. This includes the ease of selection, choice of a size, convenient price, easy carry home, easy opening and ease of use and disposal. This is especially true in the beverage field.[1]

In 1966, approximately one third of the can production or twenty billion cans were used for beer and soft drinks. Of these, thirteen billion had easy opening lids.[2]

Total production of metal cans in 1966 was estimated at about 53.5 billion units.[3]

The metal can is practical in that is will resist heat, cold, moisture and rough handling during transportation. The metal container greatly extends the shelf life of many products.

The average consumer does not realize it, but the appearance of the label on a product may influence his selection of that product. He consumes the contents and discards the container without realizing anything about

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[1] "New Directions," Packaging Encyclopedia (1967 ed.), vol. 40, p. 15.

[2] Ibid., p. 15.

[3] "Metal Cans," Packaging Encyclopedia (1967 ed.,), vol. 40, p. 316.

the printing process that persuaded him to buy the product. Many consumers still believe that all metal containers are decorated with paper labels. The consumer is unaware of metal decorating simply because the conservative nature of the industry tends to hide the process.[4]

The growth of the metal decorating industry is also due to the change in package designs and costs of raw materials. Although the cost of the capital investment for converting to metal decorating is high, the ultimate cost for paper labels and metal decorating is roughly the same.[5]

The scope of the industry is amazing. Multicolored products confront the consumer everywhere. Examples are beer, juice, coffee, motor-oil cans, pressurized spray cans for cosmetics, closures for jars and bottles and other containers of many shapes and sizes. The metal decorating industry could not have developed as it has without the invention of lithography.

Invention of Lithography. Lithography was first discovered by Alois Senefelder in 1798 in Bavaria. Senefelder's experiments involved the use of

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[4]R. E. Whitworth, "Printing of Metal," Visual, vol. 2 (Nov., 1964), p. 8.

[5]Ibid., p. 10.

a water absorbing limestone used as the lithographic form. The image was drawn on the dry stone with a greasy crayon or liquid tusche. When the image was complete, the stone was etched with an acidified gum arabic solution. When the gum dried, the crayon was washed away with turpentine and liquid asphaltum was put in its place. Thus, the water repellent base image was formed. The stone could then be washed with water and rubbed down to just a damp condition. Ink was applied to the images with rags and then rollers. This is essentially the lithographic process in its infancy. In lithography, the separation of image and non-image areas is said to be chemical. The natural antipathy of water for grease is used as a basis for the separation of printing from non printing areas. The lithographic plate has a plane surface and is sometimes referred to as a planographic printing process. The image areas are made highly grease receptive so they will take ink and repel water. The non-printing areas are made water receptive so they will, when wet, repel ink.

Both the water rollers and ink rollers contact the entire lithographic plate, but only the image area takes ink when the plate is dampened properly. This is the reason that conventional lithography employs water in its process. In dry offset, the printing areas of the plate are raised above the non-printing areas. The inking rollers touch and deliver ink only to the high parts of

the plate. Both conventional and dry offset plates will be discussed at length later on in this paper.

Lithographic Presses. On a modern sheet-fed metal decorating or paper press, printing is accomplished by means of a three cylinder unit. The first cylinder is the plate cylinder because it carries the plate. It is generally the uppermost cylinder of the three because it is accessible to the inking system.

The second cylinder is the blanket cylinder which carries a sheet of fabric covered with a film of rubber wrapped around the cylinder. The blanket picks up the image on the plate and transfers it to the sheet being printed. The advantage of this process is the high fidelity of transfer. The rubber blanket is able to pick up the finest dot on the plate and transfer it to the substrate.

The third cylinder, the impression cylinder, is responsible for the transfer of the impression and carrying the sheet to the delivery end of the press.

It is possible to print multicolor sheets by either passing them through a single color machine the required number of times, or using straight line feed tandem units. Some manufacturers allow for a changeover at a later date to a tandem press simply by adding additional units. The sheet control mechanism on the additional unit is identical to that of the first, therefore hairline register is assured.

The Hoe press manufacturers claim that tandem presses have been built in as many as four units and are extremely efficient in minimizing the costs of color work. The tandem press can be run at considerably higher speeds than old style one unit two-color presses and wet colors can be printed directly over one another. A tandem printing press allows the pressmen to produce superior lithography in color work.

The press size most commonly used today is the 34" x 36" press on which the greatest majority of metal food and beer cans, metal crowns and other products are manufactured. The 50" x 77⅛" press is the latest Hoe development, primarily for the decorating of steel drums and other large metal containers used for packaging oil and other liquids, paint, varnish and semi-liquid products.

The running speed of 5,100 sheets per hour on the smaller presses is the speed at which the presses are actually being operated in plants.

In the decoration of cans manufactured by the impact extrusion method or the drawn and iron process, the Rutherford or Levy Cylindrical Printers are being used. The extruded and drawn and iron cans are seamless and are decorated in the round on the cylindrical printing machines.

Rutherford claims that their machine prints four hundred cylindrical containers per minute. These presses utilize the dry offset process to lay down all four colors

on the blanket cylinder in one pass. This, in turn, is rolled on to the container as it passes through on a revolving mandrel. The machine may be used for containers from 1½" to 3'" in diameter and up to 8" long. It will print four colors and overprint a varnish. The quality which Rutherford offers by incorporating the dry offset printing process is excellent. It transfers the image to an intermediate or blanket cylinder and then to the surface to be printed. The dry offset plate is a relief plate. It has a clearly defined image .015" higher than the image on a deep etch offset plate. It is considered a long running offset plate with the number of impressions ranging in the low millions.

Levy claims their machine will print on an aluminum extruded can at a rate of six hundred cans per minute.

Lithographic Troubles. The lithographic printing process runs smoothly when all conditions are carefully controlled. There are a number of variables in the process that may hinder reproduction. These variables are the non-image area, the image, plate failures and mechanical failures.

The non-image area is the area of the plate that does not print and is made to resist the acceptance of ink in two ways. They are called desensitized areas. When properly formed they accept only water.

When the lithographic process went from stone to metal,

a desensitizing etch was developed that would work if the metal was coarsely grained. The grain formed wells to hold water and increase the specific areas of the plate.

With the introduction of photomechanical plates and camera halftones, the coarse grains were no longer satisfactory. Finer grains mean that finer screens may be used and better formed dots will be printed. Less water used on the press means more brilliant colors on the sheet with less ink.

The printing areas or images on stone were usually coated with a film of asphaltum. This also did an excellent job on metal plates. Asphaltum is highly ink receptive, resists water and does not lose its ink affinity when plates stand waiting for press. The image areas must be highly sensitive to ink and highly resistant to dampening solutions. They must at all times be protected with a healthy film of ink

The entire art of lithography depends upon the chemical separation of image and non-image areas. The plates, being flat, are contacted all over by both water and ink rollers. Therefore, the surface must be chemically selective with each area accepting what is meant for it and repelling the other. No matter how well a lithographic plate is made, it can be ruined by poor handling on the press.

Plate failure is another variable that hinders metal decorating. Most plates are spoiled because of too much of something. Plates will not print properly if there

is too much ink, too much roller pressure, too much plate to blanket pressure, too high a blanket, too thick gum and too much asphaltum.

If the pressman runs too much ink for any reason at all, there will be trouble. The allowable variation in ink film that can be successfully used on a plate is rather small. The minimum amount is where there is danger of exposing the image to the dampening solution. The maximum is where the halftones start to fill up. Between minimum and maximum, there is a narrow safety zone. When there is too little ink, the water overcomes the ink and the print gets light. Most troubles come from too much ink. The indications are filled halftones and dirty dampeners. The dots grow, scum appears and finally the plate is ruined.

Ink rollers set too heavy on the plate have a scrubbing action. They wear the plate, cause roller streaks and filled halftones. The plate must be cleaned repeatedly until it finally breaks down completely. The rollers must be clean, pliable and set light for quality work and good plate life. Plate to blanket pressure must be as light as possible also. The pressure on medium sized presses should be .003" and on larger presses .004". Heavy pressure here can cause a rub that will quickly wear a plate. A poor blanket packing can quickly wear a plate out too. If the blanket is too high in relation to the plate, a damaging rub will occur and ruin the printing qualities

of the plate.

A gum that is too thick when used on the plate is difficult to remove from the images of a plate. Gum is smoothed down on a plate to get it off the images. If any is left there to dry, it will desensitize the image and blind it. Gum that is thick or stringy is almost impossible to remove entirely.

Whenever the plate is to be washed out and put under asphaltum, extra care must be used in gumming it. There must be a full charge of ink on the image. Correctly applied, the color of the asphaltum will be light tan and the film will be transparant. Such a film of asphaltum can be removed easily at any time and will not make the plate scum on the press.

Only the damage to the two chemical surfaces has been dealt with. There are mechanical damages that occur and that can cause a great deal of trouble. For instance, too sharp a bend put into the clamp edges of the plate shortens the life of the metal. The plate may tear at this point and not finish the job. Most plates are discarded because of tears. Extreme care should be practiced to avoid buckles and kinks in the press plate. They will show up on the press as worn spots. It is extremely difficult to obtain an even coating on a plate that has once been kinked.

Numerous other difficulties that bear mentioning and may cause problems are, temperature of workrooms,

humidity, consistency of the ink, degree of acidity of the fountain solution (even hardness of the water from which it was made), the quality of ink and of solution fed to the press, timing of exposure and of development of the sensitized coatings on the plate, can affect the smooth operation of the lithographic process.[6]

Decorating Process. In the decorating of metal, a certain process is followed. First, a base white is applied on the outside of the container for a printed background. This is not done on all decorated cans, especially aluminum cans made by the drawn and iron process. Generally the aluminum is allowed to show through. Budweiser is one brewer that has a base white coat applied. Then, the design is printed. Next, a varnish or lacquer is applied to the printed surface and baked. This is done to protect the printed surface from scratching in either the shipping, filling or in the consumer use stage. The final stage in both the drawn and iron and flat sheet can is the application of an internal coating on the inside of the can or the reverse side of the sheet, whichever the case may be.

In printing, the metal decorator runs into many problems due to the character of the substrate involved. For example, when a background color other than that of the metal is desired. This means that a background must be

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[6] Ibid., p. 9.

applied and the most frequently used color is white. The metal decorator can never hope to match the quality attained by the lithographic process on paper and cannot try to compare the two.[7]

From substrate to substrate there will be a variance in color using the same ink. A white ink printed on tin plate does not look the same as a white ink on aluminum.

A prime factor that affects metal decorating is the seam that is necessary to form a can. In the past and even recently most cans were soldered or welded and the decoration could not extend into these seam areas. These seam areas have to be completely free of any decoration, lacquer or varnish. This limitation of the soldered seam cuts down on the attractiveness of the container as seen in the beverage market of soft drinks and beer.

Many can manufacturers have done much to solve this problem. American Can Company has developed a tin free steel can that has a lapped seam. This allows for complete decoration of the container. The seam is lapped and held by cementing rather than soldering. In this case, an organic material, nylon is used. The seam is claimed to have greater holding strength than the metal itself. Reynolds Aluminum Company has also been instrumental in doing away with the seam. They have developed the drawn

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[7] W. H. Douglas, "Designing and Reproducing for Tin Printing," Litho-Printer, vol. 6 (Jan., 1963), p. 25.

and iron seamless aluminum can which is decorated in the round as described earlier in this paper. The aluminum can seems to show great merits in terms of attractiveness and consumer appeal.

At present, many manufacturrrs are looking into the production of seamless aluminum cans. Among these are American Can Company, Continental Can Company, Kaiser and Alcoa Aluminum Companies. Aluminum seems to be a natural material for cans because of its consumer appeal and other physical and chemical characteristics. At any rate, tin free steel will try to make inroads into the metal container field. It is a cheaper can and can be produced much faster than the drawn and iron aluminum can. American Can claims that five hundred tin free steel cans can be produced in one minute as opposed to three hundred aluminum cans per minute per line.

Substrates. The substrates used in the metal decorating process are important in that they affect the characteristics of the printed image produced and the general appearance and utility of the containers. Following are the categories of substrates and their properties:

1) Black Plate is the base steel used for tin plate. It is used mostly for large containers and flat pieces. Characteristic uses for black plate are drums and containers for dry non-food items.

2) Tinplate is a substrate of steel coated with tin. The tin is a surface treatment to protect the steel base and to provide a base for decorative or protective coatings. Although it is recognized by its typical bright appearance, it can be produced with a matt or bright silver finish.[8] Tin can be applied by evaporation in a vacuum, although currently it is applied by electroplating.[9] About two thirds of the world's tin plate is now produced by the electrolytic process.[10]

3) Aluminum-coated steel utilizes a steel substrate. The surface is coated by using aluminum with the vacuum deposited process. The range of thickness can be controlled. It is resistant to atmospheric rust. Although it is subject to staining by water, it can be treated to eliminate this problem.[11]

4) Aluminum substrates can be produced to have different characteristics. The many properties of aluminum include light weight, good workability, resistance to corrosion, high strength by alloying, non-magnetic properties, high scrap values, clean appearance,

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[8] Ibid., p. 25.

[9] A. N. Laubscher, "Tin-Free Steel for Decorating," Modern Lithography, vol. 35 (Aug., 1967), p. 35.

[10] Whitworth, Visual, p. 12.

[11] "Member Panel Highlights NMDA Meeting," Modern Lithography, vol, 34 (Nov., 1966), p. 76.

conduction of electricity and heat, reflection of light and safety for food.[12]

In the decorating of aluminum, feeders on lithographic presses must be equipped with new attachments because of the non-magnetic properties of aluminum. It is also important to remember that coating, drying and curing temperatures for metal decoration are in the range that can affect the strength of aluminum. The same high temperature may also cause a sheet to warp.

5) United States Steel Tin-Free Steel was developed and introduced in 1965. It is produced from the same steel base as that of tin plate but no tin is deposited on the surface. Tin-free steel has a gray cast, but when coated with a clear lacquer it appears similar to tin. Lithographic printing operations are no problem. However, it lacks the highlights of a printed label which are afforded by tin plate.[13]

Tin-free steel cannot be soldered, but where nylon adhesives are used for lap seams as American Can Company is doing, the operation is quite successful. Tests comparing it with tin plate show favorable results for rust, corrosion, humidity and water processing.[14]

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[12]B. N. Peak, "Aluminum for Decorating," Modern Lithography, vol. 33 (Aug., 1965), p. 63.

[13]"Analyzing Ink Problems," Printing Magazine/National Lithographer, vol. 91 (Sept., 1967), p. 131.

[14]Laubscher, Modern Lithography, p. 78.

In considering tin-free steel, manufacturers view it as a cheaper material to use in producing cans, especially for the beer and soft drink market. Cans are generally sold by the price per 1,000. The tin-free steel can is now selling at approximately two dollars per 1,000 less than the tin plate and aluminum cans.

The aluminum can manufacturers do not view the tin-free can as commercially available at this time. When they feel it is, the aluminum manufacturers will reduce their prices to remain competitive.

Inside and Outside Coatings. The nature of certain products such as food and beverages requires that cans be protectively coated on the inside to eliminate the reactions between the contents and the metal of the can.

Uniform coating over the entire sheet is suitable for certain articles such as trays, signs and crowns. Where soldering must follow as in the case of most packers cans, a margin of uncoated sheet must be left. To do this, strip coating is used. When strip coating is used, a surface tin on each side of the body blank must be left clean to make soldering possible. In addition to leaving soldering strips, margins of uncoated tin surface at the top and bottom of the can body must be left to prevent coating material from stringing off in the flange area during the sealing process.[15]

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[15]Harold W. Lee, "Metal Decorating, or Tin Printing," Share Your Knowledge Review, vol. 47 (june, 1966), p. 7.

After the coatings are applied to the inside of the cans, the tiny dispersed resin particles must be coalesced into tough flexible films by baking the coating in ovens. A typical bake would be ten minutes at 350° to 375°F. If the temperature is allowed to be greater than 400°F, problems of thermal degradation occur. Microscopic scratches may expose the base iron and when the organosols contact the iron at high temperatures, harmful black thermal degradation products result.[16]

There is a strong emphasis put on the quality of the coating and on quality control programs in the can industry. In many cases, quality control proceaures are essential to satisfy requirements of the Food and Drug Administration.[17]

Inks Used in Metal Decorating. Inks used in metal decorating must be able to resist breakdown from high temperatures. This is due to the heating process which is necessary for baking the overprinting of the varnish or lacquer after the image is printed. Most varnishes and lacquers dry by evaporation in eight to ten minutes at 248°F. This gives them a hard, glassy finish that protects the image underneath. Some lacquers are known to dry in four minutes but normally they take twenty

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[16]M. A. Glaser and G. L. Weaver, "Dispersion Coatings," Modern Lithography, vol. 33 (March, 1965), p. 68.

[17]D. E. Callis, "Product Insurance for the Metal Decorator," Modern Lithography, vol. 33 (Jan., 1965), p. 52.

minutes. Lacquers must be flexible enough to withstand bending and stamping operations. Lacquers used over white inks must be extremely pale in color and possess excellent color retention.

Inks used in metal decorating must not bleed during the heating process. Some inks are subject to pasturization and sterilization processes which may be done by dry heat, pressurized hot water and steam.[18]

General Printing Ink Division of Sun Chemical Corporation, introduced an ink that may be subjected to a baking temperature of 460°F. This ink has superior printing properties and hiding power for use on conventional metal decorating presses and for dry offset printing with Dycril plates. It bakes in ten minutes at 280°F, extremely hard in three minutes at 400°F or in one minute at 425°F.[19]

Since the base metals are not white as paper is, large areas of solid colors, white or tinted, must be layed down as a printing base. The offset printing process can be used, but roller coating has a number of advantages.[20] These advantages are:

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[18]E. A. Apps, "Inks for Metal Decoration," Litho-Printer, vol. 5 (June, 1962), p. 379.

[19]"GPI Offers High-Heat Decorating Inks," Modern Lithography, vol. 33 (June, 1965), p. 115.

[20]R. Whitworth, "From Paper to Tin," Litho-Printer, vol. 9 (Sept.,1966), p. 38.

1) Equipment is simple, occupies little space and is easy to operate.

2) An even thickness of coating can be obtained, eliminating the need for several printings to get the required thickness.

3) A wider range of solvents or resins can be used.

4) High gloss is easier to obtain.

5) Costs less than offset tin printing.

6) It has low odor.

7) Finishes can be made for air drying.

8) Pigments can be used that are not suitable for the offset process.[21]

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[21]Apps, Litho-Printer, p. 377.

LITHOGRAPHIC PLATES

Introduction. The plates used in metal decorating are of the same general characteristics as those used in paper lithography. The conventional wet lithographic plates and dry offset plates will be discussed

Production of Lithographic Plates. The production of lithographic plates may be divided into three different stages. These are: 1) photography, 2) stripping and 3) platemaking.

The object of the photography stage in the process is to photograph the prepared copy and prepare negatives and positives to be used for exposing the sensitized lithographic plate. The process camera is used to photograph the flat copy and is usually of the darkroom type. In the darkroom, all handling and developing of film is done.

The main parts of the horizontal process camera are the fixed back, a movable lens board and a movable copy board. Cameras range in sizes from 24" x 24" or 30" x 30" and larger. There are modifications on many cameras for using glass halftone screens for either color separations or the production of black and white halftones. Contact screens may be used in place of the glass screen but the fixed back must be fitted with a vacuum back to hold the screen securely to the film.

A light-tight bellows encloses the space between

the lens board and the camera back. The copy holder often has a hinged glass cover and can be tilted to a horizontal plane for positioning copy. Illumination for exposures is done by arc pulsed xenon or quartzline lamps.

Lenses are of several types, speeds and focal lengths, all adapted to give good definition over the entire surface of the image. Some lenses are especially color-corrected for process color separation.

The stripping operation involves the assembly of the negatives and positives in to a flat which is used to expose the sensitized plates. The elements are stripped into position on the flat. The completed negatives or positives are positioned and attached with tape to a sheet of "goldenrod" paper, the size of the press plate or of a complete unit for a photo composing machine.

The photo composing machine is essentially a large vertical photographic printing frame in which an offset plate ready for exposure is mounted to receive a number of identical images. This is used constantly in metal decorating when thirty-five can bodies of the same design are printed on one sheet of metal. In this way, only one set of negatives or positives is used. A movable chase or plate holder holds the negative or positive or flat carrying the design and can be positioned within a tolerance of .001 inches. This is done by the use of

worm screws with micrometer adjustments. While the rest of the plate is covered, the transparency is held in contact with the plate by vacuum and the exposure is made. After this exposure, the vacuum is released and the operator moves the chase to the next position for the next exposure.

The types of plates used for metal decorating are:

1) Surface plates
2) Presensitized plates
3) Deep etch plates
4) Bimetallic plates
5) Dry offset plates or wrap around plates

Surface Plates. Surface plates have one feature in common in that the printing areas are on the surface of the image carrier. Surface plates were originally coated with albumin. Albumin is an organic colloid which is better known under the name of egg white. Albumin plates have lost their importance in comtemporary platemaking. These have been superseded by presensitized plates.

Presensitized Plates. Presensitized plates have been used by metal decorators and they report 60,000 impressions with Minnesota Mining and Manufacturing "S" type plates. For runs of 75,000, the "S" and "S-P" plates can be capped with a manually applied developer known as Image Guard.[22]

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[22]R. B. Kincaid, "What's New for Metal Decoration?," Modern Lithography, vol. 34. (Aug., 1966), p. 89.

Presensitized plates are manufactured by several companies and are available in a wide range of sizes and thicknesses. The base material is generally aluminum and it is pre-coated with a diazo coating. Diazo compounds are nitrogen derivatives of cold tar.

Presensitized plates are divided into two areas, negative working and positive working plates. Negative working plates are exposed to photographic negatives. Where light passes through the negative, the diazo coating is hardened. The light hardened diazo coating is not soluble in a developer solution, while the unexposed coating is soluble. After the plate is developed, it is gummed up with a solution of gum arabic and ready to be put on the press.

For the positive working plate, a positive must be used for exposure. The positive working plates are interesting in that the unexposed areas remain impervious to the developer, whereas the exposed areas are soluble. It is possible in this process to make a positive image on the plate by exposing to a positive. Positives are easier for the stripper to use because all images are right reading and positive whereas negatives are wrong reading from the emulsion side and negative.

Deep Etch Plates. Deep etch plates have been known to have considerably longer life on the press than do surface plates. The name deep etch is related to the

fact that the printing image is recessed in the plate material. The non-printing areas are on the surface of the plate and slightly above the printing areas. In deep etch plates, the printing areas are made ink receptive by removing the light hardened photo mechanical stencil and by applying a non-blinding lacquer to image or printing areas of the plate.

Deep etch plates are made with aluminum and the plate metal is often copperized in image areas which lends to the plates ink receptivity. Copperizing is done by treating theplate with a copperizing solution. The result is an extremely thin film of copper deposited over the image areas of the plate.

The steps of procedure in making the deep-etch plate are as follows:

1) Wash the plate with running water.

2) Pre-etch, applying pre-etch solution with wide paint brush for about one minute and then flushing with water.

3) Coat the plate with positive deep-etch coating solution. The whirler is set at 40 to 50 revolutions per minute and the coating solution is poured from its container through a cheesecloth filter to remove all bubbles. Increase the speed to 80 or 90 revolutions per minute, using a little heat. Too much heat may cause tough developing. Dry the coated plate thoroughly.

4) Expose the plate in the vacuum printing frame with

arc lights.

5) Stop-out solution is applied to all unwanted areas such as dust spots, tape marks and film edges. Plates are fan dried.

6) Develop on a flat table trough and pour the positive developing solution on the plate. Spread the solution with the developing pad over the entire surface using a circular motion. Continue development until bare printing areas are exposed and foaming action starts. Remove with squeegee and coat again with developer.

7) Etching solution is poured on and spread out with the etching pad. Let the etching solution work in for 1½ minutes on that part of the image which has not taken the exposure and squeegee off.

8) Redeveloping involves pouring more developing solution over the plate to guard against corrosion. This neutralizes the etching solution. Squeegee off the plate.

9) Lacquer is poured on the surface and spread with a cloth pad. This gives a base for the developing ink which follows. Dry the lacquer thoroughly and expose the back of the plate to the arc light for a minute.

10) Developing ink is poured on the plate and smoothed out with a cloth pad over the entire plate. The plate is rubbed until dry.

11) Developing is completed by washing the plate with warm water and a soft scrubbing brush to remove the stencil from the non-printed areas of the plate.

13) Desensitize removes traces of scum from non-printing areas of the plate. Place the plate in a tray and pour over a desensitizing solution.

14) Rinse with running water, squeegee plate and gum plate with gum arabic.

15) Apply asphaltum to protect image.

Instead of negatives, the deep-etch process requires a flat made up of right-reading positive images on transparant backgrounds. Photographically-composed positive transparencies pulled on cellophane are popular. For making deep-etch plates, it is best to purchase the needed chemicals and solutions from a chemical supply house.

Bimetallic Plates. Bimetallic plates take advantage of the fact that certain metals have different affinities for ink and water. Copper is the most receptive metal to ink; and aluminum, nickel, chromium and stainless steel are water receptive. Copper forms the image areas and non-image areas are of chromium, stainless steel or aluminum.

Some bimetal plates use a third metal such as iron or zinc that acts as a base for the other two metals. These are known as trimetal plates. The base material takes no part in the formation of image or non-image areas. Since reliability is a big factor in metal decorating, many printers feel that steel based bimetal plates, although more expensive than the rest, are well worth

the cost.[23] Decorators find that they can get well over one hundred thousand impression from one of these plates.[24]

Bimetallic plates can have copper, the image forming metal, either on top of stainless steel or aluminum, or the copper can be under the chromium. Another difference between the different kinds of bimetallic plates is that some are made from negatives and some from positives.

The Aller plate is made from negatives and has copper on top of stainless steel. The Lithengrave plate, which is also a negative plate, has copper on top of aluminum. The Lithure plate has a solid base of copper and is electroplated on one side with chromium. Bimetal plates of this type are closely related to deep etch plates because they are made from positives and the copper images are slightly recessed below the non-image areas.[25]

Many suppliers today are producing presensitized bimetal plates which eliminate the need for plate whirlers which are used for applying the coating material to the metal surface.

Dry Offset. The most common plates used in metal decorating are lithographic, but an increasing number of

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[23]Carl.B. Harris, "Don't Neglect Plates and Chemicals," Modern Lithography, vol. 33 (May, 1965), p. 71.

[24]Modern Lithography, vol. 34, p. 81.

[25]Paul Hartusch, "Survey of Litho Plates," Graphic Arts Monthly, (Nov., 1965), p.68.

wrap around plates are being used by the major metal decorators.

Conventional wet lithography depends upon a chemical separation of printing and non-printing areas. The wrap around plate utilizes a mechanical separation of printing and non-printing areas, such as obtained with a shallow relief plate. The advantage of blanket printing is still used but now there is no critical ink/water balance in the printing system. With no water in the printing system, the color is held more easily once established.

There are a number of wrap around or dry-offset plates used in metal decorating. The number of impressions these plates will produce depends on a number of factors but the typical range is one to two million.[26] These plates have a good fit around the cylinder, hold fine detail, eliminate dampening and provide better color control. Allowances must be made for the undercut on the plate cylinder for the thicker relief plate.[27] The plates discussed in this paper will be the single metal wrap around plate, the DuPont Dycril plate, and the Kodak Relief plate.

a) Single metal wrap around plate. The single metal

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[26] Ibid., p. 70.

[27] "Should a Supervisor Be a Pressman?," Modern Lithography, vol. 34 (Dec., 1966), p. 49.

wrap around plates are of either zinc, magnesium or copper, coated with chromium to increase the number of impressions possible. The plate metal after being coated and dried is exposed to photographic negatives. The plate is then etched by a powderless etching process similar to that used for letterpress engravings. What results is a relief image that is considerably higher than the base metal. This is done by increasing the etching time of the plate in the etching bath. The longer the plate is in the etching bath, the greater the amount of metal which is eaten away. This results in a deeper etch.

b) DuPont Dycril plate. The DuPont Dycril plate is a photopolymer plate. This means that ultraviolet light changes the plastic material so that it forms a polymer and physically hardens the image and makes it insoluble to the dilute caustic washout solution used in the process.

The structure of the photopolymer plate has many layers in it. The plate has a phtotsensitive plastic and a bonding layer containing an anti-halation material to control light reflection from the metal support. The ultraviolet rays passing through the openings of the negative polymerize and harden the plastic. The portions under the opaque sections of the negative remain unaffected and are easily removed by a spray of dilute caustic in the subsequent wash out step. The exposure takes place throughout the entire thickness of the plate. The printing image is formed during the exposure step and the washout

merely removes unwanted non-image area.[28]

The negative required for Dycril is basically the same used for other negative working lithographic plates. Opaque areas should have a density of 4.0 and detail should be sharply defined. The plate reproduces accurately the image on the negative.

The mechanics of making Dycril plates are:

1) Conditioning

2) Exposure

3) Washout

4) Drying

Conditioning is done in a carbon dioxide cabinet. The purpose of conditioning is to remove oxygen that may have been absorbed from the air. Oxygen has a retarding influence on the speed of the plate. The speed of the plate concerns the amount of time required to harden the photosensitive coating when exposed to arc lamps.

Exposure is done either flat or rotary under vacuum contact. The flat exposure is used when a plate is needed for a flat bed press. Rotary exposure is used when the plate is to be mounted on an offset press cylinder. Rotary exposure is optically controlled to produce the desired shape of supporting structure below the printing surface. After exposure the plate is put on a flat or rotary washout machine. Finally, drying is done in a

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[28]D. B. Hurd, "Metal Decorating Without Water," Modern Lithography, vol. 32 (May, 1964), p. 58.

mild stream of warm air.

Dycril plates are available in a number of types. Type 25 is .025" thick and has a maximum etch of approximately .010 inches. Type 30 is .030 inches thich and has a maximum depth of .015 inches. Both type 25 and 30 are on flexible steel. Type C is on Cronar and exceptionally thin. It has a total thickness of .015 inches and maximum depth of approximately .007 inches. The three types of Dycril plates are made in sizes up to 40½" x 76".[29]

c) Kodak Relief Plate. The Kodak Relief plate was designed as a combination plastic and metal plate. The metal base is steel, .010 inches in thickness. The plastic layer on top of the lacquered steel is a modified acetate. This is the layer that provides the printing relief.

On top of this modified acetate is a white layer which increases the visibility of the developed image and the uppermost layer is the photosensitive emulsion.[30]

Plate exposure is similar to regular lithographic plates. Exposure times are shorter than for many plate materials and the exposure may be made in the flat or the round.

Processing of the plate is simple. It is simply

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[29]Ibid., p. 60.

[30]John P. Marshall, "Dry Offset For Metal Decorating," Modern Lithography, vol. 35 (Oct., 1967), p. 21

activated which develops the image. The activation steps consist of dipping the exposed plate into a tank of Kodak Relief Plate Activator. After about three minutes of activation, the plate is removed. The exposed, visible image is now composed of developed silver and tanned gelatin.

The developing of the silver emulsion in the exposed areas also hardens the gelatin, while the unexposed areas remain soft and are washed off with a warm water spray. A temperature of 120° to 140°F is used. During this step of the process, any unwanted areas of the image can be readily removed.[31]

The plate is then dried in a warm air cabinet. The result is a black resist image in very slight relief. The image is an exact positive proof of the job which can be checked before any further work is done on the plate.

Both the Dycril and the Kodak Relief plate have definite advantages over conventional wet lithography. The plate's printing image conforms to the plate cylinder. This allows the plate to be drawn snugly on the plate cylinder by the use of normal plate clamps. Solid and halftone areas conform smoothly and do not tend to remain flat, causing hard edges. The tops of halftone dots assume a curve.

The main advantage with dry offset is that there is no water in the system. There is a color uniformity

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[31] Ibid., p. 21

throughout the run as obtained with letterpress printing. Once the ink fountain is adjusted, a minimum of attention is required during the press run.

The ability to print long runs over one million impressions and the ability to re-use a plate many times without tearing the clamped edges is another advantage.

THE EFFECT OF LITHOGRAPHIC MERGERS ON COLLECTIVE BARGAINING

Introduction. The lithographic craftsmen of the metal decorating industry are responsible for the forward looking policy of cooperating with management and adopting new machines and processes. Lithographers in metal decorating have jurisdiction over all plate preparation and pressroom operations. The lithographers have recently merged with the photoengravers. Of main concern in this paper, is the philosophy of this merger and its effect on collective bargaining.

There are a few terms which need clarification before embarking on the significance of this paper. Jurisdictional dispute, merger activity and technological change will be mentioned. The purpose of this thesis is to link these concepts to craft solidarity and the influence on collective bargaining.

Jurisdictional dispute is the control or authority over craft operations that become less distinctive due to advanced technology. A dispute is raised as to which union will represent and bargain for the membership. The craftsmen who prepare printing plates have been confronted with the problem of dispute , which is eliminated through merger, because contract negotiations are handled by one union.

The combining of resources by creating a single labor orgainization through the process of merger is known

as merger activity. The union philosophy of merger is to protect and advance the interests of the membership.

Change due to the application of scientific principles in developing the efficiency, preciseness and productivity of industry is technological change. In this paper, technological change will be examined by union attitudes and procedures in dealing with it.

Review of Merger Activity. To understand the situation that the present day lithographer is confronted with, it is important to understand the background of union merger activity. On Labor Day, 1964, the printing industry saw its first merger of graphic arts unions since the International Stereotypers and Electrotypers Union merged at the turn of the century.[32] The merger was a result of the Amalgamated Lithographers of America, founded in 1882 and the International Photo Engravers Union, founded in 1900, to form the Lithographers and Photoengravers International Union (L.P.I.U.). The new union is comprised of 51,000 members.[33] The L.P.I.U. President is Kenneth Brown, formerly president of the A.L.A. and the executive vice president is William Hall, formerly the I.P.E.U. president.

The idea of the two unions merging began in 1941.

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[32]"Unity Pattern Set by Merged Union," Editor and Publisher, (Sept., 1964), p. 10.

[33]Ibid., p. 10.

A tentative agreement to merge was reached, but the printing pressmen would not agree with the A.L.A. and I.P.E.U. merger. The successful merger effort came about after more than two and one half years of talks.[34]

There had been agreement for a new 64,000 member union called the Graphic Arts International Union (G.A.I.U.). The terms had been approved by the 51,000 member L.P.I.U. and the 13,000 member International Stereotypers and Electrotypers Union (I.S.E.U.). The date for the official merger was set for Labor Day, 1967.[35] Ratification by a referendum vote in January, 1967 did not pass a two-thirds majority vote of L.P.I.U. and I.S.E.U. membership, so the ratification of that constitution was defeated. It will probably be put to another vote in the future. No information is available as to when this will be.

There have been other talks which are possibilities for future mergers to organize graphic arts craftsmen. The L.P.I.U. has had exploratory talks with the 115,000 member International Printing Pressmen and Assistants union. These talks formally began in October, 1965. The L.P.I.U. had also entered into exploratory talks with the International Brotherhood of Book Binders in October, 1966.[36]

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[34] Ibid., p. 10.

[35] "Creation of New 64,000 Member Graphic Arts Union by Merger is Approved by Executive Bodies of Two A.F.L.-C.I.P. Unions," The Photoengraver's Bulletin, (Sept., 1966), p. 45.

[36] "Officers of L.P.I.U., Stereotypers Agree to Merge," Modern Lithography, 34 (Sept., 1966), p. 68.

The recent trend of merger activity in the lithographic industry has brought to life the proposal of various future mergers. It is the writer's belief that in the future it will be inevitable that all graphic arts craftsmen will be organized and represented by one central labor organization.

It is also the writer's opinion that merger in the graphic arts industries is a defensive measure to protect against displacement by technological change. By merging, the graphic arts unions are trying to increase their solidarity by joining forces in response to technological change. White the metal decorators are concerned about technological change, they see that the adoption of new processes will further expand job opportunities.

Objectives of the L.P.I.U. Merger. The philosophy of the merger activity plays a significant role in defining theobjectives of the L.P.I.U. According to Kenneth Brown, there are three main objectives of the L.P.I.U. They are:

1) To organize and merge all local unions and mobilize the expanded total resources to enlist new members from among unorganized graphic arts companies.

2) To become more active in trade unionism through the A.F.L.-C.I.O.

3) To make the best possible use of increased bargaining strength for the benefit of members and for the good of the industries served.[37]

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[37]Amalgamated Lithographers of America and the International Photo Engravers Union, Why Merge?, (Oct., 1963), p. 7.

An A.L.A. publication, published before the merger, stated a number of reasons why the proposed merger would be a sound one. According to this, the merger would enable each of the organizations to protect advances which had been made and secure greater benefits for the members.[38] These advances and benefits refer to wages, hours and other conditions of employment. It is the objective of the union to see that these standards are protected against infringement. Greater organization would protect all wages, hours and working conditions.

Another major objective of the L.P.I.U. merger is to eliminate jurisdictional dispute. The elimination of jurisdictional dispute very strongly increases solidarity. Instead of the unions fighting over jurisdictional dispute, they can now spend their time on organizing non-union shops and obtain further economic goals.

The most important objective of the union merger program is due to technological change. According to Munson, the distinction between lithography and letterpress will be reduced to the running of different plates on the same press.[39] What Munson is referring to is the advent of dry offset. Dry offset is a process in which a relief plate, commonly made by photoengravers,

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[38] Editor and Publisher, p. 10.

[39] Fred Munson, Labor Relations in the Lithographic Industry, (1963), p. 223.

is run on an offset press by lithographers.

There is other evidence to prove that the technology in the lithographic industry is rapidly changing. There has been increased use of electronic devices, such as the densitometer for checking ink density in the press-room and the densities of halftones and color separations in the cameraroom. Electronic scanners and low grade computers are being used for the production of color separations, which require literally no color correction. Further evidence of technological change is the use of tape operated, programmed step and repeat machines that produce multiple image offset plates with the utmost of efficiency. Roll film cameras are now being used that eliminate the need for the cameraman to enter the darkroom to photograph copy. The use of automatic film processing equipment and the offset plate processor have added to increased productivity and preciseness.

In considering technological change, the area of union concern is that there is to be an orderly introduction of these changes. Munson believes, "If technological change continues to expand job opportunities, the union will continue to support it."[40] Excellent evidence of this fact is seen by the union members keen awareness of the impact of technological change in the graphic arts and the effect of their job security.

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[40]Munson, p. 51.

The L.P.I.U. has adopted an educational training and retraining program. There are training facilities in Chicago, Washington D. C. and Montreal.[41]

In coping with technological change, the L.P.I.U. has written into many contracts the clause that requires the company to give notice to the union of any installation of new or improved processes. This requires forty-five days notice in writing. The equipment shall not be operated unless there is mutual consent by both parties. It is also stated in the contracts that no employe shall be layed off because of technological developments.[42]

The general consensus of opinion obtained by talking with rank and file, management and a union president on the local level, leads the writer to believe that the merger was in itself a move to increase the union's strength and solidarity and guard the membership against the massive retraining that will occur in the future due to rapid technological advances.

A third objective of the L.P.I.U. merger is to preserve and improve wages, hours and other working conditions in the future.

In Chicago, lithographers earn a minimum of $182.27 weekly or $6.07 per hour for a 30 hour work week on the night shift. There are also four weeks paid

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[41] "L.P.I.U. Training Centers," Graphic Arts Unionist, (June, 1967), p. 32.

[42] Contract between Detroit EMployes and L.P.I.U. Local #12-F, Articles 19 and 23.

vacation after one year of service and ten paid holidays per year.

Electronic engraving and scanning machine operators, who produce relief printing plates in metal or negatives and positives for offset lithography, have negotiated a three year agreement with Printing Developments Inc. of Chicago. In 1969, day rates will be increased to $283.62 per week and night rates to $311.98 per week.

Summary and Conclusions. In conclusion, it is possible to see that many factors have made the merger of lithographers and photoengravers necessary. The largest contributing factor is the advent of rapid technological change. In the future the lithographer will become a technician rather than a craftsman due to the increased use of mechanical and electronic instruments.

In terms of wages and jurisdictional disputes, the merger has strengthened the position of the union in these areas also. The fact that the merged union would have greater control over preparatory work, platemaking and presswork is in itself a strong bargaining tool for the L.P.I.U.

The union attitudes concerning the adoption of new machines and processes has increased the opportunities of employment by keeping the costs of production low. This allows the metal decorating industry to serve more and more customers as new fields open up.

BIBLIOGRAPHY

Amalgamated Lithographers of America and the International Photo Engravers Union, A Declaration of Principles, October, 1963.

Amalgamated Lithographers of America and the International Photo Engravers Union, Why Merge?, October, 1963.

"Analyzing Ink Problems," Printing Magazine/National Lithographer, 91, Sept., 1967.

Apps, E. A., "Inks for Metal Decoration," Litho-Printer, 5, June, 1962.

Callis, D. E., "Product Insurance for the Metal Decorator," Modern Lithography, 33, Jan., 1965.

Contract between Detroit Employes and L.P.I.U. Local #12-F, Articles 19 and 23.

"Contract Provisions," The Photoengraver's Bulletin, December, 1966.

"Creation of New 64,000 Member Graphic Arts Union by Merger is Approved by Executive Bodies of Two A.F.L.-C.I.O. Unions," The Photoengraver's Bulletin, Sept., 1966.

Douglas, W. H., "Designing and Reproducing for Tin Printing," Litho-Printer, 6, Jan., 1963.

"L.P.I.U. Training Centers," Graphic Arts Unionist, June, 1967.

Glaser, M.A. and Weaver, G. L., "Dispersion Coatings," Modern Lithography, 33, March, 1965.

"G.P.I. Offers High-Heat Decorating Inks," Modern Lithography, 33, June, 1965.

Harris, Carl B., "Don't Neglect Plates and Chemicals," Modern Lithography, 33, May, 1965.

Hartusch, Paul, "Survey of Litho Plates," Graphic Arts Monthly, Nov., 1965.

Hurd, D. B., "Metal Decorating Without Water," Modern Lithography, 32, May, 1964.

"I.T.U., A•L.A. Local #1 Make Affiliation Official," Inland Printer, American Lithographer, CLX, April, 1965.

"I.T.U. Delegates OK Merger," Modern Lithography, 35, October, 1967.

Kincaid, R. B., "What's New for Metal Decoration?" Modern Lithography, 34, Aug., 1966.

Laubscher, A. An., "Tin-Free Steel for Decorating," Modern Lithography, 35, August, 1967.

Lee, Harold W., "Metal Decorating, or Tin Printing," Share Your Knowledge Review, 47, June, 1966.

"L.P.I.U. Training Centers," Graphic Arts Unionist, June, 1967.

"Local #1 Severs Ties with A.L.A.," Nation's Business, LIV, Jan., 1966.

Marshall, John P., "Dry Offset for Metal Decorating," Modern Lithography, 35, Oct., 1967.

"Member Panel Highlights NMDA Meeting," Modern Lithography, 34, Nov., 1966.

"Metal Cans," Packaging Encyclopedia, 1967 ed., vol. 40.

Munson, Fred, Labor Relations in the Lithographic Industry, 1963.

National Association of Photo Lithographers, Contract Provisions, 1967.

"NMDA Looks to the Future," Modern Lithography, 33 Nov., 1965.

"New Directions," Packaging Encyclopedia, 1967 ed., vol. 40.

"Officers of L.P.I.U., Stereotypers Agree to Merge," Modern Lithography, 34, Sept., 1966.

Peak, B. N. "Aluminum for Decorating," Modern Lithography, 33, Aug., 1965.

"P.D.I. Agreement Covers Four Cities," Graphic Arts Unionist, Feb., 1968.

"Should a Supervisor Be a Pressman?" Modern Lithography, 34, Dec., 1966.

"Unity Pattern Set by Merged Union," Editor and Publisher, Sept., 1964.

Whitworth, R. E., "From Paper to Tin," Litho-Printer, 9, Sept., 1966.

_____, "Printing on Metal," Visual, 2, Nov., 1964.