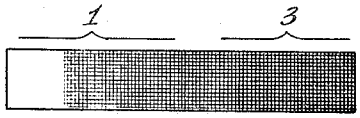
Aug. 12, 1924. 1,504,782

J. H. POWRIE

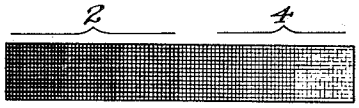
ART OF PHOTOLITHOGRAPHY

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Fig. 1. 

Subject From Which Plate is to be Made

Fig. 2. 
Negative of Fig. 1. Without Half Tone Screen

Fig. 3. 

Negative of Fig. 1. Through Half Tone Screen

Fig. 4. 

Positive from Negative of Fig. 2. Through Half Tone Screen

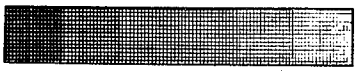
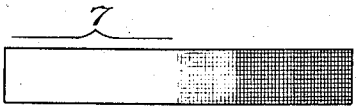
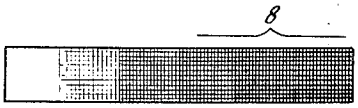
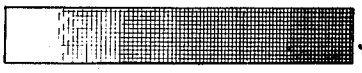
Fig. 5. 
Negative From Positive of Fig. 4. Without Screen

Fig. 6. 

Printing Element from Negative of Fig. 3.

Fig. 7. 

Printing Element from Negative of Fig. 5.

Fig. 8. 
Superposed Printings from Plates of Figs. 6 and 7.

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Aug. 12, 1924. 1,504,782

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ART OF PHOTOLITHOGRAPHY

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Fig. 9.

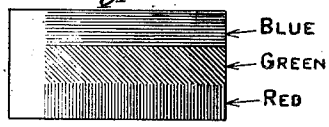


Fig. 10.

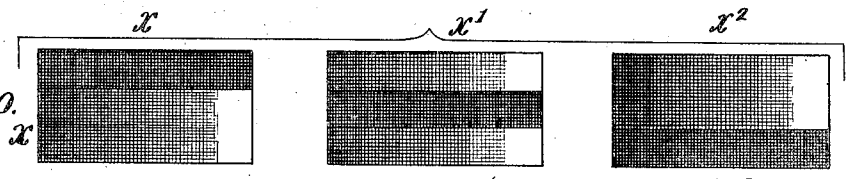


Fig. 11.

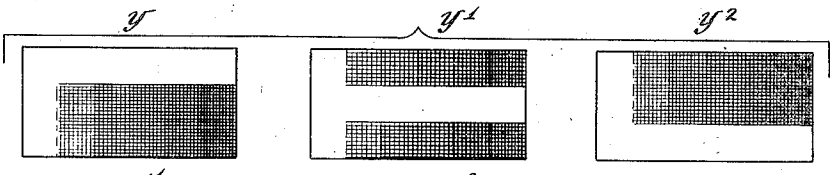


Fig. 12.

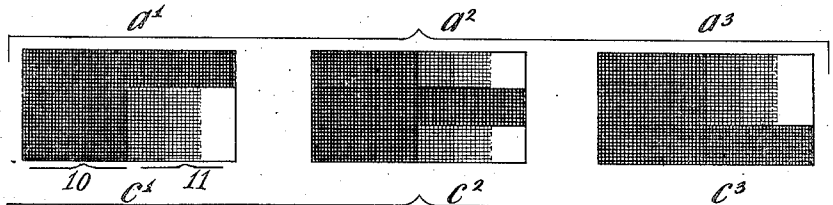


Fig. 13.

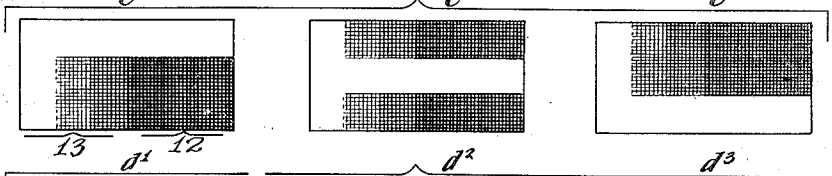


Fig. 14.

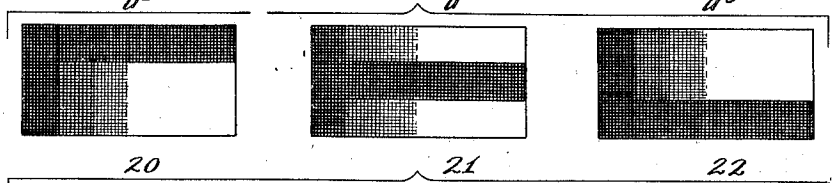


Fig. 15.

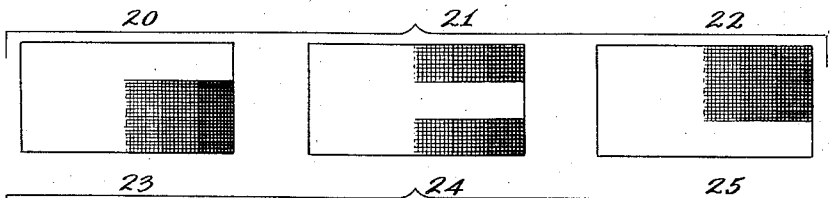
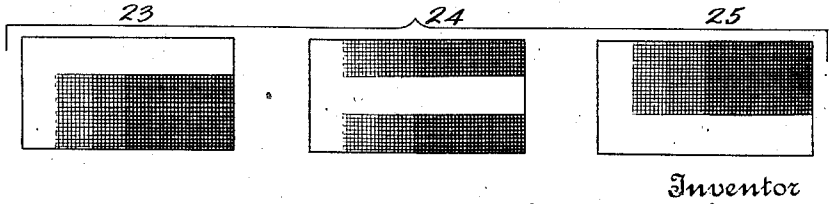


Fig. 16.



Inventor

John H Powrie

By his Attorneys

Phelps Fenwick Rice Kennedy

Patented Aug. 12, 1924. 1,504,782

UNITED STATES PATENT OFFICE.

JOHN H. POWRIE, OF NEW YORK, N. Y.

ART OF PHOTOLITHOGRAPHY.

Application filed February 9, 1921. Serial No. 443,632.

To all whom it may concern:

Be it known that I, JOHN H. POWRIE, a citizen of the United States, residing at New York city, county of New York and State of New York, have invented certain new and useful Improvements in the Art of Photolithography, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to certain improvements in the art of producing printing surfaces by the use of the line screen, commonly known in the art as a half tone screen.

In the preparation of surfaces for mechanical printing, the object the impression of which is to be printed is photographed through a screen structure having opaque areas usually in the form of lines with transparent areas or spaces therebetween. Such a screen is termed a half tone screen and the pattern of this screen is formed to produce the opaque and transparent areas of the fineness which may be desired for any particular work, the opaque portions of the screen being usually of greater area than the transparent space. This screen thus produces a surface which is broken up so that mechanical impressions with different tones may be produced in ink or color.

In carrying out the method of making printing plates with these screens, a screen of the desired character is placed in front of a sensitive plate and the object to be reproduced is photographed thereon through the transparent portions of the screen. Owing to the character of the screen, having the transparent areas through which the light for affecting the plate must pass less than the opaque areas, the time of exposure of the plate has to be considerably prolonged to obtain sufficient density to form the pattern of dots in the shadow portion of the negative where the intensity of the light is low, and this prolonged exposure has the effect of relative over exposure on the sensitive plate with respect to the true values of the original.

As is well known the sensitive plate has limitations for recording the various intensities of the light projected upon it through the lens of the camera. If the exposure is insufficient or under, the details in the shadow portions of the picture are lost or too feeble to be distinguished and the high lights or light portions of the picture become too greatly exaggerated. If the plate be subjected to a prolonged exposure or overexposed, the contrasts in the shadows or dark portions of the picture are intensified in the making of a negative but the high lights and the middle tones are flattened, that is there is not sufficient variation in the tone steps to produce the true contrasts. In other words, either under exposure or over exposure of the plate causes what may be termed a tone error and upsets or disturbs the balance of the gray scale, that is a tone scale running from black to white in mathematical progression of tone.

In the preparation of the printing surface, therefore, with a half tone screen, as heretofore carried out, the exposure required introduced an error in the tone scale of the plate, which has the effect of exaggerating the contrasts in the shadows and flattening the lighter tones. This error has heretofore been corrected by retouching either the glass negatives or positives or the metal or other printing plates made from such negatives or positives. This retouching is laborious in the extreme, takes a great deal of time, and as it can be done only by highly skilled artizans is very expensive.

It is the especial object of the present invention to reduce the error in the tone scale of a printing plate made photographically by the use of a half tone screen, so that retouching of the negative or positive plates or the printing plate is not necessary and a good printing can be obtained with speed and at greatly reduced expense compared with the retouching method now practiced.

Generally speaking my method consists in preparing separate printing surfaces, each surface being made with such a complementary tone error as will offset or neutralize the error of the other in superposed printings, so as to produce a final impression having substantially correct tone values. In the accompanying drawings—

Figure 1 indicates a black and white subject to be reproduced with the black tones gradually running to white.

Figure 2 is a negative of Fig. 1, taken without a half tone screen.

Figure 3 is a negative of Fig. 1, taken through a half tone screen.

Figure 4 is a positive taken from the negative of Fig. 2 through a half tone screen.

Figure 5 is a negative made from the positive of Fig. 4 without a half tone screen.

Figure 6 indicates a printing plate or the like made from the negative of Fig. 3.

Figure 7 is a printing plate or the like made from the negative of Fig. 5.

Figure 8 indicates the results of superimposed printing from the plates of Figs. 6 and 7.

Figures 9 to 16 inclusive show the steps where the method is employed in making color printing plates.

Figure 9 is a representation of an object to be reproduced having the three primary colors, each color decreasing in its chroma to white.

Figure 10 represents three negatives taken of the original through blue, green and red separation filters, respectively, without the use of a half tone screen.

Figure 11 represents positives made from the negatives of Fig. 10.

Figure 12 represents three negatives made from the positives of Fig. 11, but through a half tone screen.

Figure 13 represents three positives made from the negatives of Fig. 10 through a half tone or similar screen.

Figure 14 represents three negatives made from the positives of Fig. 13, but without a half tone screen.

Figure 15 represents three printing plates made from the negatives of Fig. 12.

Figure 16 represents three printing plates made from the negatives of Fig. 14.

In carrying out my method I may proceed as follows;—and the steps described below are the ones I prefer to employ.

In producing my improved printing surfaces I first take with a suitable photographic apparatus, a negative *a* of the original object *o* which is to be reproduced in the printing. This negative *a* is taken through a half tone screen, such as the usual half tone screen having the desired fineness of lines, this negative *a* being taken through the screen has the high lights marked 1 in Fig. 1, flattened as indicated at 2 in Fig. 3, and the shadows 3 of Fig. 1 are exaggerated as indicated at 4 in Fig. 3, this exaggeration of the shadows being due to the necessary overexposure caused by the use of the half tone screen. I then take a negative *b* of the object to be reproduced, this negative being taken without a screen. As no screen is employed a correct exposure is obtained without tone error, and the high lights and shadows have their correct tone values, this result being indicated in Fig. 2.

From this negative *b* is made a positive *c* through the half tone screen. In this positive *c* the shadows are flattened, that is, there are substantial or similar tones without sufficient contrast, as indicated at 5 in Fig. 4, and the high lights are exaggerated due to the necessary overexposure of making this positive from the negative through the half tone screen, as indicated at 6 in Fig. 4. A negative *d* is now made from the positive *c* but in making the negative *d* no screen is employed. This results in the production of a plate shown in Fig. 5, in which a tone error is produced, a correct representation of negative *c* being obtained due to the fact that no screen has been employed.

The negative *a* is now employed to make a positive printing surface on a metal plate or the like in the usual manner, and this printing surface becomes printing plate *e*, in which there is a tone error in the high lights indicated at 7 in Fig. 6. A second positive printing surface is made from the negative *d* on a plate of metal or the like in the usual manner and this becomes printing plate *f*, in which there is a tone error in the shadows indicated at 8 in Fig. 7.

An impression is then made in any usual or suitable printing machine on a sheet from printing plate *e*. The sheet is then run through the machine in register and is given a second impression from printing plate *f* which has its impression superposed on the impression made from plate *e*.

The complementary tone error in each of the plates is thus neutralized by the superposed impressions and a final impression is obtained in which the tone error due to overexposure necessitated by the use of screens is very greatly reduced and so far eliminated as to make it unnecessary to retouch the plates or the negatives or positives from which the plates are made.

The method so far described is adapted for producing printing surfaces in monotone. The method, however, may be employed in producing printing surfaces for printing in color, these surfaces being prepared to produce color values from color separation negatives. In carrying out the method for the production of printing surfaces suitable for color printing I may proceed as follows, it being assumed that the subject requires color value plates of the three so-called primary colors.

The steps by which the method may be employed in making plates for printing from colors is shown as well as it can be in a black and white line drawing in Figs. 9 to 16.

Referring to these figures, I may proceed as follows—It is assumed that the object to be photographed includes the three primary colors, blue, green and red varying in chroma to white, and this object is indicated at *o'* in Fig. 9. I first make three negatives *w*,

x', x^2 of this object through suitable blue, green and red separation filters (not shown) by means of any suitable photographic apparatus without the use of a half tone or similar screen. I then make three positives y, y', y^2 by contact or in an enlarging camera from the three negatives x, x', x^2 without the use of any half tone or similar screen. Three negatives a', a^2, a^3 are made from the positives y, y', y^2 through a half tone screen similar to that used in preparing the monochrome plates, before referred to, and from each of these negatives a', a^2, a^3 a suitable printing surface as a metal plate is made, this being indicated by the numerals 20, 21 and 22, as shown in Fig. 15. There are thus three plates with the correct color values, but in which there is an error of the tone scale due to the flattening of the high lights, as indicated at 10 in Fig. 12, and the slight exaggeration of the shadows indicated at 11 in Fig. 12, this error being produced because of the necessary overexposure due to the use of the half tone screen. I then make three positives c', c^2, c^3 from the negatives x, x', x^2 through the half tone or similar screen which causes a flattening of the shadows, as indicated at 12 in Fig. 13, and a slight exaggeration of the high lights, as indicated at 13 in Fig. 13. From the positives c', c^2, c^3 are made three negatives d', d^2, d^3 but without a screen. In these negatives d', d^2, d^3 there is a tone error the reverse of the tone error in the negative a', a^2, a^3 and from these negatives d', d^2, d^3 are prepared three printing surfaces, as metal plates 23, 24, 25. These printing plates have the correct color value, but with a tone error the reverse of the tone error of the plates 20, 21 and 22.

I then print for the first color with superposed impressions from plates made from negatives a' and d'; for the second color from plates made from negatives a^2 and d^2; and for the third color from negatives a^3 and d^3.

I am thus enabled to produce without any substantial retouching of the plate, good impressions in which the tone errors of the plates have been offset or neutralized and a good printing effect produced.

It will, of course, be understood that it may not be necessary to use all six printing plates, as for instance, the colors of the subjects may require but one set of plates or two sets of plates, and I will of course proceed in accordance with the character of the colors of the subject impressions of which are to be reproduced.

A half tone plate or block for printing in either monotone or color may, therefore, be produced with much greater rapidity and at a very much less expense than by the methods heretofore used in which such plates or the negatives or positives from which they were made had to be retouched by hand, and a good printing effect is obtained.

The production of two or more printing surfaces having a complementary tone error may be effected in various ways, and while the steps described are very convenient and easy of accomplishment for producing such printing surfaces, I do not limit myself precisely to such steps.

What I claim is:

1. The method of correcting the error in the tone scale of a photographically prepared printing element which is introduced by the use of the half tone screen, which consists in preparing separate printing elements each element being made with such a complementary tone error as will offset or neutralize the error of the other in superposed printings so as to produce a final impression having a substantially correct tone scale.

2. The method of correcting the error in the tone scale of a photographically prepared printing element which is introduced by the use of the half tone screen, which consists in preparing separate printing elements, one of said elements having a tone error increasing from the high lights to the shadows and the other of which has a tone error increasing from the shadows to the high lights these tone errors being complementary to each other and acting to offset or neutralize each other in superposed printings so as to produce a final impression having substantially correct tone values.

3. The method of correcting the error in the tone scale of a photographically prepared printing element which is introduced by the use of the half tone screen, which consists in making negative (a) through half tone screen; making a negative (b) without a screen; making a positive (c) from b through a half tone screen; making a negative (d) from positive c without screen; making a printing plate (e) from (a); making a printing plate (f) from (d); and printing superposed impressions from e and f.

4. In the method of preparing printing plates in which a half tone or similar screen is employed, the step which consists in so preparing two photographic images of the subject as to produce complementary errors in the tone scale of the subject.

5. In the art of color printing the method which consists in preparing color separation negatives making a set of two printing plates therefrom with a half tone screen for each color, each of said plates having complementary errors in the tone scale, and superimposing impressions from the plates of each set.

6. In the art of color printing the method which consists in preparing color separation negatives; making a set of positives

(y) one from each negative; making a negative a' from each of positives y through a half tone screen; making a positive (e') from each of the color separation negatives through a half tone screen; making a negative (d') from each of positives c'; making a printing surface from each of negatives a'; making a printing surface from each of negatives d', and superimposing impressions from each of the plates.

In testimony whereof, I have hereunto set my hand.

JOHN H. POWRIE.