

Oct. 5, 1937.

G. VON KUJAWA

2,095,015

MANUFACTURE OF HALF TONE SCREENS

Filed Feb. 24, 1933

2 Sheets-Sheet 1

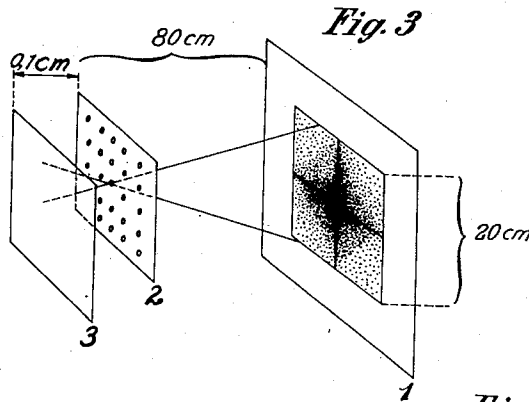
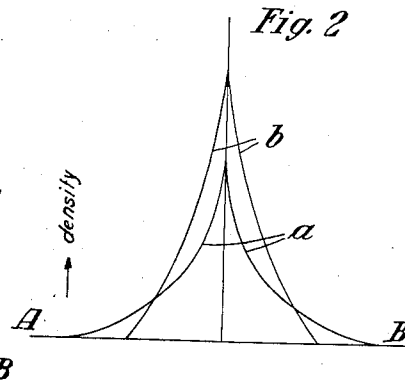
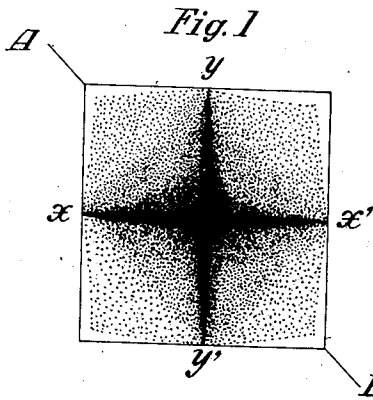


Fig. 4

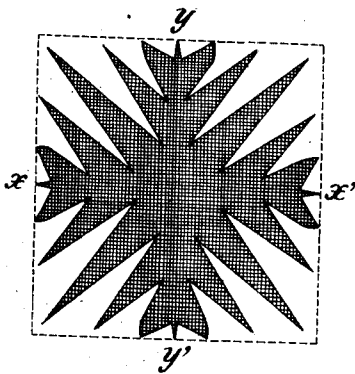
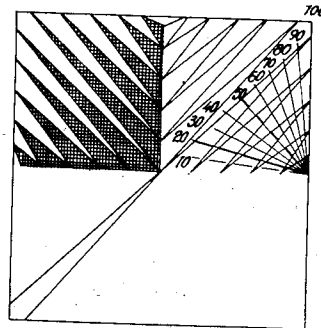


Fig. 5



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Fig. 6

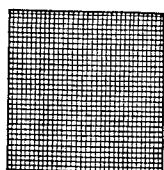


Fig. 7

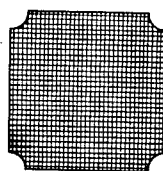


Fig. 8

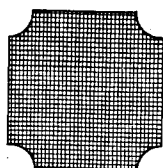


Fig. 9

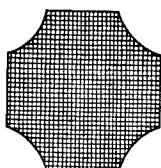


Fig. 10

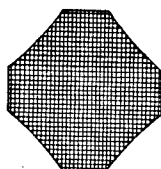


Fig. 11

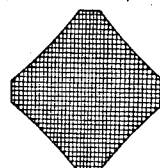


Fig. 12

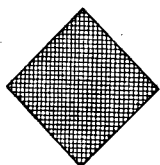


Fig. 13

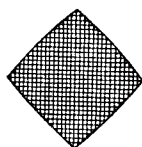


Fig. 14

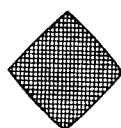


Fig. 15



Fig. 16 Fig. 17



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UNITED STATES PATENT OFFICE

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MANUFACTURE OF HALF TONE SCREENS

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Application February 24, 1933, Serial No. 658,388
 In Germany February 29, 1932

2 Claims. (Cl. 95—81)

My present invention relates to half-tone screens of the kind used in photo-mechanical reproduction.

One of its objects is to provide a process for the manufacture of improved half-tone screens. Another object are these improved screens. Further objects will be seen from the detailed specification following hereafter. Reference is made to the accompanying drawings in which

Fig. 1 shows the negative of an element of the half-tone screen,

Fig. 2 shows comparatively the desired courses of the blackening curve of the elements of the half-tone screen for printing processes of the kind of printing half-tone engravings and for flat printing,

Fig. 3 shows an arrangement for producing a half-tone screen according to my invention,

Fig. 4 shows a vignette adapted for the production of an element of the half-tone screen,

Fig. 5 shows the method of constructing a vignette, and

Figs. 6 to 17 show a set of masks adapted for the production of an element of the half-tone screen.

The conditions for the distribution of blackenings and transparencies in the elements of half-tone screens which, in the printing and taking process would produce a perfect rendition of the details and the tonal values of the original to be reproduced, are known theoretically. However, a half-tone screen fulfilling these conditions could not hitherto be produced.

I have found that it is possible to produce a perfect half-tone screen by multiple projection of the enlarged positive or negative of an element of the screen on a light sensitive layer.

In carrying out the invention, there is taken on a photographic plate 3, in the manner represented in Fig. 3 by means of a perforated screen 2 a positive or negative picture or a diapositive or a dianegative of an enlarged element of the screen with continuous tonal values, such as is represented, for instance, in Fig. 1. The distance of the perforations of the screen depends on the desired fineness of the screen to be produced. If the plate 3 is arranged at a distance of 80 cm. from the picture 1 which bears an enlarged element having sides of about 20 cm. in length the perforated screen 2 must be placed at a distance of 0.1 cm. from the plate 3; the screen has circular perforations of diameter at the most 0.1 mm., the distance between adjacent perforations being 0.25 mm. The enlarged picture of the screen element may be prepared either by drawing, or by photo-

graphically reducing a vignette of the shape shown in Fig. 4 beyond the dissolution power of the photographic emulsion, and afterwards strongly enlarging the reduction by soft focus. In the vignette of Fig. 4, the rays have such dimensions that a distribution of blackening and transparency is obtained which corresponds to the theoretical conditions required for one screen element. The geometrical construction of such a vignette is seen in Fig. 5.

Instead of making the screen by photographing a screen element with the intercalation of a perforated screen, it may also be prepared, for instance, by photographing a screen element by the additive method with the aid of a multiplier attachment.

The reproduction of the true tonal values in pictures taken with the interposition of a screen depends on the gradation of the photographic material and on the variations of gradation which occur in the etching process. The best method of complying fully with these requirements is to operate with a suitably selected plate 3 or with a picture 1 of appropriate dimensions. Thus it is possible to produce a half-tone screen having any gradation required for reproduction of the original in its true tonal values in the printing process. For instance, reproduction by a process of the kind of printing half-tone engravings requires a distribution of blackenings and the transparencies of a screen element different from that required for reproduction by a flat printing process; if, for instance, the theoretical course of the blackenings on the line AB of Fig. 1 corresponds diagrammatically with curve a of Fig. 2 in the case of flat printing, there is used for processes of the kind of half-tone engraving a course of the blackenings corresponding with curve b of Fig. 2 since the dots on the metal picture must be larger at the beginning, because only as the etching process proceeds do they become the correct size.

Instead of using an enlarged picture of a screen element for producing the screen by multiple projection, there may be used a number of black and white partial pictures of the enlarged screen element, the outlines of these pictures corresponding with lines of equal blackening in the enlarged screen element; these partial pictures are in succession placed at the place of the picture and are photographed on the plate in superimposed relationship in the manner above described. The time of exposure must of course be substantially less than is necessary for complete blackening of the plate and can easily be determined by experiment. The partial pictures with outlines corresponding with lines of equal blackening

(isophotes) may consist, like the hereinbefore described star-like pictures used for the production of the enlarged screen element, of opaque diaphragms placed against a uniformly illuminated white background. In order to ensure continuity of gradation in the screen to be produced, these partial pictures, in their preferred form, are given outlines which are not sharp, but are fading, hazy or indented. Figs. 6 to 17 represent a set of such masks. The masks must be placed, for the taking operation, successively with their centers at exactly the same point so that the photographic pictures of the diaphragms on the screen will be in concentric superposition.

By using a set of partial pictures the gradation of the blackening from the center towards the margin can be more easily influenced. When proceeding according to the process described with reference to Figs. 1 to 4, the production of another gradation of shades requires the preparation of a different picture of the screen element, whether it be in the form of a half-tone diaphragm or of a star-like diaphragm. When using a set of masks which are photographed successively one upon the other, it is only necessary, in order to obtain the same effect, to modify slightly the relative times of exposure of the different masks.

Instead of a set of different masks, it is possible to use a mechanically operated diaphragm having a continuously contracting or expanding aperture. Such a diaphragm is known in the art of reproduction. The diaphragm must, however, be so constructed that the outlines of its aperture correspond at each stage approximately with the isophotes of the screen element shown in Fig. 1.

For the production of a larger number of screens

of the kind described, the process of taking multiplied photographic pictures need be performed but once. The screen produced in this manner can advantageously be multiplied by a simple photographic printing process. The photographic reproduction of a screen produced according to the invention involves the advantage that by a proper selection of the printing material and suitable manipulation of the illumination and development, the gradation of the half-tone screen can be influenced at will. Furthermore, a photographic printing process allows the preparation of large-sized screens, by placing side by side a number of half-tone screens prepared according to this invention, or photographic prints thereof, and printing them together on to a film of the desired size by one of the known devices intended for this purpose. For the reproduction of a screen made in accordance with this invention, of course, any process known in the printing art may be applied. On a commercial scale the screens may be reproduced, for instance, according to a photo-mechanical printing process.

What I claim is:

1. The process of producing a half-tone screen which comprises photographing a vignette under reduction, enlarging the picture obtained, and projecting the resulting picture through a perforated screen.

2. The process of producing a half-tone screen which comprises projecting of a set of part pictures of an enlarged picture of a screen element successively one picture upon the other through a perforated screen.

GERHARD v. KUJAWA.