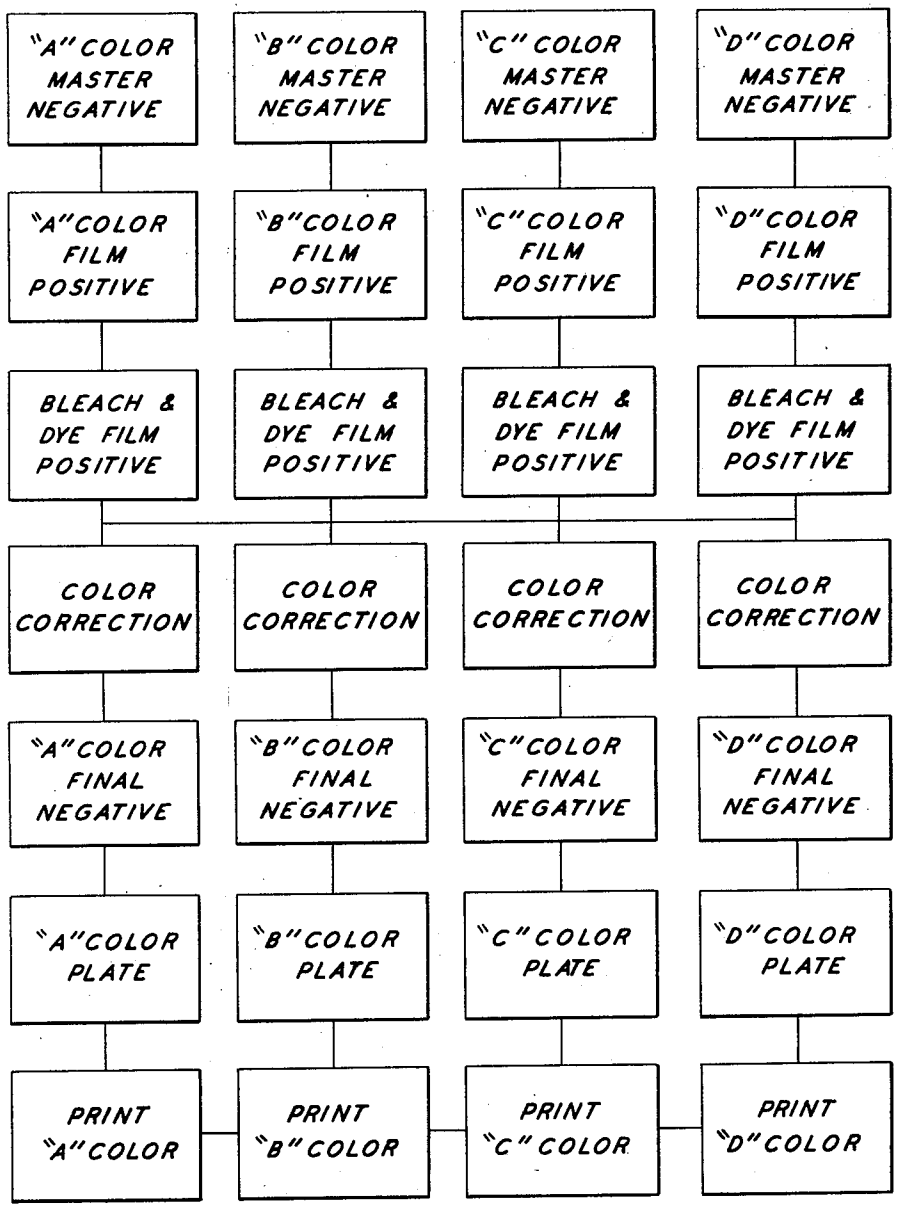
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COLOR PRINTING

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COLOR PRINTING

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This invention relates to printing, to improved methods of preparing plates for printing and to printing with the specially prepared plates, to the end of producing continuous tone pictures.

Heretofore in the making of plates to print continuous tone pictures it was necessary to use a fine screen for the purpose of breaking up the tone areas into minute dots. This process is known as "halftone" reproduction and is used for the printing of all photographs, wash drawings, paintings, and other continuous-tone subjects, both in black and white and in multicolor. For such reproduction processes, special screens are prepared on glass and on film for making halftone negatives. These screens contain crossed lines, with the number ranging from 65 lines to the inch up to 200 lines or even 300 lines to the inch. The finer screens are used for the highest-quality printing, usually on smooth, coated paper, by offset lithography and by letterpress. Generally speaking 120- or 133-lines to the inch are used in most reproductions.

Certain objectionable features are inherent in the screen halftone process. These include the high cost of screens, the problem of "moire" patterns occurring when multicolor screened images are printed, with one series of dots printing over another, and, in the coarser screens, a certain mechanical appearance of the screen pattern itself. To minimize "moire" patterns in printing multicolor halftone pictures, the screens must be set at a different angle for each color. This necessitates additional labor and care in the preparation of multicolor halftone reproductions.

It has also been proposed with the process identified as the "mezzograph" to employ a halftone screen giving a grain effect. The screen glass was coated with a resist which is treated to reticulate, i.e. to form a smooth even graining structure. The so coated glass is etched with hydrofluoric acid. No opaque filling was required between the grains. Screens of this type were difficult to work with, not only in the photography but also in etching the relief reproductions. The fine grain in the highlights had a tendency to etch away and the final result left much to be desired. This process has long since fallen into disuse.

Other halftone screens with various textures have heretofore been proposed, also, but these had a limited field of operation and have not made any lasting impression on commercial color printing.

The principal object of the present invention is to simplify the methods of making halftone negatives for the sake of economy and to achieve superior printed results in multicolor reproductions.

A further object of the present invention is to provide color reproductions having a pleasing texture in which all moire patterns and mechanical regularity of dot spacing are eliminated.

A further object of the present invention is to provide a method of color printing in which visual color corrections can be made on transparent-color images before final printing plates are made, thus eliminating costly plate corrections.

A further object of the present invention is to provide an improved screen for use in color printing which can be made at much less cost than screens now employed.

Other objects and advantageous features of the invention will be apparent from the description and claims.

The nature and characteristic features of the invention will be more readily understood from the following description, taken in connection with the accompanying drawing forming part thereof, in which:

The figure is a diagrammatic view illustrating the various steps in accordance with the invention.

It should, of course, be understood that the description and drawing herein are illustrative merely, and that various modifications and changes may be made in the steps described without departing from the spirit of the invention.

The improved method of the present invention primarily involves the making of negatives for halftone prints of a type which may be designated as "screenless halftones."

The first step in the process is to make a continuous-tone film negative of the subject; or if the subject is in color, a series of film negatives of the primary colors. These color separations are achieved in the well known and accepted manner by exposing the films through filters which block the passage of all light of the primary color desired. The filters are the color complements of the primary colors, a blue-violet filter being used for the yellow, a green filter for the magenta, and a red-orange filter for the blue. A fourth negative to print black may also be made in the accepted manner if desired. This helps to provide depth in the shadow areas.

The resulting master negatives are used in the next steps of the process. These steps consist of making film positives through the negatives. The positives may be one of two types. In the case of a single-color or black and white pictures, an ordinary continuous tone film positive may be made. In the case of color separations, the positives may be made on a matrix film. For this purpose, commercially-made gelatin matrix film for dye-transfer printing has been found particularly satisfactory. A positive image is developed on this film. It appears as a gray, toned image, but when bleached, this image becomes virtually invisible, leaving only a thin layer of clear gelatin wherever elements of the picture have been recorded through the negative. These gelatin images are next dyed the desired colors, which are generally the primary colors, cyan (blue), magenta, and yellow.

These transparent color images, when superposed in register, provide an approximation of the original color picture, but as in all color-separation work, they usually need some correction to achieve color balance. By means of dampened cotton or a soft brush dipped in water certain areas of the image may be lightened as desired. Other areas may be deepened by the application of liquid dye. This color correction is done on each of the color images until a well-balanced full color rendition of the subject is achieved.

After each of the gelatin images has been satisfactorily color-corrected the final "screenless halftone" negatives are made. These negatives are exposed by direct contact with the dyed images (or with black and white continuous tone positives) in the following manner:

A piece of unexposed "line" or "lith" film is placed

in contact emulsion to emulsion, with one of the dyed gelatin images, or with an ordinary film positive or negative. Between the films and the light source, and in contact with the dyed gelatin image, positive or negative, an element is placed of a piece of specially-treated transparent glass or synthetic plastic sheet material. The nature of the surface of this element, of glass or other transparent material, is an important factor in connection with the present invention.

Best results have been obtained with plate glass of a thickness of one eighth to three eighths of an inch and which has both surfaces slightly abraded, preferably by acid etching, so that the light passing through it casts very small or microscopic shadows. The acid etching is best achieved by exposure of both sides of the glass in clean and uncoated condition to hydrofluoric acid in fume or vapor form which very lightly etches both surfaces so as to remove the surface glass but does not penetrate the glass to any appreciable extent. The time required measured in seconds, will vary dependent upon the composition of the glass, the ambient temperature and the extent of circulation or agitation of the acid vapor or fumes. It has been found that etching to a root mean square (R.M.S.) depth measured with a Profilometer of about ten to fifteen microinches gives the desired results, the preferred R.M.S. depth being twelve and one half to thirteen microinches. In a particular instance the treated surface appears to be somewhat equivalent to a 200 line screen or finer.

The acid etched glass plate, itself takes the place of any screen, and produces on the "lith" film a finely granulated negative image from which offset, letterpress or other types of printing plates may be made. The degree of fineness of the granulation of the negative image is determined by the treated surfaces of the glass plate. It can be so fine as to be invisible to the naked eye. Line negatives can be produced which are so finely textured that they approximate the effect of continuous tone.

As each color positive is used in this manner, a color filter is placed over the light source. A green filter is used when the magenta image is being contacted with the lith film; a blue-violet filter for the yellow image, and an orange-red filter for the blue image.

Printing plates are made from the resulting negatives by well known processes and contain the same finely-granulated texture as the line negatives. These printing plates, when linked with the appropriate colors, faithfully reproduce the positive images which appeared on the corrected dyed matrix films, film positives, or negatives.

In multicolor prints reproduced by this screenless halftone process, the random texture formed by the etched glass plate never falls in exactly the same pattern twice. The result is that the microscopic formation of dots tends to interlock as one color falls over another and the small rings of dots seen in an ordinary color reproduction never occur. In addition, the texture itself is pleasing to the eye, and in its coarser forms can be used to print on newsprint or rough surfaces without the mechanical screen pattern of ordinary coarse screen halftones. In its finest applications and with the surface quality or roughness of the glass as referred to above, the result lends a uniquely beautiful quality to the finished reproductions.

The etched or finely abraded glass used for this process can be produced for only a small fraction of the cost of halftone screens. It can be easily inserted into any graphic arts camera or printing frame and needs no complicated mechanism for measuring or controlling screen angles.

While plastic films might be used in place of the glass for making screenless halftones as most of these materials are easily scratched, they are more difficult to handle. Accordingly glass is the preferable material upon which to provide the desired surface texture.

As a final, optional step in the process for color reproduction, the screenless halftone negatives may be used to expose a new set of matrix film overlays. When these matrix films have been bleached and dyed in their respective primary colors and are placed in register on a white background, they provide a color "proof." This is much less costly than color proofing by the usual method of making proofing plates and printing a few copies to test the ultimate color result. It also furnishes a perfect guide for the printer, who may use the transparent images as he would use "progressive proofs," to test the effects of any combination of two, three or four colors, or to view any one of the colors individually.

While reference has heretofore been made to transfers from one film to another this transfer can be a direct contact transfer or by projection of the image to be transferred.

This application is a continuation-in-part of my prior application filed February 23, 1962, Serial No. 175,115.

I claim:

1. The method of making continuous tone pictures which comprises preparing a master negative of the object of a predetermined color, preparing a dyed gelatin film positive from the negative for the predetermined color, making a film negative for plate preparation from the dyed film positive by exposure with a color filter on the light source through an element having a fine grain surface with a grain depth of about ten to fifteen microinches, and preparing a printing plate from said last negative.

2. The method of making plates for the production of continuous tone pictures which comprises transferring an image from a film to a sensitized film through a transparent plate element having a fine grain surface texture with a depth of about ten to fifteen microinches, and after development of the sensitized film preparing a printing plate from said developed film.

3. The method as defined in claim 2 in which the element is a glass plate.

4. The method as defined in claim 2 in which the element is a glass plate having said surface texture on both faces thereof.

5. The method of making continuous tone pictures which comprises preparing master negatives of the objects for each of a plurality of predetermined colors, preparing a dyed gelatin film positive from each of said negatives, making a film negative for plate preparation from each of the dyed film positives by separate exposure with a color filter on the light source through an element having a fine grain surface with an etched depth of about ten to fifteen microinches, and preparing a printing plate from each of the last mentioned negatives.

6. The method as defined in claim 5 in which printing plates are prepared for each of the primary colors.

7. The method as defined in claim 5 in which printing plates are prepared for each of the primary colors and black.

8. The method of making continuous tone pictures which comprises, for each of a plurality of selected colors, preparing a master negative of the object for one of the colors, making a film positive from the master negative for each selected color, bleaching and dyeing the film positives for each of the selected colors, making a final film negative from each of the film positives, during one of the transfers between films interposing a screen element having a granular surface with a grain depth of about ten to fifteen microinches, making a color plate from each said final negative, and printing in superposed relation with each of the color plates with a color corresponding to said color plate.

9. The method as defined in claim 8 in which the element is a glass plate.

10. The method as defined in claim 8 in which the colors are primary colors.

11. The method as defined in claim 8 in which the colors are primary colors and black.

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