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PROCESS FOR PHOTOGRAPHICALLY PRODUCING PRINTING PLATES

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This invention relates to processes for photographically producing printing plates, and more particularly to processes for producing the photographic plates from which the final metal printing plates are to be made.

In the graphic or printing arts, photographic reproductions of originals are produced either by the photo-engraving, photo-lithography or photo-gravure process.

Where the original is to be reproduced in colors, it is usually photographed on panchromatic dry plates which are sensitized for all colors, and a series of negatives are made through different color filters, each of which negatives is used to make a different printing plate, and each of these plates when printed in the proper color and superimposed results in a reproduction of the original in colors.

Theoretically, it is possible to print reproductions in all colors to match the originals by means of three printing plates, one to print yellow, another to print red, and another to print blue. In practice, however, due to limitations of printing inks and the photographic process, a black printing plate is usually added in the photo-engraving and photo-lithographic processes. Yellow, red and blue inks, when superimposed in the proper proportions, will produce all colors and black. A pure yellow area in an original will be reproduced by printing such area in yellow from the yellow printing plate and by superimposing substantially no color thereon from the red and blue printing plates. In a similar way red is produced by the red printing plate, and blue by the blue printing plate. Green, which is a combination of yellow and blue, will therefore be produced by the superimposing of inks from the yellow and blue printing plates. Orange, which is a combination of yellow and red, will be produced by the yellow and red printing plates, and violet or purple which is a combination of blue and red will be produced by the blue and red printing plates. Black is produced by superimposing yellow, red and blue inks in full strength from the corresponding printing plates. Certain intermediate colors will be produced by superimposing all three colors, but with one or more of the colors appearing light by virtue of being printed from fine half-tone dots of the printing plate.

In the photo-engraving process, for example, a negative is made by photographing the original through a violet or purple color filter. This filter permits the red and blue color values of the original to pass through the filter and act

on the negative while the yellow light or value of the original is absorbed by the filter and is thus shut off from the negative. When a positive is made from this negative the fact that the yellow value did not act on the negative and therefore left such areas of the negative light or transparent results in these areas being dense or dark on the positive, while the blue and red values which acted on the negative and were therefore dark thereon will be light on the positive. Inasmuch as the metal plate which is used to do the actual printing is a positive, the dark portion on the positive is what represents the printing surface which will be used for printing in yellow ink. For this reason the negative from which this positive is made is called the yellow plate or negative or separation negative. In a similar way, the red separation negative is made through a green filter which shuts off red and transmits yellow and blue, and the blue separation negative through an orange filter which shuts off blue and transmits yellow and red. The black separation negative has sometimes been made heretofore through a yellow filter.

If it were attempted to produce the yellow, red, blue and black printing plates solely and entirely by photographic methods without handwork, when the various colors were printed in superposed relation to produce the finished picture it would be found that the printed reproduction would look but little like the original and would not be satisfactory. Where there were bright blues, reds, yellows, etc. in the original, the printed reproduction would tend to dullness, somberness, and in parts to blackness. This is largely due to failure to secure correct and full color separation on the different printing plates by photography alone. Where a pure yellow should appear, for example, it would be masked by too much red, blue and black from the corresponding printing plates. And inasmuch as yellow, red and blue inks when superimposed tend to produce black, this explains why such a printed reproduction would not look like the original and would therefore be unsatisfactory. It has, therefore, been the practice to employ experts of long training and great skill to correct the color printing plates by handwork to overcome these inherent defects of the photographic process. This hand correction by experts is expensive, not completely effective where the design is complicated, and the quality naturally varies with the ability of the expert workmen.

The defects inherent in the photographic process are largely due to there being too little

contrast between the color that is to be printed from a printing plate and those colors which it has been attempted to eliminate therefrom. I have found a way by which this correction can be automatically and photographically made to any desired or practical extent.

It is therefore an object of this invention to provide a process whereby color printing plates can be automatically and photographically produced so that when the different colors are printed in superposed relation to these plates, the printed reproduction will be a substantial duplicate of the original.

Another object of this invention is to provide an improved process for automatically and photographically producing dots of proper size and density in the printing plates.

The above and other objects and advantages will appear from the following description and appended claims forming a part of this specification.

In carrying out my improved process, a yellow separation negative may be made through a violet filter on a panchromatic photographic plate which is sensitized for all colors. In a similar way, the red separation negative is made through a green filter, and the blue separation negative is made through an orange filter. As hereinbefore explained, these separation negatives, if used as they are, would not give the true color values. The yellow plate is approximately 60% correct, the red plate 40-50% correct, and the blue plate approximately 85% correct.

In order to correct the yellow separation negative the yellow value should be retained in its light or transparent condition, and the red and blue values should be made darker to get greater contrast between the yellow value on the one hand, and the blue and red on the other, since the light portions of the negative which represent the yellow will be dark in the positive to represent the yellow printing value, whereas the red and blue values must be eliminated from or made light in the positive so that yellow ink will not be printed in any substantial depth of color on the final picture where only red and blue values should be printed. In a similar way, the red value should be dark in the red positive, and the yellow and blue values should be made lighter. In the blue positive, the blue value should be dark, and the yellow and red values should be made lighter.

In order to accomplish this automatically and photographically, I make a thin positive from the yellow negative and a thin positive from the blue negative. The density of these positives will be varied by the operator in accordance with the conditions encountered and will be referred to as "positive overlays".

To correct the yellow negative, the positive overlay made from the blue plate is placed in register over the yellow negative and a corrected positive is made by photographing through the negative and positive overlay. Inasmuch as the blue negative was made through an orange filter which transmits yellow and red rays, the yellow values will be dark in the blue negative and therefore light or transparent in the blue positive overlay. Thus, light readily passes through the areas which represent strong yellow values in the yellow separation negative and the blue positive overlay, to record the yellow values dark in the corrected positive made from the yellow negative. And since the blue values are dark in the blue positive overlay, this will lighten the blue

values in the yellow corrected positive. In practice, it is found that by the above procedure the red values are also reduced sufficiently in the yellow corrected positive. Thus, in the yellow corrected positive, the yellows have been retained dark and at full strength to represent the printing surface in the final metal printing plate to be made, whereas the red and blue values have been eliminated or lightened to the extent desired. In a similar way, a red corrected positive is made from the red separation negative placed in register with the blue positive overlay, and a blue corrected positive is made from the blue separation negative with the yellow positive overlay placed in register therewith.

The positive overlays may be made either on glass photographic plates or on films. Ordinarily, glass overlays are preferable where the corrected positives are to be made in the camera, since glass gives more perfect register. Film overlays, however, give fairly satisfactory registry and at the same time are much thinner than those of glass and are therefore advantageous in making corrected positives by the contact method in the printing frame, since the film overlay being much thinner than a glass plate permits the separation negative to be closer to the sensitized plate, thus producing a sharper image on the sensitized plate.

I prefer to make the black separation plate by giving a partial exposure to a sensitized plate through one colored filter at one time and another colored filter subsequently. These colored filters may be respectively green and orange, and the amount of each exposure will be determined by the operator in accordance with the black values in the original which is to be reproduced. By correct exposure of the black separation negative, it can be made quite correct and requires little, if any, retouching.

In case it is desired to reproduce an original by printing in more than four colors in photolithography, the additional colors, which are usually pink, light blue and grey, are printed in corresponding colored inks. The pink and light blue printing plates are made from corrected positives of the red and blue separation negatives, respectively, in the manner described above, and the grey printing plate is made from the black separation negative, the positives being given longer or shorter exposures and being reduced or intensified to get the proper strength for these additional colors.

This process which I have developed, in a great many instances enables retouching to be entirely done away with and, in some instances, reduces the amount of retouching required by 85-95%. The corrected positives may be produced either by the printing frame or camera. To produce a corrected positive in the printing frame, a glass half-tone screen is placed in a vacuum printing frame and on this half-tone screen is placed the separation negative with the proper positive film overlay on top of the negative and secured in register therewith in any suitable way, as, for example, by pieces of gummed paper. Next, a sensitized photographic plate is placed with its sensitized surface in contact with the film overlay, and light is passed through the half-tone screen, separation negative and positive overlay to produce the desired corrected positive on the sensitized plate. In order to produce dots of the proper size and density on the corrected positive, a contrast plate is preferably used. I find that

the super-contrast plate made by Cramer & Co. is especially suitable for this purpose.

The vacuum printing frame is preferably in a horizontal position while the plates are being assembled therein. The vacuum frame is then closed and the vacuum applied to press the plates in close contact in a way which is well known. The frame is then swung to a vertical position and exposed to light to produce the corrected positive. I have found that excellent results are produced by carrying out this operation in a dark room with a beam of light thrown upon the printing frame from a concentrated source of light placed several feet away from the printing frame. In particular, I have found it advantageous to use a projector provided with a concentrated light source and condenser lens means and preferably also having a reflector behind the concentrated light source. A projector of this nature which gives satisfactory results is the Bausch & Lomb projector provided with a suitable lens and primarily manufactured to be used to throw enlargements of transparencies on a screen. I preferably place the projector about 7 to 8 feet from the printing frame and give a suitable length of exposure which ordinarily is very short, usually a fraction of a second. As the projector above-described sends the light from a concentrated source in a beam sufficiently divergent to properly cover a photographic plate, good dot formation is produced in the corrected positive. The resulting corrected positive is examined for correct density, detail and proper dot size and density, and may be intensified or reduced by chemical treatment as required. I have found that additional contrast may be obtained by placing a clean transparent glass plate of suitable thickness, such, for example, as the thickness of a photographic plate, between the half-tone screen and the separation negative, since this causes the light to be so diffracted as to increase the size of the large half-tone dots more than the small half-tone dots.

Instead of producing a half-tone corrected positive direct from the separation negative and positive overlay, the half-tone glass screen may be omitted from the process just described, and a continuous-tone corrected positive will then be produced. This continuous-tone positive permits hand retouching which is not practical in a half-tone positive. The continuous-tone corrected positive, retouched if desired, is then placed in the printing frame between a glass half-tone screen and a sensitized photographic plate and a half-tone negative is then produced by means of the projector in the way above-described.

Instead of using the vacuum frame to make corrected positives, the camera may be used. On account of the better register attained, the overlays are preferably made of glass in this instance. The negative and glass positive overlay having been joined in perfect register are placed before the camera and a half-tone positive is made through a half-tone screen of desired size of ruling, preferably on a wet plate. Where the original which is to be reproduced is very large, I find it advantageous and economical to make the corrected positive on a smaller sized plate and with a correspondingly finer screen ruling than ultimately desired on the final negative, the screen ruling used being calculated so as to give the desired size of screen ruling on the final printing plate.

For photo-lithography it is desirable that the high-light half-tone dots should be eliminated. I

have found a way by which this can be very advantageously accomplished both for color and monotone reproductions. A negative is made of the copy to be reproduced. In the case of color reproduction, the separation negatives are what are needed. In the case of a monotone copy, a good orthochromatic negative is needed. Either place the negative before the camera and make a half-tone positive therefrom in a finer screen and in a smaller size than the final negative should be, or place the negative in a vacuum frame and expose with the projector lamp as before described in order to produce a positive on a sensitized glass plate.

I have found that by reducing this glass plate positive by chemical treatment, the high-light dots which are small can be readily and completely eliminated. If necessary, intensify the positive until the dark portions have satisfactory dot formation. Now place a positive made in this way before the camera in case it has been made on a finer screen and is of a smaller size, and make from it an enlarged negative of the proper size and proper screen ruling, and after exposure intensify or reduce the negative as may be necessary to get the final proper dot formation. In case the positive is made with the proper screen required for printing, and to the right size, the negative may be made in a contact vacuum frame, preferably on a Cramer contrast plate, and reduced or intensified as required.

From corrected positives obtained either by contact printing in the printing frame or by the camera method, negatives are made by placing the negatives before the camera and making final half-tone negatives, either on dry or wet photographic plates. By correct exposure and manipulation the proper dot formation may be obtained. From these final half-tone negatives, positives are made on metal for use in printing, as is well known.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics of the invention, and the present embodiment of the invention is, therefore, to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes that come within the range of equivalents of the claims are, therefore, intended to be embraced therein.

I claim:

1. In the art of photographically producing printing plates, the process comprising making yellow, red, blue and black separation negatives, making positive overlays from the yellow and the blue separation negatives, making a corrected positive of the yellow separation negative by photographing through the yellow separation negative and the blue positive overlay, making two corrected positives by photographing through the red separation negative and the blue positive overlay, one corresponding to the red printing plate and the other corresponding to the pink printing plate, making two corrected positives by photographing through the blue separation negative and the yellow positive overlay, one corresponding to the blue printing plate and the other corresponding to the light blue printing plate, and making two positives from the black separation negative, one corresponding to the black printing plate and the other corresponding to the grey printing plate.

2. In the art of photographically producing printing plates, the process which comprises mak-

to the individual colors required to reproduce the original composite coloring making transparent positive overlays from certain of said separation negatives and making a corrected half-tone positive of certain of said negatives by placing a half-tone screen, the separation negative, film overlay and a sensitized plate in a vacuum printing frame and exposing the same to light from a projector having a condenser lens.

3. In the art of photographically producing printing plates, the process which comprises making a series of separation negatives corresponding to the individual colors required to reproduce the original composite coloring, making transparent positive overlays from certain of said separation negatives and making a corrected half-tone positive of certain of said negatives by placing a half-tone screen, transparent plate, separation negative, film overlay and a sensitized plate in a vacuum printing frame and exposing the same to light from a projector having a condenser lens.

4. In the art of photographically producing printing plates, the process comprising making yellow, red and blue separation negatives, making a positive overlay from the yellow separation negative having a predetermined density such that when superimposed upon the blue separation negative the transmitted light possesses the color value required to produce the corrected positive, making a positive overlay from the blue separation negative having a density such that when superimposed on the yellow separation negative and on the red separation negative respectively the transmitted light will have the color

values required to produce the corrected positives, making a corrected positive of the yellow separation negative by photographing through the yellow separation negative and the blue positive overlay, making a corrected positive of the red separation negative by photographing through the red separation negative and the blue positive overlay, and making a corrected positive of the blue separation negative by photographing through the blue separation negative and the yellow positive overlay.

5. In the art of photographically producing printing plates, the process which comprises making a series of separation negatives corresponding to the individual colors required to reproduce the original composite coloring, making transparent positive overlays from certain of said separation negatives and making a corrected half-tone positive of certain of said negatives by placing a half-tone screen, the separation negative, film overlay and a sensitized plate in a vacuum printing frame and exposing the same to light.

6. In the art of photographically producing printing plates, the process which comprises making a series of separation negatives corresponding to the individual colors required to reproduce the original composite coloring, making transparent positive overlays from certain of said separation negatives and making a corrected half-tone positive of certain of said negatives by placing a half-tone screen, transparent plate, separation negative, film overlay and a sensitized plate in a vacuum printing frame and exposing the same to light.

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