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PHOTOCHEMICAL REPRODUCTION

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This invention relates to multicolor screen reproduction processes and provides a method of making a screen record with modified dot areas by forming a combination photographic image from two or more screen images recorded at different screen angles.

The method of the invention is not to be confused with the production of the ordinary color print made up of ink images derived from records made at different screen angles since the product of the present method is itself a photographic image, e. g., a silver image on glass or film or a bichromated glue image on a metal base. It is further to be noted that the method of the present invention affects fundamentally the dot area rather than the dot density since the record at a different screen angle provides dots which at least in part overlap the other dots as well as lie in the spaces between the dots formed at the primary screen angle.

The method of the invention is of particular value in the production of correction masks for multicolor screen reproduction processes.

In high-speed four-color printing by the letter press or offset lithographic processes it is necessary to reduce the amount of colored ink printed in black areas and to use the black printing plate to give the required strength in these areas. This treatment to reduce the amount of colored ink printed in the black areas is referred to as "undercolour removal." Hitherto it has been necessary to effect this "undercolour removal" on the printing plate at some stage in their preparation.

In practice, it is found that a total of 240% of ink (where a "solid" printing of any colour is taken as 100%) is the maximum that can be tolerated in any area, while the strength of blacks is found to suffer if the total is less than 210%, even where the black printing itself exceeds 95%. Theoretically, it should be possible to reproduce any colour by suitable amounts of two of the three colours yellow, magenta and cyan, and black, since the two colour printings would control the hue of the mixture and the black printing its brightness. Experience has shown, however, that on high speed four-colour presses, washed-out results are obtained unless a system is used which lies somewhere between a conventional three-colour system and a theoretical four-colour system. The present method of under-colour removal for photolithography is to make a set of ordinary four-colour separation continuous-tone negatives and to dye-retouch them to add density to the areas of dark neutral tone in the original. Screen positives are then made from the retouched negatives and final adjustments are made on these by dot-etching. For letterpress plate-making it is usual to prepare an ordinary set of four-colour plates and then to reduce the dot-areas in the dark neutral tones by the ordinary fine-etching technique or by mechanically engraving through the areas of dark tone with a multiple line graver of the same pitch as the screen. These retouching methods are difficult to apply and, because of the drastic amount of reduction necessary to reduce what would have been a practically "solid" area to an isolated

dot, hard edges are liable to show in the finished reproduction unless extreme care is taken. Various methods of masking have been attempted in an effort to solve the problem of undercolour removal automatically but, apart from a limited use of high-contrast masks on colour transparencies, no very satisfactory solution has been found.

The present invention provides however a method of producing screen negatives from normal separation screen positives while imparting a satisfactory degree of under-colour removal.

According to the present invention a process for the production of a negative color separation screen reproduction modified to reduce the dot area of said reproduction in the areas corresponding to the black or darker neutral colored areas of the original subject, comprises a process for the production of a negative color separation screen reproduction modified to reduce the dot area of said reproduction in the areas corresponding to the black or darker areas of the original subject, which comprises forming a positive screen record (*a*) of the whole responsive of the original in one selective waveband, forming a positive screen record (*b*) of the whole response of the original in another selective waveband, forming a positive screen record (*c*) of the black areas of the original, forming a negative record (*d*) by printing (*b*) and (*c*) successively in register on a single sheet of light sensitive photographic material and forming a negative record (*e*) by printing (*a*) and (*d*) successively in register on a single sheet of light sensitive photographic material, the said records (*a*), (*b*) and (*c*) being made at different screen angles and the said negative record (*e*) constituting the product required. More particularly the screen angles should differ by at least 15°.

It is to be appreciated that two screen positives with different screen angles, printed successively in register yield a negative in which all the lighter tones are blocked out i. e., solid, leaving a double pattern of small dots in the darker areas only.

In practice screen positives may be made on light sensitive plates using the following screen angles:

Yellow printer	90°
Magenta printer	75°
Cyan printer	15°
Black printer	45°

These screen positives can conveniently be made by the method defined in U. S. Patent No. 2,704,252. As explained in that patent the "yellow printer" is the blue separation screen positive, i. e. the positive screen record of the response of the original to blue light, the "red (magenta) printer" is the green separation screen positive, i. e. the positive screen record of the response of the original green light, and the "blue (cyan) printer" is the red separation screen positive, i. e. the positive screen record of the response of the original to red light. The term "black printer" is used in its common significance in the printing art and as in the said U. S. patent as being a positive screen record of the black areas only of the original. From these screen positives "corrector" plates are made as follows. A light sensitive plate is exposed by contact in succession and in register, to the cyan printer positive and the black printer positive, yielding "corrector" plate A. A light sensitive plate is exposed in succession, and in register, to the magenta printer positive and the black printer positive, yielding corrector plate B. Corrector plate A is registered, emulsion to emulsion, with the magenta printer positive, with a light sensitive element on a thin transparent base between them and an exposure is made from both sides of the "sandwich." The sensitive element is then developed and yields a magenta printer

screen negative which has a normal dot pattern in all areas except those corresponding to the darker neutral tones of the original, where the usual small dot pattern is modified to a "rosette" pattern of much greater area. This local increase in area introduces under-colour removal in a manner analogous to that obtained by the technique of mechanically cutting through the dot pattern on letterpress plates which has already been mentioned.

Similarly corrector plate A is registered with the yellow printer positive, with a light sensitive element between them and exposed from both sides, yielding on development a yellow printer negative with the under-colour partly or wholly removed.

Again corrector plate B is registered with the cyan printer positive, with a light-sensitive element between them and exposed from both sides, yielding on development a cyan printer negative with the under-colour partly or wholly removed.

The negatives thus obtained may be printed down directly on to metal for making letterpress plates or used to make positives for lithography. The degree of under-colour removal is controlled by the area of the double dot pattern on the corrector negative, which can be varied widely by varying the contact printing exposures which it receives. However, colour correction is desirable in addition to undercolour removal and this is conveniently obtained by use of the process of U. S. Patent No. 2,704,252 for making the screen positives. When this is done a much greater control of dot-size on the corrector negatives is possible. Instead of removing the dye negative image from the reversal positives completely, it may be only partially removed and then very extended contact printing exposures may be given to spread the dots in the shadow areas of the corrector negative without causing serious light spread in the lighter areas. Still further control is possible by making the corrector negatives on orthochromatic plates and giving sufficient white light exposure correctly to record the highlight areas and then giving an extended exposure to yellow light to spread the shadow dots.

It should be noted that the double printing of screen images with different screen angles which is characteristic of the present process gives a quite different effect from double printing of continuous-tone images since the areas are added rather than exposures and this gives the required effect of removing under-colour from the darker tones only.

The following example will serve to illustrate the invention.

Example

(1) Yellow, red and blue printers are made from an original multicolour subject in accordance with the method described in Example 3 of U. S. Patent No. 2,704,252 (sections B, C and D). A black printer is made exactly as section E of the said example excepting only that the negative exposures given to the colour separations, and the positive screen exposure (step 9 of that section) is effected exactly as for step 9 of section B. The positives are balanced so that they all have an integrated shadow density of 1.3.

(2) The black printer positive and the cyan printer positive are brought successively into contact with a process plate (the type of plate sold under the registered trademark "Kodalith" is suitable) in a vacuum printing frame. The light source is a 25 watt tungsten filament lamp housed in a box having an aperture 1 inch square, placed at a distance of 5 feet from the printing frame. An exposure of 30 seconds is given through each of the said printer positives, the successive positives being located in register. The exposed process plate is developed and fixed in the usual way to produce "corrector plate A."

(3) Step 2 is repeated using successively the black printer positive and the magenta printer positive, the conditions being otherwise identical, to produce "corrector plate B."

(4) A sheet of "Kodalith" film is sandwiched between the cyan printer positive and corrector plate B, the sensitive emulsion side of the "Kodalith" film being in contact with the emulsion side of the cyan printer positive. Since "Kodalith" film is supplied with an anti-halo backing on the reverse side a larger exposure is required from the "corrector plate" side, the exposure (using the light source specified above) being 30 seconds on the printer side and 90 seconds on the corrector side. The film is developed and fixed in the usual way yielding a colour-corrected, tone-corrected and under-colour-corrected screen negative for printing in cyan.

(5) The procedure of step 4 is repeated using the magenta printer positive and corrector plate A, the procedure being identical and yielding the corrected screen negative for printing in magenta.

(6) The procedure of step 4 is repeated using the yellow printer positive and corrector plate A, the procedure being identical, and yielding the corrected screen negative for printing in yellow.

(7) A contact screen negative is made from the black printer positive.

There are thus obtained a set of negatives of which the cyan, magenta and yellow negatives are corrected for colour and tone reproduction and have the undercolour wholly or substantially removed.

I claim:

1. A process for the production of a negative color separation screen reproduction modified to reduce the dot area of said reproduction in the areas corresponding to the black or darker areas of the original subject, which comprises forming a positive screen record (*a*) of the whole response of the original in one waveband selected from blue, green and red wavebands, forming a positive screen record (*b*) of the whole response of the original in another and different waveband selected from blue, green and red wavebands, forming a positive screen record (*c*) of the black areas only of the original, forming a negative record (*d*) by printing (*b*) and (*c*) successively in register on a single sheet of light-sensitive photographic material and forming a negative record (*e*) by printing (*a*) and (*d*) successively in register on a single sheet of light-sensitive photographic material the said records (*a*), (*b*) and (*c*) being made at different screen angles and the said negative record (*e*) constituting the product required.

2. A process for the production of a negative color separation screen reproduction modified to reduce the dot area of said reproduction in the areas corresponding to the black or darker areas of the original subject, which comprises forming a positive screen record (*a*) of the whole response of the original in one waveband selected from blue, green and red wavebands, forming a positive screen record (*b*) of the whole response of the original in another and different waveband selected from blue, green and red wavebands forming a positive screen record (*c*) of the black areas only of the original, forming a negative record (*d*) by printing (*b*) and (*c*) successively in register on a single sheet of light-sensitive photographic material and forming a negative record (*e*) by printing (*a*) and (*d*) successively in register on a single sheet of light-senstive photographic material the said records (*a*), (*b*) and (*c*) being made at screen angles differing by at least 15°.

3. A process for the production of a negative color separation screen reproduction modified to reduce the dot area of said reproduction in the areas corresponding to the black or darker areas of the original subject, which comprises forming a positive screen record (*a*) of the whole response of the original to green light, forming a positive screen record (*b*) of the whole response of the original to the red light, forming a positive screen record

(c) of the black areas only of the original, forming a negative record (d) by printing (b) and (c) successively in register on a single sheet of light-sensitive photographic material and forming a negative record (e) by printing (a) and (d) successively in register onto a single sheet of light-sensitive photographic material located between them, the said records (a), (b) and (c) being made at screen angles differing by at least 15°, whereby the said negative record (e) constitutes a magenta printing negative with the undercolor at least partly removed.

4. A process for the production of a negative color separation screen reproduction modified to reduce the dot area of said reproduction in the areas corresponding to the black or darker areas of the original subject, which comprises forming a positive screen record (a) of the whole response of the original to red light, forming a positive screen record (b) of the whole response of the original to the greeen light, forming a positive screen record (c) of the black areas only of the original, forming a negative record (d) by printing (b) and (c) successively in register on a single sheet of light-sensitive photographic material and forming a negative record (e) by printing (a) and (d) successively in register onto a single sheet of light-sensitive photographic material located between them, the said records (a), (b) and (c) being made at screen angles differing by at least 15°, whereby the said

negative record (e) constitutes a cyan printing negative with the undercolor at least partly removed.

5. A process for the production of a negative color separation screen reproduction modified to reduce the dot area of said reproduction in the areas corresponding to the black or darker areas of the original subject, which comprises forming a positive screen record (a) of the whole response of the original to blue light, forming a positive screen record (b) of the whole response of the original to the red light, forming a positive screen record (c) of the black areas only of the original, forming a negative record (d) by printing (b) and (c) successively in register on a single sheet of light-sensitive photographic material and forming a negative record (e) by printing (a) and (d) successively in register onto a single sheet of light-senstive photographic material located between them, the said records (a), (b) and (c) being made at screen angles differing by at least 15°, whereby the said negative record (e) constitutes a yellow printing negative with the undercolor at least partly removed.

References Cited in the file of this patent

UNITED STATES PATENTS

1,134,382	Hatt	Apr. 6, 1915
1,349,956	Hatt	Aug. 17, 1920
1,934,367	Lucas	Nov. 7, 1933