June 14, 1960 C. G. SHUERT 2,940,850

REPRODUCING ENGINEERING DATA

Filed June 26, 1958

FIG. 1

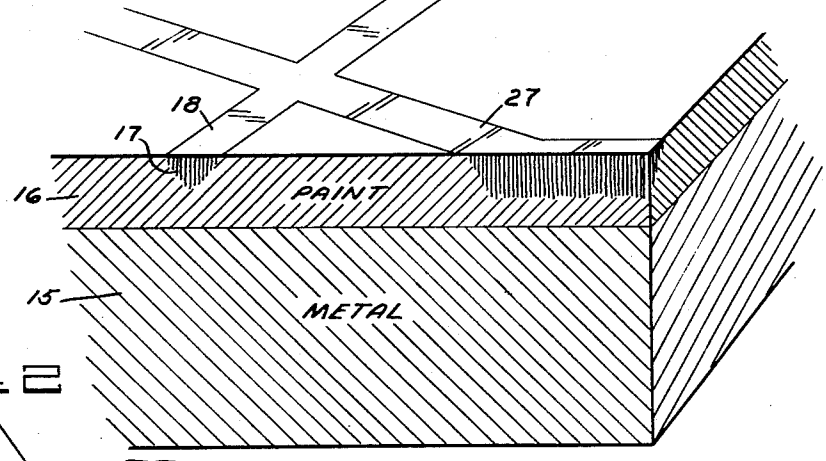


FIG. 2

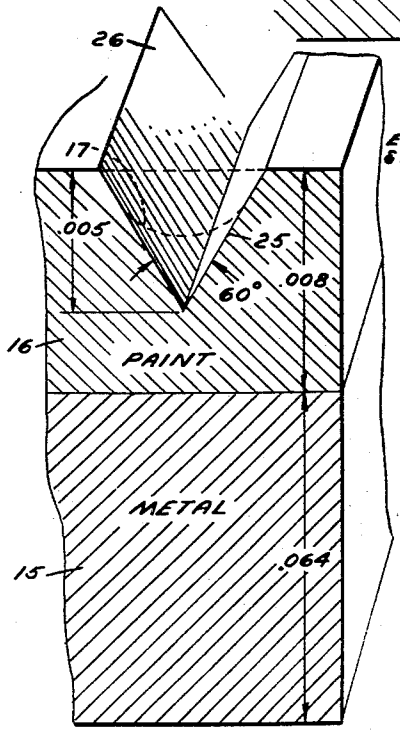


FIG. 3

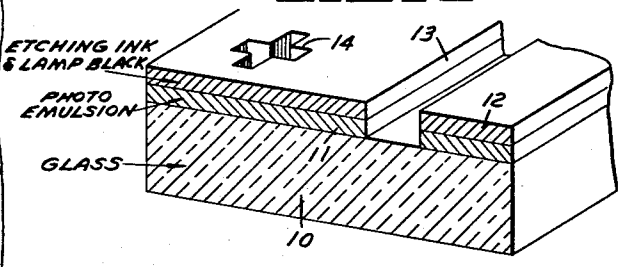
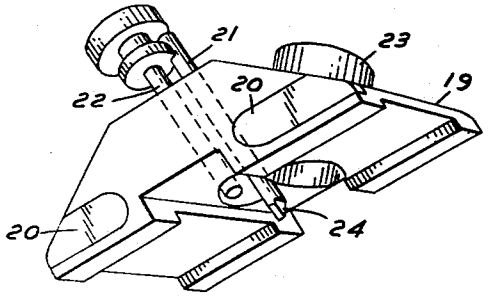


FIG. 4



INVENTOR.
CECIL G. SHUERT
BY
Barnes, Kisselle, Laughlin & Raich
ATTORNEYS

United States Patent Office 2,940,850
Patented June 14, 1960

2,940,850

REPRODUCING ENGINEERING DATA

Cecil G. Shuert, Grosse Pointe, Mich.
(13550 Conant, Detroit 12, Wayne County, Mich.)

Filed June 26, 1958, Ser. No. 746,065

10 Claims. (Cl. 96—27)

This invention has to do with reproducing engineering data, and relates to the accurate and identical reproduction of loft layouts, and particularly to reproduced layouts to be used for drafting or additional drafting work. This application is a continuation-in-part of application Serial No. 346,461 filed Apr. 2, 1953.

It has been standard practice in the commercial production of airplanes, ships, automobiles and the like, to use painted metal sheets for the layout surface. On this painted layout surface is made a full scale master drawing of the particular new design desired, usually in pencil. A process for making a reproduction of such a master drawing on to a dimensionally stable metal surface is disclosed in the application to Stewart, Serial No. 5,575, filed Jan. 31, 1948, now forfeited, wherein is disclosed a reflex process of photo-mechanically transferring the lines of a master drawing on a loft or draft to a photo-sensitive surface presented by a sheet of painted size retaining material such as aluminum or steel, this being accomplished by a contact method utilizing one or more negatives with transparent lines; the master drawing being reproduced on the painted steel in the form of sharp clean inked lines of the exact same dimensions as the lines of the master drawing. Such metal reproduction of the replica type as made by the Stewart process, usually consisted of an ink coated bichromate line on a white background, and had the disadvantage of a line which was raised minutely and which was coated with ink; such raised line, if protected by a lacquer coating, would be suitable for reference work, but a loft draftsman could not work over the lacquer. However, the unprotected raised line would not be suitable for additional drafting because such line would be subject to smearing and abrading. The making of loft drawings often takes several months, and the surface of the drawing must withstand the abrasion of the draftsman's body and often many major erasures or changes are made.

The process of the present invention is an improvement over the process disclosed in said Stewart application Serial No. 5,575, in that the labor costs of printing the metal reproductions are reduced approximately 75%; the product of the present invention is an improvement over the product of the said Stewart application in that the reproduced lines forming the accurate replica of the original drawing are flush with the surface of the metal reproduction and hence do not readily wear away under drafting use; furthermore, the surface of the loft reproduction is free of any gelatin or emulsion, leaving exposed the normal surface which readily adapts itself to the drafting pencil.

Essentially the present invention makes use of a negative or negatives of the type disclosed in said Stewart application wherein the negative is formed of glass with transparent lines and an opaque coating between the lines; the negative preferably being formed in accordance with the Stewart process wherein a sheet of transparent size retaining material such as plate glass is coated on one

surface with a very thin emulsion of the ammonium dichromate type which is temporarily photo-sensitive, the emulsion side of the glass being placed in face contact with the loft drawing to be reproduced, the emulsion being exposed to light transmitted through the glass and being reflected from the drawing whereby the emulsion contacting the lines of the drawing is rendered water soluble and the remaining emulsion water insoluble, the exposed emulsion next being rolled up with etching ink and the water soluble portion of the emulsion and the etching ink covering the same being removed, such as by water spray, to form clear sharp transparent lines on the negative identical with the lines of the original drawing.

I have found that it is not only possible to obtain replica lines on metal reproductions that are flush with the surface, but this can be done much cheaper than by the Stewart ink line method, by utilizing a dye mixed with an emulsion sensitizer. After having obtained the negative with transparent lines, the mixing of the dye with the sensitizer makes it extremely easy to photo-mechanically transfer the lines from the master loft to the metal reproduction, the essential steps consisting of painting a sheet of metal such as aluminum with a white paint, preferably a slightly porous primer of the synthetic lacquer type, the porosity of the paint is important in that it will allow the sensitizer to be sucked into the pores of the paint and be bonded into the painted surface, and also offers a correct "tooth" to a 9H drafting pencil. The emulsion used is preferably one of the bichromate type and the dye used is preferably a casein vehicle dye, the mixture of emulsion and dye being relatively thin.

This combination dye and sensitizer is sprayed over the surface of the painted base as a very thin uniform coating; the negative is then applied to the sensitized surface, exposed to light to harden the sensitizer, where exposed through the transparent lines, and the exposed base or panel is then developed with water to remove the unexposed sensitizer. The resulting line, which only remains colored in accordance with the selected dye, is flush with the surface of the paint, the dye and sensitizer having penetrated into the pores of the paint become a part of the paint. The surface of the painted panel is then cleaned with an oxalic acid solution and rinsed with clear water to, whereby when dry, present a replica of the master drawing by means of very tough durable and accurate lines which will not smear or abrade and which form a part of a perfectly flat uncoated loft drafting surface.

The labor saving in using my process for printing the reproduction stems principally from the elimination of the step of ink coating of the exposed sensitizer as disclosed in the Stewart application and the probability of damage to the print during development and the use of relatively inexperienced labor to make prints by my process. Originally about two hours were required to make a five by fourteen feet print by the Stewart process, whereas with my process such prints can be produced in thirty minutes.

A further feature of the present invention which ties in with the production of an image line, and permits drawing without interference, has to do with the manufacture of gridded layout panels. Since loft drawings have become a "must" in connection with aircraft, airframes and automotive bodies, due to the high degree of accuracy required, it has been customary for the draftsman to lay out accurate squares, usually five or ten inches on the loft surface, which squares become the base for accuracy control throughout the engineering and tooling phases. The time required by a highly skilled draftsman for the erection of the proper geometric pattern to assure accurate grid pattern layout on a sheet of painted metal five feet by fourteen feet is approximately twenty

or more man hours. Even then, because of the human element, the pattern is inaccurate and, because the master drawing is based and related to this pattern, the drawing itself is inaccurate. Of course no two such hand laid out panels are ever the same.

Many attempts have been made to improve the method of laying in grid patterns, such as by gang scribers, but none of these methods have produced accurate grid patterns economically. Since it is now possible, as above described, to print lines on painted metal surfaces, which lines are flush with the surface, I have conceived the idea of combining the registration feature as set forth in Stewart application Serial No. 5,575 with an accurate negative of the required grid pattern to print any size grid pattern on metal. The manner of achieving this accurate negative is by coating a plate glass support (about forty-eight by seventy-four inches in size) with a bichromate sensitizer, and then completely exposing the sensitizer coating to a light source to effect an overall hardening of the bicromate sensitizer, which hardening action firmly bonds the sensitizer to the glass support. The hardened bichromate coating is then coated over all with etching ink.

This coated glass support is then placed in position on a Swiss boring machine and the fine lines are scribed through the coating to the glass support, resulting in transparent sharply defined lines. A machine such as the Swiss boring machine permits the accurate placement of both the horizontal and vertical lines to create the desired grid pattern and also the placement of the registration marks in the proper locations to make possible the printing of large grid panel patterns commonly five feet by fourteen feet. Having obtained the master grid negative it is only a matter of thiry minutes to, in accordance with the process set forth in the second above paragraph, print the large grid panel layout and to duplicate the same as many times as desired from the master negative. All such panels are identically accurate and similar one to another.

Other features have to do with detailed steps of the method, structural details and formulae, all of which will be more fully and specifically set forth in the following specification and claims.

In the drawings:

Figure 1 is an enlarged sectional perspective view of a replica panel illustrating how the lines on the surface are bonded into but flush with the top of the print.

Figure 2 is an enlarged sectional view of a scribed gridded layout panel.

Figure 3 is an enlarged sectional perspective view of a master negative used for making gridded layout panels.

Figure 4 is a perspective view of a scriber used for scribing out reproduced grid patterns.

While the present process particularly relates to the photo-mechanical reproduction of full sized loft drawings, the lines of which are flush with the surface of the loft, it is also concerned with the accuracy of the original master loft drawing, because this accuracy is reproduced right down through the entire process. It is therefore thought that the present invention may be best understood by first describing the method of making the gridded panel layout on which is placed the original loft drawing.

Preparation of master negative.—Select a good grade of plate glass, approximately 48" x 74" x ¼" thick having surfaces as flat and smooth as commercially possible, preferably made from a glass formula permitting maximum light transmission and minimum discoloration characteristics. Coat this glass, in a machine called a whirler, with a light sensitive solution, as described in said Stewart application Serial No. 5,575 for the preparation of a negative.

An effective light senstive solution may be prepared as follows:

20 oz. fresh egg albumen
200 grains ammonia dichromate
40 drops ammonium hydroxide
1 gallon distilled water

Beat egg albumen (whites) well with power beater—use some of distilled water to dissolve dichromate—mix water, albumen and dichromate solution thoroughly, add ammonium hydroxide. Filter carefully through cotton at least twice, let stand three days before using and filter again just prior to use. Keep clean and free of dirt. Albusol solution can be substituted—use approximately same quantity of albumen but adjust according to negative problem. Albusol sensitizer solution can be used immediately after filtering through filter paper. Keep stored in dark bottles in a cool place. Solution should be good for thirty days.

After having obtained a uniform thin dry emulsion on the plate, such sensitive surface is exposed over its complete area, using a suitable light source to render the total sensitive surface insoluble in water. The complete surface of exposed emulsion is next coated with a relatively thin coating of black ink and lamp black, as described in said Stewart application. The black ink coating may be an etching ink having a proportion of 50% Frederiksen's etching ink and 50% Perfection etching ink. The lamp black may be applied to the ink coating by using a sifter and a cotton swab, the excess lamp black being blown off with air, the oil surface of the ink holding the required lamp black in place. Such a base member with a glass plate **10**, photo-senstive emulsion **11**, and surface of etching ink and lamp black **12** is shown in Figure 3.

The thus coated glass plate is placed, coated side up, in the bed of a Swiss boring machine (or equivalent machine tool) and locked in place. Using a spring mounted scribing tool clamped in the head of the machine, the desired grid pattern is cut in the coated surface of the glass to expose the glass surface in the lines clearly and completely. These accurate lines are usually cut entirely across the plate, usually either five or ten inches apart, the plate or the head then rotated 90° and similar lines cut to form accurate five or ten inch squares. The scribing tool controls the width of the line, preferably about .003" to .004", and the spring mounting of the scribe tool permits it to follow the surface of the plate glass without scratching the glass and only removing the coating. Such a scribed line is shown at **13** in Figure 3. The same scribing tool is used to cut a registration device, such as shown at **14** in Figure 3, in each of the four corners of the master negative. A completed cutting of the pattern in the coated surface of the glass presents a concise negative embodying lines of a controlled width and definition. The negative thus produced is then retouched, if required, to render opaque any blemishes in the background area caused by handling, and is then coated with a clear lacquer such as Dinoc #2155 manufactured by the Dinoc Company.

While the master negative just described may be used for making positive print gridded layout panels, it is, because of its original cost, preferably used only for the purpose of making a positive print on plate glass ¼" thick, and in turn this positive print is carefully preserved and used only to make the actual printing negatives on ¼" plate glass. These supplementary glass positives and negatives are made by coating glass with a suitable sensitizer which is then exposed and developed as described in said Stewart application Serial No. 5,575. Such supplementary positives and negatives are preferably lacquer coated for protection.

Preparation of gridded layout panels.—For drafting layout panel purposes as used by aircraft and automotive engineering groups, a metal panel, as shown at **15** in Figure 1, usually about five feet by fourteen feet and preferably aluminum, is painted to produce a surface **16**

about .007 inch to .010 inch depth when finished. The paint used for this surface is preferably a slightly porous primer type synthetic lacquer known as a combination primer surfacer such as Du Pont 65–1050 Preparacote (a high alkyd resin type primer surfacer), or comparable paints made by Ditzler, Acme, or Sherwin-Williams, the important point being that the paint when dry, should have sufficient porosity as to suck in or accept the sensitive bichromate coating so that the bichromate coating, when hardened by exposure, will be bonded to the painted surface. When dry, the porosity of the paint surface is enhanced by sanding or rubbing so as to offer the correct "tooth" to a 9H drafting pencil.

The dry painted surface **16** is next sensitized by applying the following formula with a spray gun—

Example I

1½ oz. ammonium bichromate
50 oz. Albusol
Water (alcohol can be substituted for a portion) to make a gallon
1¼ oz. casein vehicle dye (any selected color) (Lamp black or commercial opaque)
4 oz. glue

Dye is dissolved in water or alcohol and then mixed with other materials.

Albusol is an aqueous solution of albumin marketed by Mallinkrodt Chemical Company of St. Louis, Missouri.

From the skill and experience in the making of layout panels under the present process I have found it best to apply a sensitized coating made up of several finely atomized applications. The combined dye and sensitized solution, being applied in a plurality of finely atomized applications, goes into the pores of the paint whereby the surface of the paint still defines the top surface of the panel.

The sensitized panel is next placed in a vacuum frame and the master negative, previously described, is placed to cover the left end of the panel with the coated surface **12** of the negative in contact with the sensitized surface of the panel. The frame is locked, vacuum applied, and exposure is made using a high intensity light source, all of which steps are disclosed in said Stewart application Serial No. 5,575. The negative is then removed and the right hand registration device area, as printed on the panel by light shining through the device **14** such as shown in Figure 3, is then locally developed by using a water wet cotton swab. The negative is then moved to the right to register the left hand registration devices **14** of the negative to the registration marks just developed on the panel. The exposure procedure as just described is repeated. This registration and exposing is repeated until the entire panel is completely exposed.

The panel is then placed in a large sink and developed with flowing water and swabbed off with a cotton or sponge. The high intensity light, which has shone through the scribed openings **13** in the negative, will have rendered the sensitizer and dye (which is held bonded in the pores of the paint) insoluble, such as shown at **17** in Figure 1. Developing of the panel in the sink with the cotton or sponge swab removes the excess unexposed and soluble sensitizer and dye with the result that lines **18** corresponding to the transparent lines **13** on the negative remain, colored according to the selected dye. Any bichromate stains can be removed with a weak oxalic solution or similar bleach and the panel rinsed off.

When dry, the result is a panel with fine grid lines of the selected sensitizer color and an accuracy of plus or minus .003" or less over the total panel with no accumulated error. Heretofore such accuracy has never been achieved. Furthermore the sensitizer dye forming the lines is held in the pores of the paint presenting a drafting surface defined by the paint itself with no ridges. In other words, the lines forming the grid panel are flush with the surface of the painted coating because the line pigmentation is essentially bonded into the pores of the paint and as a result the lines do not readily wear away under drafting use. Every gridded layout panel produced in this manner is identical with every other panel produced by the same method.

Many drafting rooms require that the grid pattern on the panel be scribed in the paint surface of the panel. I have found it possible to supply such a scribed gridded layout panel, having the same accuracy as the above described printed grid panel, by scribing out the lines **18** of the printed gridded layout panel as follows:

A scribed or cutting tool block as shown in Figure 4 is made of a block of transparent plastic **19** having wear plates **20** on each side thereof. Positioned to extend vertically to the center of this block is a carboloy tipped shaft **21** locked in place on a feed screw **22**. A magnifier **23** is located in the block and positioned to be focused on the tip **24** of the cutting tool. The cutting point **24** is shaped to produce a cut as shown at **25** in Figure 2, and the depth of the cut is controlled by setting the cutter against a micrometer. By these controls the depth and width of the cut can be predetermined; as shown in Figure 2 the width of the cut is approximately .005" and the depth approximately .005 inch.

To produce a scribed line pattern on the above described grid panel, a straight edge is placed on the panel approximately parallel to the first line, such as **18** in Figure 1, and distant from that line a space approximately the equivalent to the distance from the scribe point **24** to the outside of the scribe block **19**. Then, using the magnifier **23** the scribe block is positioned so that the cutter point **24** splits a line **18** on the panel when the block **19** is snug against the straight edge. This line up operation is repeated for the opposite end of the line and the scribe block is then pulled along the straight edge and the scribed point pulled through the line, completely removing the line **18** from the panel, and replacing it with a scribed line **26** as best shown in Figure 2; Figure 2 also showing the sensitizer dye line **17** in dotted lines.

As will be seen from Figure 2, the scribed line **26** is a true V in shape, the low point of the line being the true center of the line. Using this procedure, all the lines **18** on the panel are replaced by scribed lines. Automatic proof of the accuracy of the pattern is at all times visible because each line must be completely cut out by the scribe to maintain accuracy. Having completed the scribing operation, the scribed lines may be blacked or colored using suitable pigments or dyes and the panel cleaned up by lightly wet sanding to the desired finish. The white panel with colored lines is now ready for drafting purposes requiring a scribed pattern and maintains an accuracy of plus or minus .003 inch.

Photo-mechanically reproducing engineering draft or loft drawings.—After a loft drawing has been made on a gridded layout panel of the type previously described, either colored line or scribed line, it is often desirable to have many reproductions of this loft drawing made on painted metal to produce exact loft reproductions. Previously reproductions of master loft drawings onto dimensionally stable metal surfaces in the form of ink lines have been accomplished by the process disclosed in Stewart application Serial No. 5,575, and in the present invention use is made of some of the steps disclosed in said Stewart application except that instead of reproducing as an ink line the drawing is reproduced as a colored flat line and in so doing the labor cost of printing such reproduction is reduced to approximately 75%.

Specifically, the master negative of the master loft drawing is prepared in exactly the same manner as described in said Stewart application. In fact, the master negative of the loft drawing is prepared in the same manner as previously described in this application under the heading "Preparation of master negative" for gridded

layout panels, except that after the bichromate sensitizer solution has been applied to the glass plate, the master loft drawing is placed in face contact with said light sensitive coating and the intense light shining through the glass negative will render the sensitive surface on the glass plate insoluble in water except for those surfaces lying underneath the lines of the drawing. The exposed emulsion on the glass surface is then coated with a relatively thin coating of black ink and lamp black as previously described in connection with the making of the gridded layout panel negative and as described in said Stewart application. Next, instead of scribing lines on the exposed surface as is done in making the gridded layout panel, the exposed negative of the master loft drawing is subjected to a fine spray of air and water to remove the soluble emulsion and backing ink in the form of distinct clean lines.

After the negative with transparent lines is formed to print the loft drawing of the negative on to a metal surface, such reproduction metal surface is painted as described in connection with the making of gridded layout panels in that it is painted with a slightly porous primer of the synthetic lacquer type to achieve bonding of the final lines and to present a surface adaptable to a drafting pencil. The dry painted surface of the reproduction panel is then sensitized with a solution of combined dye and sensitizer. In the winter time or with controlled humidity it is possible to use a dye and sensitizer solution of the type previously set forth in Example I in the same manner as previously described, namely, with several finely atomized applications, such applications being fine so that the dye sensitizer solution goes into the pores of the paint.

If low or controlled humidity conditions are not present, then it is desirable to use a dye sensitizer solution as follows:

Example II

Solution A:
- 2½ ounces ammonium bichromate
- 40 ounces Albusol
- 4 ounces glue
- Water to make 1 gallon

Solution B:
- Carters Poster Black, Mural-Tone or equivalent casein vehicle dye in any color
- To use: Combine 4 parts Solution A with 1 part Solution B.
- Application: Spray one fine almost dry undercoat of Solution A and then spray about five fine almost dry over coats of combined Solutions A and B.

After the dye sensitizer coating on the reproduction panel is dry, it is placed in a vacuum frame and the developed coated surface of the negative, which is similar to the negative shown in Figure 3, is then placed in contact with the dye sensitizer surface of the panel and the vacuum locked assembly exposed to a high intensity light source as previously described in connection with printing of the layout panel. The exposed reproduction panel is then removed to a sink, developed with water using a cotton or sponge swab to remove the soluble dye sensitizer and leaving only a colored line as at **27** in Figure 1, which line is identical in all respects with the line **18** used in forming a gridded layout panel. The dye sensitizer being rendered insoluble by the light and being bonded in the pores of the paint, presents a colored line of better quality and usefulness than the ink line of the Stewart print by eliminating the undesirable characteristics of the ink line in that it will not smudge and will not abrade because it is flush with the paint surface. Furthermore, if it is desired at some future time to change the reproduction loft drawing or to use it as the basis for a later drawing, the emulsion free, flush reproduction line porous paint surface is an ideal surface for drafting purposes and, furthermore, such drafting surface is identical to that of the original layout panels in that erasing of lines and new drafting is easily carried out.

In the case of large loft reproductions, a multiple number of negatives using registered marks, as previously described, could be used in reproducing the large master loft drawing; it will be understood that all the steps previously described in the making of gridded layout panels, master loft drawing negatives and reproduction panels may be carried out in normal light. It will also be understood that reproduction material is not confined to aluminum but can be any material preferably one having dimensionally stable properties.

Regardless of whether the loft drawing is printed on the painted metal or whether the master grid lines are printed on the painted metal, or whether the printed lines are cut out to form a scribed layout panel, it will be seen, because the dye sensitizer mix enters into and is bonded into the pores of the paint, that the entire exposed surface of the printed and/or scribed panel is free of any emulsion, making such surface ideal for the use of a drafting pencil in drawing over the reproduced lines or when erasing such reproduced lines for changes.

I have also discovered that it is possible to use a metal print emulsion by combining silver nitrate with ammonium bichromate instead of dye and ammonium bichromate to obtain clear distinct lines instead of fuzzy lines. However, such a silver nitrate print emulsion is so much more expensive than a dye bichromate emulsion as to make it prohibitive. It will be understood, however, that while the ammonium bichromate sensitizer is preferred and best from a commercial and economic standpoint, that other light insolubilized sensitizers known to those skilled in the art, for example, the potassium bichromate type, may be used.

From the foregoing it will be apparent and obvious the the gist of the present invention lies in the use of a colored sensitizer of the light insolubilized type in combination with a surface of such porosity that the colored sensitizer is substantially completely absorbed by the pores of the surface so as to produce a reproduction presenting a colored line substantially flush with the reproduction surface. It will therefore be understood that the dimensionally stable metal sheet, designated **15** in the drawing, may be of any convenient thickness and instead of being coated with a porous synthetic lacquer as previously described, such metal surface may itself be rendered porous to provide a porous surface capable of substantially completely absorbing the dye sensitizer solution. In the case of a metal surface, such as an aluminum sheet, the requisite porosity may be imparted to it by etching or abrading, such as by sand blasting, calendering, or sanding with a #220 grit. In such an arrangement wherein the metal sheet is in itself formed with a porous surface for substantially completely absorbing the dye sensitizer solution, the cross hatched area designated **16** in Figure 1, instead of representing paint, represents the porous surface of the metal.

It will also be observed that the reproduction panel **16** may be of a material other than metal. For example, a dimensionally stable plastic sheet. In the case of a dimensionally stable plastic sheet, a porous surface on one side thereof can be imparted thereto as discussed above in connection with a metal backing sheet, by calendering, abrading or roughing in any suitable manner as long as the porous surface produced on the sheet is of such porosity that the dye sensitizer solution will be substantially completely absorbed in the pores so as to present, upon reproduction, a colored line substantially flush with the reproduction surface.

What I claim is:

1. The steps in the process of photo-mechanically transferring of drawings from one dimensionally stable sur-

face to a reproduction dimensionally stable surface by the contact method utilizing a negative with transparent lines and opaque coating between the lines, which comprises coating said reproduction surface with a white synthetic lacquer primer paint which when dry contains pores, drying the paint, abrading the surface of the dry paint, such abraded surface presenting a tooth for penciling and being readily absorptive of a thin sensitizer solution, impregnating said paint with a combined dye and dilute organic colloid ammonium bichromate sensitizer solution, said combined dye and sensitizer solution being capable of being substantially completely absorbed by said paint and the amount of said solution being regulated to provide substantially complete impregnation by absorption so that said sensitizing solution is substantially completely absorbed by said paint, locating said negative in face contact with said dye sensitizer surface, transmitting light through said transparent lines to render insoluble the dye sensitizer in the pores of the paint underlying said transparent lines, washing out the soluble dye sensitizer solution from the surface and pores of the paint to leave a positive reproduction of said transparent lines of the negative in the shape of colored lines formed by the insoluble dye sensitizer solution in the pores of the paint and presenting colored lines substantially flush with the surface of the paint.

2. A process as set forth in claim 1 wherein said organic colloid ammonium bichromate sensitizer solution includes albumen as the primary constituent of said organic colloid.

3. A process as set forth in claim 1 wherein said porous synthetic lacquer primer paint has a high alkyd resin content.

4. A process as set forth in claim 2 wherein said porous synthetic lacquer primer paint has a high alkyd resin content.

5. The steps in the process of photo-mechanically transferring of drawings from one dimensionally stable surface to a reproduction dimensionally stable surface by the contact method utilizing a negative with transparent lines and opaque coating between the lines, which comprises using a dimensionally stable reproduction backing material having a porous surface which presents a tooth for penciling and which is readily absorptive of a thin sensitizer solution, impregnating said porous surface with a combined dye and dilute organic colloid light insolubilized bichromate sensitizer solution, said combined dye and sensitizer solution being capable of being substantially completely absorbed by said porous surface and the amount of said solution being regulated to provide substantially complete impregnation by absorption so that said sensitizing solution is substantially completely absorbed in the pores of said surface, locating said negative in face contact with said dye sensitizer surface, transmitting light through said transparent lines to render insoluble the dye sensitizer in the pores of said surface underlying said transparent lines, washing out the soluble dye sensitizer solution from on and within said porous surface to leave a positive reproduction on said transparent lines of the negative in the shape of colored lines formed by the insoluble dye sensitizer solution in the pores of said surface and presenting colored lines substantially flush with said surface.

6. A process as set forth in claim 5 wherein said sensitizer solution is ammonium bichromate.

7. The steps in the process of photo-mechanically transferring of drawings from one dimensionally stable surface to a reproduction dimensionally stable porous surface by the contact method utilizing a negative with transparent lines and opaque coating between the lines, which comprises abrading said reproduction surface, said surface being readily absorptive of a thin sensitizer solution and presenting a tooth for penciling, impregnating said porous surface with a combined dye and dilute organic colloid light insolubilized bichromate sensitizer solution, said combined dye and sensitizer solution being capable of being substantially completely absorbed by said porous surface and the amount of said solution being regulated to provide substantially complete impregnation by absorption so that said sensitizing solution is substantially completely absorbed in the pores of said surface, locating said negative in face contact with said dye sensitizer surface, transmitting light through said transparent lines to render insoluble the dye sensitizer in the pores of said surface underlying said transparent lines, washing out the soluble dye sensitizer solution from on and within said porous surface to leave a positive reproduction on said transparent lines of the negative in the shape of colored lines formed by the insoluble dye sensitizer solution in the pores of said surface and presenting colored lines substantially flush with said surface.

8. The steps in the process of photo-mechanically transferring of drawings from one dimensionally stable surface to a reproduction dimensionally stable surface by the contact method utilizing a negative with transparent lines and opaque coating between the lines, which comprises coating said reproduction surface with a white porous synthetic lacquer primer paint which when dry contains pores, drying the paint, abrading the surface of the dry paint, such abraded surface presenting a tooth for penciling and being readily absorptive of a thin sensitizer solution, impregnating said paint first with a thin undercoating of a dilute organic colloid light bichromate sensitizer solution and then with an overcoating of said sensitizer solution combined with a dye, said solutions being capable of being substantially completely absorbed by said paint and the amount of said solutions being regulated to provide substantially complete impregnation by absorption so that said sensitizing solutions are substantially completely absorbed by said paint, locating said negative in face contact with said dye sensitizer surface, transmitting light through said transparent lines to render insoluble the dye sensitizer in the pores of the paint underlying said transparent lines, washing out the soluble dye sensitizer solution from the surface and pores of the paint to leave a positive reproduction of said transparent lines of the negative in the shape of colored lines formed by the insoluble dye sensitizer solution in the pores of the paint and presenting colored lines substantially flush with the surface of the paint.

9. A process as set forth in claim 8 wherein the sensitizer solution is ammonium bichromate.

10. The steps in the process of photo-mechanically transferring of drawings from one dimensionally stable surface to a reproduction dimensionally stable surface by the contact method utilizing a negative with transparent lines and opaque coating between the lines, which comprises using a dimensionally stable reproduction material having a porous surface which presents a tooth for penciling and which is readily absorptive of a thin sensitizer solution, impregnating said porous surface first with a thin undercoating of a dilute organic colloid light insolubilized bichromate sensitizer solution and then with an overcoating of said sensitizer solution combined with a dye, said solutions being capable of being substantially completely absorbed by said porous surface and the amount of said solutions being regulated to provide substantially complete impregnation by absorption so that said sensitizing solutions are substantially completely absorbed in the pores of said surface, locating said negative in face contact with said dye sensitizer surface, transmitting light through said transparent lines to render insoluble the dye sensitizer in the pores of said surface underlying said transparent lines, washing out the soluble dye

sensitizer solution from on and within said porous surface to leave a positive reproduction of said transparent lines of the negative in the shape of colored lines formed by the insoluble dye sensitizer solution in the pores of said surface and presenting colored lines substantially flush with said surface.

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