Aug. 26, 1941. J. R. FITZGERALD 2,254,033

METHOD OF MAKING PHOTOGRAPHIC SCREEN STENCILS

Filed July 29, 1940

FIG. 1.

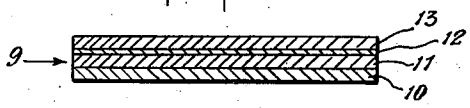


FIG. 2

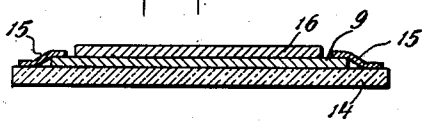


FIG. 3

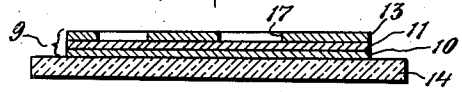


FIG. 4

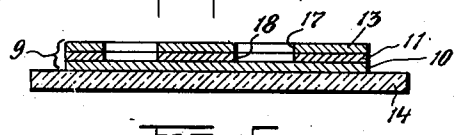
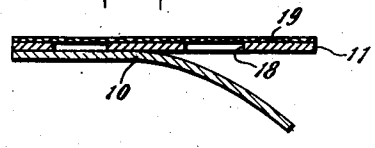


FIG. 5



FIG. 6



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METHOD OF MAKING PHOTOGRAPHIC SCREEN STENCILS

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9 Claims. (Cl. 41—38.5)

This invention relates to screen stencils and to the method of preparing the same, and relates more particularly to an improved process of forming silk screen stencils by the photographic method, and to the stencil material used therefor.

Photographic screen stencils have enjoyed a limited use, and for certain types of reproduction work a screen prepared by the photographic method is superior to a mechanically prepared negative which is adhered to the screen after portions thereof corresponding to a design to be reproduced are cut from a unitary sheet or film of resist material impervious to the inks or printing pastes, the film being mounted on a carrier sheet during the cutting operation.

One of the advantages of a photographic method is in the relative ease in reproducing a considerable amount of fine detail, particularly small dots, grains, lines and certain half-tone and Ben Day effects. It is difficult, however, to obtain sharp and clear cut edges in the stencil, and more important still, the photographically prepared screen has a relatively short period of effective use compared with the mechanically prepared negative.

Photographic stencils are made possible by virtue of the fact that certain types of gelatin, glue and other organic colloids are sensitive to light when impregnated with chromic salts. This impregnation is accomplished either by coating the gelatin or glue film layer with the chromic salts, or by incorporating them in the gelatin before it is formed into a film. When exposed to strong light the gelatin becomes sufficiently hard so that it cannot be dissolved in hot water, which is a normal solvent therefor. By placing a positive of the design to be reproduced, which positive has been imprinted on transparent material, in contact with the sensitized gelatin before exposure, portions corresponding to the positive are shielded from, and therefore unaffected by, the light, and such portions are thereafter washed out with hot water.

In all the practicable processes of this character the gelatin is first applied by means of a brush to the silk tautly mounted in a frame, the potassium or ammonium bichromate either being incorporated in the gelatin or being applied by brush or by spraying after the gelatin film has been formed. The silk threads are not sufficiently translucent to permit any considerable measure of light to pass therethrough, and accordingly the gelatin film on the opposite side of the screen would not be penetrated by the light. Some efforts have been made to specially treat the silk to render it more translucent, which attempts have met with only limited success.

Another objection to this method is in the fact that the gelatin film was of uneven thickness and the resulting deposit of ink or printing paste is of varying thickness. Accordingly, the pattern is uneven since it had varying shades of color and color gradations.

In addition to the great amount of time required to prepare a stencil of this character, the short effective life of the screen, the uneven edges of the stencil, and the color variations, the presently known photographic method of silk screen preparation had other objections too numerous to mention. As a result, the laminated stencil sheet has to a very large extent supplanted the photographically prepared stencil. This sheet comprises a paper backing and a film of uniform thickness and homogeneous texture adhesively joined to, but removable from, the backing sheet. The sheet is placed over the design to be reproduced and portions corresponding to the design are cut with a knife and removed. The remaining film is now adhesively joined to the screen and the backing sheet removed.

It is one of the principal objects of the present invention to provide a method whereby a laminated stencil sheet of this character, which has been so widely used in the trade, following the knife-cutting method, may be used in preparing a stencil by photographic means, the entire operation being accomplished while the film layer is adhesively joined to the backing sheet and before it is adhered to the foraminous stencil screen.

The advantages of such a method are readily obvious to those skilled in the art. Gelatin or glue or other materials which can be employed in connection with a photographic screen do not form films which are sufficiently durable to resist the action of the printing pastes and caustics contained in printing colors for many runs. Accordingly, the screen begins to disintegrate after a few impressions, straight lines become serrated and jagged, and pin-holes develop. The film of the laminated sheet, however, may last for 50,000 or more impressions. It is made of various cellulose esters and ethers and is built up as a homogeneous film of microscopically uniform thickness, layer by layer, on a coating machine.

Briefly, the present invention comprises the steps of overlaying the film layer with a second film layer which will be hereinafter referred to as the "coating" and being formed of photographically sensitive material, the film and the

coating being capable of attack by different solvents. A positive print, on celluloid or other transparent or translucent material, of the design to be reproduced is placed in contact with the photographically sensitive coating and exposed to suitable light.

The unexposed portions of the coating are next washed away with a solvent therefor, which, however, is incapable of attacking the film layer. Any foreign matter and accumulated scum is then removed, and a solvent capable of attacking the film but not the coating then applied to the exposed portions of the film, that is, to the whole surface including such portions. The remaining coating is next removed by an appropriate solvent and the film is ready to be adhered to the screen by the use of a suitable solvent capable of rendering the film tacky. The backing sheet is now removed and the stencil ready for printing.

Another and important object of the invention is the provision of an improved photographic silk screen preparation method wherein the resulting negative adhered to the printing screen will be of the same size and proportions as the original drawing or design used in forming the negative, thus insuring perfect registry, which is highly important in cases wherein the design is to be reproduced in one or more colors.

Further objects of the invention will become apparent or will be specifically pointed out as the specification proceeds.

The drawing shows several sections through the laminated material constituting the present invention, and also illustrates diagrammatically the several steps employed in carrying out the process.

Fig. 1 is an enlarged section taken through the laminated material.

Fig. 2 shows a transverse section taken through a sheet of the material taped to a glass carrier, and showing the positive in place on the upper surface of the laminated material.

Fig. 3 is an enlarged section showing portions of the masking layer having been removed.

Fig. 4 shows portions of the masking layer and of the film layer having been removed.

Fig. 5 is a section showing the finished negative ready to be adhered to the silk screen.

Fig. 6 shows a section of the screen and the mechanical negative adhered thereto, the backing being in the process of being stripped from the film.

The laminated material 9 shown in Fig. 1 comprises a backing sheet of paper 10, which may be glassine paper, and may itself be formed of several laminated layers to give an approved measure of strength. This backing or carrier sheet may be transparent or opaque, as desired, and may be made from any suitable material other than paper. Upon the upper surface of the backing sheet the film layer 11 is formed, preferably by a coating machine, as previously described.

The colloid layer may be superimposed directly upon the film layer, although better results are obtained by interposing therebetween a layer of an albumenous substance 12 which promotes adhesion between the film layer and the colloid layer, and also preserves the surface of the film layer which is important since this surface is eventually bonded to the silk.

For the albumenous layer good results have been obtained by dissolving the white of an egg or an equal amount of dried albumen in 48 ounces of water. A small quantity, usually 1 ounce, of an aniline dye should be added to the solution to promote adhesion between the albumen and the film surface. This solution is applied to the film surface by means of a rag or otherwise, and the surface thoroughly brushed or scrubbed with the solution, after which it is allowed to dry. This operation also has the function of thoroughly cleaning the film surface, which is important since grease and dust are enemies of photo stencils. Thus, the application of the albumenous material may be considered more as a treatment of the film surface than as an application of a separate layer to the laminated material. A certain deposit remains, however, and accordingly a separate layer 12 is shown in the drawing.

The colloid layer, or coating, 13 may be formed of glue or gelatin, the latter being preferable in some instances since it has "life" in it, that is, it may be repeatedly bent without breaking, and it retains its flexibility longer without cracking. All these solutions should be made with water which is free from chlorine, and should be carefully filtered. If glue is used, 1 ounce of a good grade of the glue is added to 8 ounces warm water, and this solution is then colored with a suitable pigment. Good results have been obtained by adding 85 grains of Windsor Newton Sepia. The solution of glue or gelatin may be applied by means of a brush, a spray gun, or it may be applied by a coating roller. An effort should be made to secure a coating of substantially uniform thickness, although the thickness may vary within reasonable limits without interfering with the successful carrying out of the process.

It was earlier pointed out that the sensitizing solution may be incorporated in the colloid coating before the same is applied, and in the event that the laminated film is to be exposed within a very brief time after the several layers have been superimposed upon the backing sheet, this may be done. In most instances, however, the manufacturer of the laminated material is not the user thereof, and accordingly the laminated material may not be eventually used for some time after it is made. Accordingly, it is best to form the laminated material as previously described, and then apply the sensitizing solution to the glue or gelatin coating immediately before use. Either potassium or ammonium bichromate may be employed, and ammonia or sodium carbonate may be added to the solution to make it somewhat less acid. A 50% solution is best for practical purposes.

To use the laminated material a portion thereof is cut corresponding with the size of the positive to be reproduced. This sheet, designated as 9 in Fig. 2, is laid in contact with a sheet of plate glass 14 and secured to such glass by the application of adhesive tape 15 around the edges thereof. This application to the glass is important since it protects the carrier sheet 10. The solution is sprayed over the entire surface until such surface appears to be wet. It is then placed in front of a fan while in a dark area and allowed to dry.

The positive 16 to be reproduced is placed in contact with the now sensitized sheet, the sheet 9 still supported by the glass carrier (Fig. 2) and exposed to a strong light. A printing frame may be used if desired. The amount of light required will vary with conditions, all as is well known in the art. After exposure the positive 16 is removed and the exposed, laminated material 9, while still attached to the glass 14, is washed by placing the same within a tray containing a solution of approximately 32 ounces of water and 5 grains of zinc sulfate. This solution can be re-

used, but in use it must be kept at a temperature of 90° F. or thereabouts. The tray may be rocked to wash away the unexposed parts, and after such washing it is removed from the tray, washed in very cold water, and then placed in front of a fan to dry. The laminated material 9 with portions of the coating or masking material washed away at 17 is shown in Fig. 3.

To remove the exposed portions of the film layer a piece of cotton is saturated with a solvent for the lacquer film, and such piece of cotton carefully rubbed over the masking material, thus cutting away all portions 18 not protected by the mask, as shown in Fig. 4. This rubbing action is continued until the backing sheet has been reached and all outlines are sharp and clean. The entire surface is then preferably cleaned by rubbing gently with a piece of cotton moistened with olive oil, which removes the scum formed in this cutting operation. This application of the olive oil further has the function of protecting the backing sheet and somewhat softens the mask.

The mask is next removed by a suitable solvent therefor, and in case glue is used as the mask, one-half ounce of 28% acetic acid is added to four ounces of a 32% solution of formaldehyde. Cotton is moistened with this solution and the masking surface gently rubbed until the coating is completely gone. Olive oil is again applied to the entire surface, which oil also prevents the backing material from buckling.

As soon as the mask has been completely removed, the remaining laminated material comprising the backing sheet 10 and the film 11 are removed from the glass carrier, as shown in Fig. 5, placed in contact with the silk screen 19 in proper register, and a suitable solvent then applied to the upper surface of the silk, thereby causing a firm bond between the remaining portions of the film and the silk. As soon as the solvent has dried the backing material is stripped from the film and the stencil is ready for printing, all as indicated in Fig. 6.

The positive to be reproduced is desirably imprinted or drawn on transparent celluloid or acetate with a photographically opaque ink. It may also be drawn on a translucent tracing paper, and in the event a drawing in several colors is to be reproduced color filters may be employed or separate color drawings may be employed for preparing each color screen. The use of the sheet is not, of course, limited to exposure while in contact with manually drawn positives, since photographic positives or negatives may also be employed, and the positives or negatives may either be in contact with the sensitized material or the projection method may be employed. In many instances of this character an enlarged drawing is first prepared and then reduced photographically to the proper size.

It will be apparent that the foregoing described process may be varied considerably without departing from the invention, and also that materials for preparing the sensitized laminated sheet, other than those specified, may be used. In accordance with earlier practices in the photographic silk screen art, the resist or blocking-out material was itself sensitized, usually after it had been adhered to the screen. Photographically sensitive materials did not, however, make good blocking-out materials. Accordingly, a screen was good for 100 to 500 impressions. The essence of the present invention, however, is to use the photographically sensitive material as a mask for the blocking-out material, and once it has performed this function its usefulness is normally ended. It will be appreciated, of course, that the laminated sheet shown in Fig. 4, prior to the removal of the masking material, can be directly adhered to the screen and good results obtained, particularly if care has been employed in forming the film of masking material of uniform thickness.

What I claim is:

1. The method of preparing screen stencils which consists in the steps of coating a laminated, separable stencil sheet comprising a backing sheet and a film layer carried thereby, with a photosensitive masking material comprising an organic colloid having impregnated therein a chromic salt, exposing the masking material to light while portions thereof, corresponding to a design to be reproduced, are shielded from the light, washing out the shielded portions, removing the now exposed portions of the film layer with a solvent therefor, removing the remaining masking material, and then adhering the remaining film layer to the screen.

2. The method of preparing screen stencils which consists in coating a laminated, separable stencil sheet comprising a backing sheet and a film layer carried thereby, with a photosensitive masking material, placing a drawing to be reproduced in contact therewith, exposing the latter to light, washing out the portions of the photosensitive material covered by the drawing, removing the now exposed portions of the film layer with a solvent therefor, removing the remaining masking material, and then adhering the remaining film layer to the screen.

3. The method of forming screen stencils which consists in the steps of applying photosensitive material to the upper surface of a laminated sheet comprising a backing sheet, a film layer of blocking-out material and layer of film-masking material, placing a positive on transparent material in contact with said upper surface and exposing it to light, washing away the unexposed portions, applying a solvent to the now exposed portions of the film layer and removing such portions, removing the remaining masking film, adhering the remaining film layer to the screen and then removing the backing sheet.

4. The method of preparing screen stencils which consists in the steps of placing a positive to be reproduced in contact with the upper surface of a laminated material comprising a backing sheet having superimposed thereon a removable film layer of blocking-out material, an albumenous layer and a top layer of photographically sensitive masking material comprising an organic colloid and a chromic salt, exposing the upper surface to light, washing out the unexposed portions corresponding to the positive, applying to the now exposed film-layer portions a solvent capable of attacking such layer but not the masking layer, removing the masking layer by applying thereto a solvent incapable of attacking the film layer, adhering the film layer to the screen and then removing the backing sheet.

5. The method of preparing screen stencils which consists in the steps of placing a positive to be reproduced in contact with the upper surface of a laminated material comprising a backing sheet having superimposed thereon a film layer of blocking-out material, an albumenous layer and a top masking layer of glue gelatin, or the like, treated with ammonium or potassium bi-

chromate to render the masking layer photographically sensitive, exposing the upper layer to light, removing the unexposed portions corresponding to the positive by applying a solvent thereto incapable of attacking the film layer, applying to the now exposed film-layer portions a solvent capable of attacking such layer but not the masking layer, removing the masking layer by the use of a solvent incapable of attacking the film layer, adhering the film layer to the screen and then removing the backing sheet.

6. The method of preparing screen stencils which consists in coating a laminated, separable stencil sheet comprising a backing sheet and a film layer carried thereby, with a layer of photosensitive masking material, exposing the photosensitive material to light transmitted through a print of the design to be reproduced, washing out the unexposed portions of the photosensitive material with a solvent incapable of attacking the film layer, removing the open portions of the film layer by the application of a solvent therefor, then adhering the film layer to the screen and then stripping off the backing sheet.

7. The method of preparing screen stencils which consists in coating a laminated, separable stencil sheet comprising a backing sheet and a film layer carried thereby, with a layer of photosensitive masking material, mounting the laminated sheet on a substantially flat carrier and sealing the edges of the sheet thereon, exposing the photosensitive material to light transmitted through a print of the design to be reproduced, washing out the unexposed portions of the photosensitive material with a solvent incapable of attacking the film layer, removing the open portions of the film layer by the application of a solvent therefor, removing the laminated sheet from the carrier, then adhering the upper surface thereof to the screen and then removing the backing sheet.

8. The method of preparing screen stencils which consists in coating a laminated, separable stencil sheet comprising a backing sheet and a film layer removably carried thereby, with a photosensitive masking material, exposing the latter to light transmitted through a print of a design or the like to be reproduced, washing out the unexposed portions of the photosensitive material, removing the open portions of the film layer by the application of a solvent thereto, removing the remaining masking material, adhering the remaining film layer to the screen, and then removing the backing sheet.

9. A method of preparing stencils for screen printing which consists in the steps of applying a film layer of masking material, having incorporated therein a photosensitive element, to a laminated separable stencil sheet comprising a substantially flexible backing sheet and a film layer of resist material impervious to printing pastes and the like, adhesively joined to but removable from the backing sheet, exposing the photosensitive layer to light transmitted through a print of the design to be reproduced, separately dissolving and removing the open portions of the photosensitive layer and the corresponding portions of the film layer by the application of solvents for each of said layers incapable of attacking the other, adhering the film layer to the screen and then removing the backing sheet.

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