COLOR PROVING ON OPAQUE WHITE PLASTIC

(POLYVINYL CHLORIDE-ACETATE COPOLYMER)

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IBH Note. — Mr. LOONEY is the Deputy Director, Lithographic Division, U. S. Navy Hydrographic Office. He has had 36 years of progressive experience in this office in all phases of lithographic work. Prior to assuming his present position he was Head of the Photographic Branch. He is the co-inventor of the black-line blue correction process used on H.O. nautical charts and a specialist in lithographic processes. Before entering the office he had extensive experience with commercial lithographic firms.

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The advent of multi-colored nautical and aeronautical charts created a corresponding need for a method of composing and correcting the base charts and various color overlays, prior to the final zinc plating and printing. To be satisfactory, the method would have to be fast, inexpensive, accurate, and available during all phases of the construction of the chart. Since 1955, the U. S. Navy Hydrographic Office has been successfully furnishing this service to the various chart construction components of the Office.

For many years, the method used in furnishing color proofs for editing a hydrographic chart was, basically, to produce a pre-publication printing on a special proving press. This was accomplished by making the regular offset zinc printing plates for the base and the various color overlays. These were then run off on the proving press, with all the attendant problems of register, make-ready for inks and blankets, etc. that would be necessary during the regular printing of the completed chart. Furthermore, any errors detected on the composite press proofs had to be corrected on the already finished printing plates. This method of correction required a highly skilled technician, which was both expensive and time-consuming. If the accumulated errors were too extensive to warrant hand correction to printing plates it became necessary to amend either the negative or the original drawings,

and then make a new set of zinc printing plates. In either case, the process was slow, cumbersome and wasteful. For example, proving the average nine-color chart required at least forty-eight man-hours and the use of a minimum of one hundred sheets of chart paper. In addition, the proof errors usually required an additional forty-four hours of corrective work on the printing plates themselves.

The increasing complexity of the average chart with its many color overlays of shaded relief, water tints, culture, navigational symbols, electronic navigation lines and other types of specialized information very forcibly pointed to the need for a better, faster, and more accurate preliminary method of furnishing composite color proofs. Personnel responsible for the correct presentation of information were finding it increasingly difficult to check the original color drawings by overlaying them against the base or other color sheets. The opaqueness of the plastic sheets upon which the drafting was done prevented an accurate check by the above method. Additionally, as the number of overlays increased, an error in one sheet was compounded into creating many adjustments on the remaining sheets. However, personnel of the Hydrographic Office continued to experiment, and various remedies were tried to alleviate the problem. One of these preliminary methods was to make a composite photoproof, by either varying the exposures or superimposing a screen pattern on one of the sheets. This process had a very limited use, as not all of the overlays could be composed together, and consequently, there could be no accurate check for registration or for color. The need was still obvious for a better method to improve the quantity and quality of the hydrographic and aeronautical programs.

The cartographic and lithographic components of the Office agreed that a method of depicting a facsimile of the finished chart, on a single vinyl sheet, in the desired colors and in register, was necessary for the proper development of a modern chart, during the cartographic construction and lithographic printing phase. The desired proof sheet would have to be dimensionally stable material, which could be photoprinted from either glass or polystyrene (film) negatives. It would have to be versatile enough to be used, with either two or more combinations of color, and still maintain the clarity and sharpness found in a finished lithographic print. During the search for such a process, several methods of color-proving were tried. All of these methods utilized albumin solutions on opaque vinyl sheets, of varying textures and thicknesses, and made use of regular press and/or roll-up inks. Each experiment proved to be too expensive, time-consuming, and even more important, the colors were absorbed by each other. Nevertheless, tests were continued in an attempt to create a satisfactory preplate proof process.

Meanwhile, the same problem was under study at other governmental and private printing establishments throughout the country. In 1955, a new color solution was tested by the Hydrographic Office. The use of this product and further development of the process proved to be successful and satisfied the requirements of the Office. The solution was light-sensitive, with the speed of, and having the same reaction as, the albumin and casein coating used in making regular offset lithographic plates. By means of this new process, it has been found possible to photo-compose at least 32 negatives in nine or more colors on a vinyl sheet and produce a true color

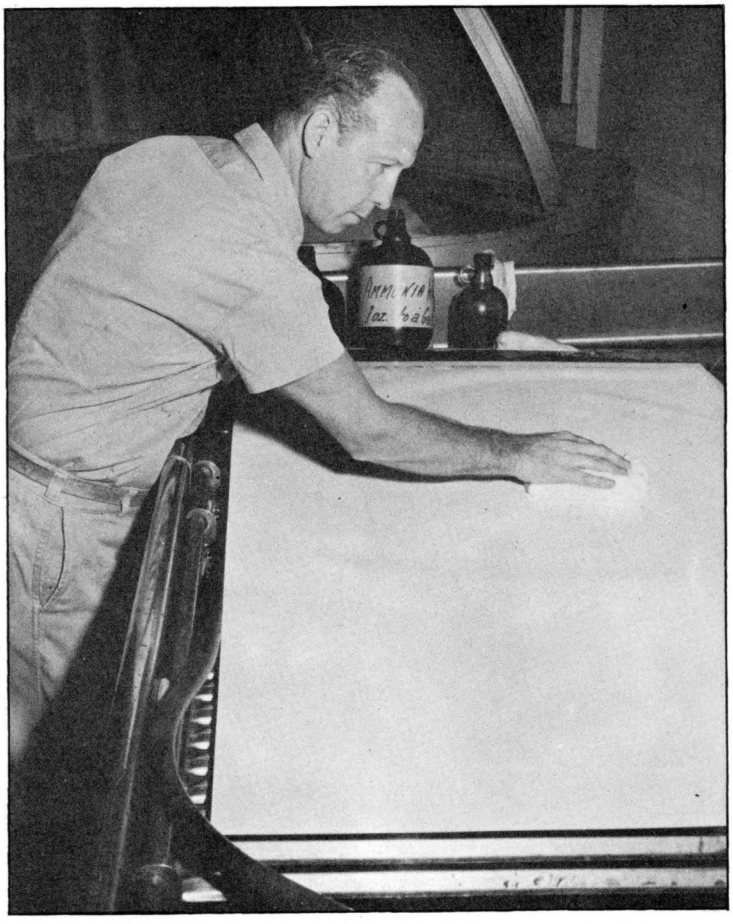

ILLUSTRATION 1. — Cleaning the matte side of the plastic sheet.

proof, similar to the finished chart, in approximately five hours. The colors are printed and developed one on top of the other, with no protection or lamination between successive tints. A complete cycle of the process is made for each additional color and all developing is done with water and ammonia solution. 32 colors and an extender are available and may be developed in any sequence, although a better and cleaner final proof is obtained when the lighter colors are applied last.

The advantages gained by the use of this new process are many, and both the construction and lithographic components of the Office have benefited by its adoption. This method provides a means of editing and a relative inexpensive procedure for correcting the original drawings as two or more color overlays are completed. By providing a completed, accurately registered, true color representation of the finished chart, errors may be detected, mis-registers prevented and most important, the corrections are incorporated on the negative before printing plates are made. With the adoption of this new color-proving method by the Hydrographic Office, considerable savings have been realized in both material and manpower.

The procedure followed by the Hydrographic Office in preparing com-

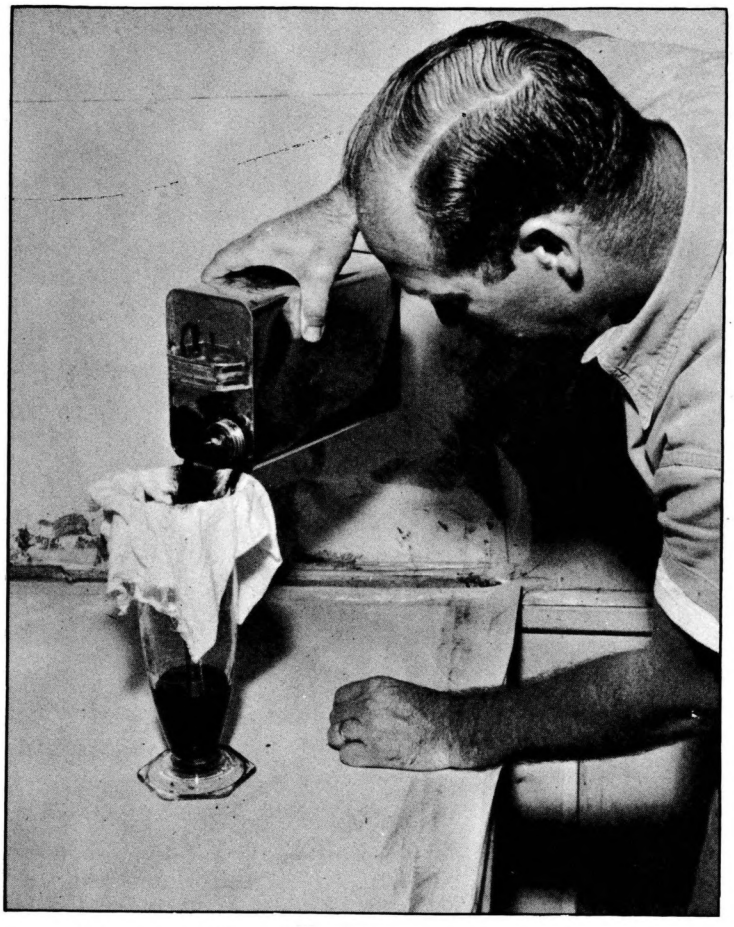

ILLUSTRATION 2. — Preparation of the color solution.
The selected color solution must be filtered.

posite color proofs does not require any unusual lithographic equipment. The only special materials used consists of different color solutions and the extender. The details of the method are as follows :

1. — Preparation of the Plastic Polyvinyl Chlorite-Acetate Copolymer, Opaque White Sheet (hereinafter referred to as plastic sheets) (See illustration 1) :

a. Clean the matte side of the sheet by flushing with a solution of one ounce of ammonium hydroxide (28 %) to one gallon of water. To remove finger marks, oil or grease stains, etc., rub the spots very lightly with a cotton swab. Care should be taken as heavy rubbing will remove the matte finish and allow the color pigments to dull and tint the background during the developing process. Rinse the sheet with clear water and keep wet.

2. — Preparation and Application of the Color Solution (See illustrations 2 and 3) :

a. Four (4) ounces of the desired color solution are prepared by

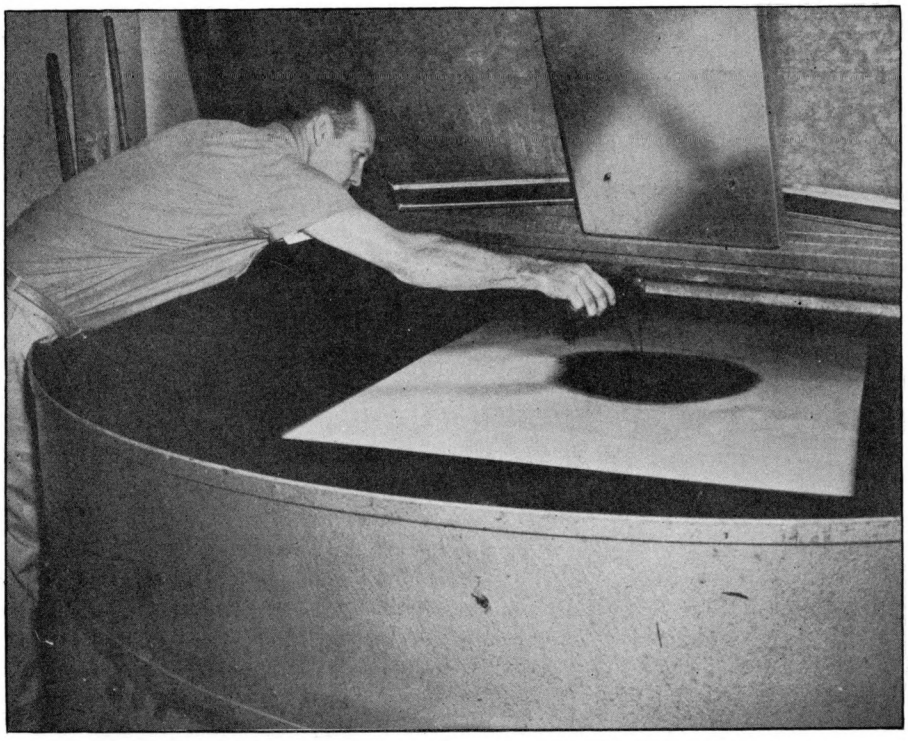

ILLUSTRATION 3. — Applying sensitive coating to the plastic sheet.

stirring, shaking and filtering through cheesecloth or cotton into a pouring beaker. The extender should be added at this time if a lighter shade of color is desired.

b. The wet, plastic sheet is placed in a horizontal whirler at a speed of 65 to 75 revolutions per minute. The plastic sheet is flushed with tepid water. Then, the prepared color solution is poured slowly, from slightly off centre, onto the whirling plastic sheet. The last 20 % of the solution should be poured from the centre towards the outer edge of the sheet.

3. — Drying and Processing the Plastic Sheet :

a. The whirler speed is maintained until the plastic sheet is dry. Next, the sheet is placed, with the coated side down, on a clean dry table top and wiped clean of any remaining moisture or color residue.

4. — Exposure of Negative on Plastic Sheet (See illustration 4) :

a. Place the dry, color-coated sheet in a regular vacuum printing frame and register with the proper negative. Although the exposure time will vary for each printing room, the following exposures have been successful at the Hydrographic Office.

(1) Single 140-ampere arc lamp, distance from frame 5 feet, with black color solution, 2 ½ minutes, all other colors, 1 minute.

(2) Double 45-45 (90)-ampere arc lamps, distance from frame 5 feet, with black color solution, 5 minutes, all other colors. 2 minutes.

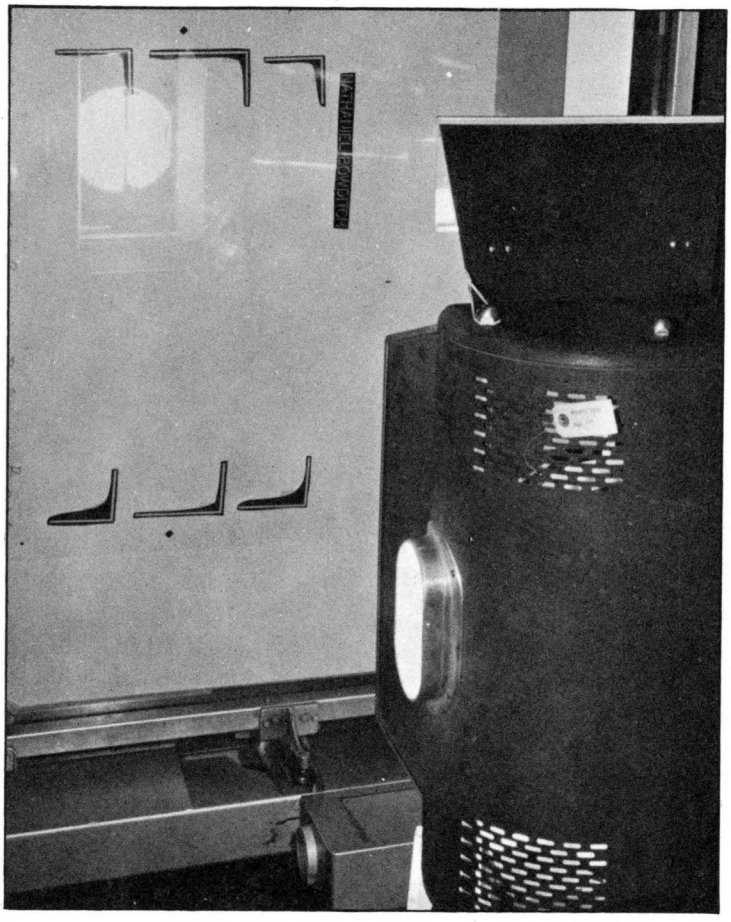

ILLUSTRATION 4. — Making exposure.

b. A black or dark-green backing should be used on the printing frame, especially when printing on translucent or transparent material.

5. — Developing the Image (See illustration 5) :

a. An aqua-ammonia developing solution is prepared in the ratio of one ounce of ammonium hydroxide (28 %) to one gallon of water, with two gallons of solution needed for developing each color used on a 30 × 40-inch plastic sheet.

b. The sheet is placed on a tilted rack in a developing sink. Then, it is flushed with the prepared developing solution, starting from the low side of the rack and pouring the solution from side to side towards the high side of the rack. Next, rinse the sheet with tepid water and remove any residual tinted color background with a wet, clean cotton swab, using a very light pressure on the swab.

6. — Addition of Colors (See illustration 6) :

a. For each additional color, the procedure is repeated from step 2, and continued until all the desired colors have been added. It is preferable to begin with dark colors and progress to lighter colors.

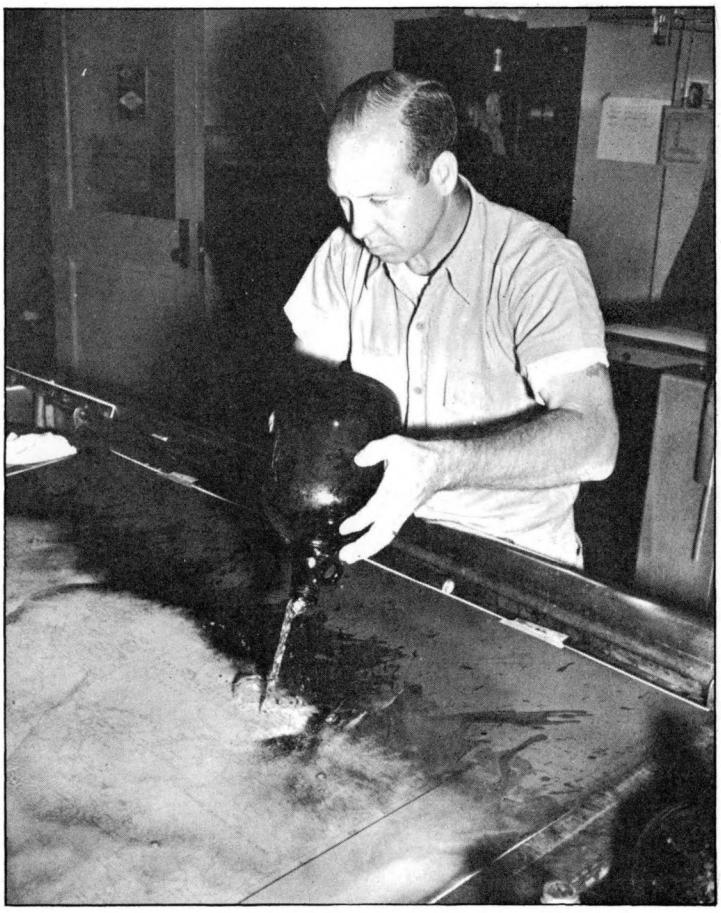

ILLUSTRATION 5. — Developing image with ammoniated solution.

7. — Cleaning the Printed Image :

a. After all colors have been printed, a background cloud of residual color may remain on the sheet. This may be reduced by flushing with a solution of one ounce of powdered soap to 32 ounces of tepid water and lightly rubbing the surface for 20 to 30 seconds with a cotton swab.

Meanwhile, experiments have been continued by the Hydrographic Office and other chart- and map-producing agencies in attempts to simplify and improve the color-proving process. The U. S. Army Map Service has developed a very successful method which eliminates the requirement for a lithographic whirler. The color solution is applied directly to the plastic sheet by a hand *rub-on* or *wipe-on* method. The procedure requires only special color emulsions and a color extender. Preliminary experiments at the Hydrographic Office indicate that, with care, the method can be used on practically any type of opaque polyvinyl sheet. The details for preparing a color proof by this method are as follows :

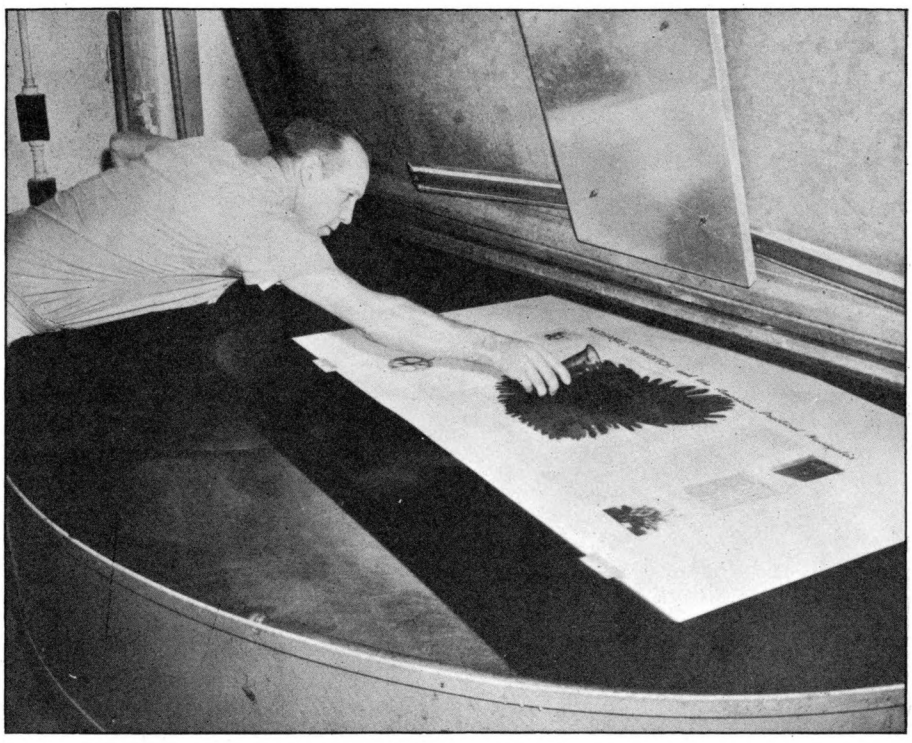

ILLUSTRATION 6. — Recoating plastic sheet with another color solution.

1. — Preparation of the Plastic Sheet, Size 30 × 40 inches :

Clean the matte side of the sheet by flushing with an aqua-ammonia solution of one ounce of ammonium hydroxide (28 %) to one gallon of water. To remove oil or grease stains, finger marks, etc., rub the spots very lightly with a cotton swab. Care should be taken as heavy rubbing will remove the matte finish and allow the color pigments to dull and tint the background during the developing process. Rinse the sheet with clear water and *dry* thoroughly.

2. — Preparing the Color Coating :

Two ounces of the desired color coating are prepared by stirring, shaking and filtering through cheesecloth or cotton into a pouring beaker. The extender should be added at this time if a lighter color is desired.

3. — Application of the Color Coating :

a. The plastic sheet should be securely fastened to a rigid backing.

b. The prepared color coating is poured slowly onto the centre of the plastic sheet. The solution is spread evenly over the sheet with a lint-free piece of cheesecloth, covering the entire surface with parallel strokes in one direction and then repeating the operation with parallel strokes in the other direction. Then with a second piece of cheesecloth, continue to lightly wipe the surface until it is almost dry. The coating is then thoroughly air-dried with an electric fan. The color-coated side must be protected from bright lights and kept absolutely dry and free from moisture.

4. — Exposure of Negative on Plastic Sheet :

Place the dry, color-coated sheet in a regular vacuum printing frame and register with the proper negative. Although the exposure time will vary for each printing room, the following times have been successful at the Hydrographic Office : with a single 140-ampere arc lamp and a distance from the frame of 5 feet, a black color-coating required 6½ minutes and all other colors required 3 minutes.

5. — Developing the Image :

a. An aqua-ammonia solution is prepared in the ratio of one ounce of ammonium hydroxide (28 %) to one gallon of water, with two gallons of solution needed for developing each color used on a 30 × 40-inch plastic sheet.

b. The sheet is placed on a tilted rack in a developing sink. Then, it is flushed with the prepared developing solution, starting from the low side of the rack and pouring the solution from side to side towards the high side of the rack. Next, rinse the sheet with tepid water and remove any residual tinted color background with a clean cotton swab, using a very light pressure on the swab. Any excess water should be removed with blotting paper and the entire sheet air-dried with an electric fan.

6. — Addition of Color :

For each additional color, the procedure is repeated from step 2, and continued until all the desired colors have been added. It is preferable to begin with dark colors and progress to lighter colors.

7. — Cleaning the Printed Image :

After all colors have been printed, a background cloud of residual color may remain on the sheet. This may be reduced by flushing with a color solution of one ounce of powdered soap to 32 ounces of tepid water and lightly rubbing the surface for 20 to 30 seconds with a cotton swab.

SOURCE OF MATERIALS

Any mention herein of a commercial product does not constitute endorsement by the United States Government.

1. *a.* Color Solutions for the *Whirler* process

   b. *Wipe-On* Watercote for *Wipe-On* process
   Direct Reproduction Corp., 811-813 Union Street,
   Brooklyn 15, New York.

2. Color-Proving Coat for *Rub-On* process
   Litho Chemical and Supply Co. Inc., 46 Harriet Place,
   Lymbrook, Long Island, New York.

3. *Webil Wipes,* tissue used for second rubbing during *Rub-On process*
   The Kendall Company, Kendall Mills Division, Walpole, Mass.

4. Opaque Plastic Sheets

   a. Loftrite No. 30 — Surface has a matte finish suitable for use with either the *Whirler* or *Wipe-On* processes
   Direct Reproduction Corp., 811-813 Union Street, Brooklyn 15, New York.

   b. The following manufacturers produce opaque plastic sheets; requires the addition of a matte surface before use in either process
   Firestone Plastic Co., P.O. Box 690, Pottstown, Pa.

   Goodyear Tire & Rubber Co. Inc., The Chemical Division, 1144, E. Market Street, Akron, Ohio.

   Monsanto Chemical Co., 324, Rose Building, Cleveland 15, Ohio.

   Borden Company, The Chemical Division, 350, Madison Avenue, New York 17, New York.

   General Tire & Rubber Co., The Chemical Division, 1708 Englewood Division, Akron 9, Ohio.