Aug. 26, 1930. L. F. STIRLING 1,773,887

METHOD OF PRODUCING PRINTING PLATES

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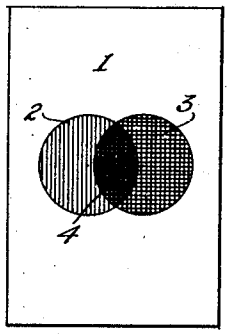


Fig. 1



Fig. 2

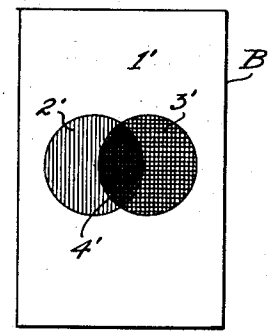


Fig. 3

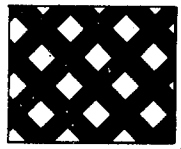


Fig. 4

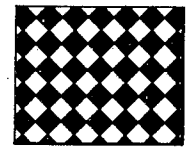


Fig. 5

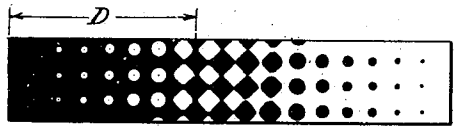


Fig. 6

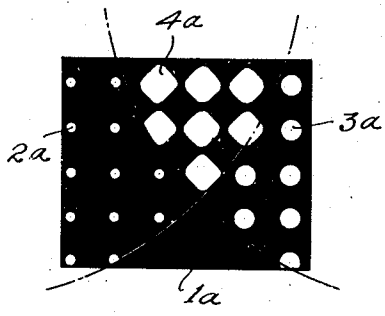


Fig. 7

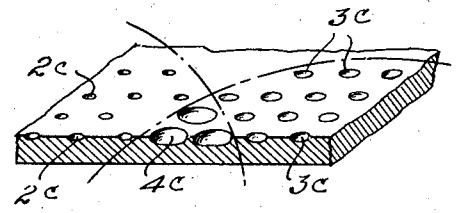


Fig. 8

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UNITED STATES PATENT OFFICE

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METHOD OF PRODUCING PRINTING PLATES

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The object of this invention is to provide a process of reproducing designs of various natures on materials capable of receiving an imprint by pressure; textiles, paper, etc., for example, by which process the design will be printed clearly and without substantial loss of tonal effects.

More specifically, an object is to provide a novel and comparatively inexpensive process of producing an intaglio plate suitable for transferring designs on textile fabrics, as well as other materials.

The methods now used for producing intaglio plates for textile printing are generally divided into three classes. One class comprises the step of actually removing metal from a plate or roll as by the use of a tool similar to a chisel, smaller depressions being made in the roll by smaller tools hammered to form the depressions. A second class of process is that known as mill engraving wherein the design is engraved by hand or chiseled into a small steel roll or plate, called the die from which a mill is made with the design raised. This mill is rolled in contact with a copper roll in a milling machine, the design being pressed into the copper. A third class of process comprises treating the surface of the metal plate or roll with wax or other etch resist and scratching the design onto this coating by the use of a pantograph. Afterward the design is etched into the plate by the use of a suitable etching fluid. Obviously, all the above outlined processes are expensive, since each requires considerable skill and each is inherently slow. Furthermore, all the above processes are limited, each to its individual style of reproduction and the skill of the mechanic or artist-engraver.

It has been proposed to follow the methods employed in photogravure printing, namely, to transfer the design by means of photographic plates or films and using such photographic plates to form etching mediums, as by means of the usual acid resist. Unfortunately, when a textile photogravure roll is made by such process it is impossible to etch to a sufficient depth to carry the desired ink intensity in color and tone, even when a very coarse screen is used. This is mainly due to the fact that when an acid of sufficient strength is used to get the full tone etching depth, necessary for textile use, then the acid is of such strength that the resist fails to function in holding back the acid in the semi-tone areas. In photogravure work, semi-tone portions of the plate have wells substantially of the same size, but of different depths which carry correspondingly greater or smaller quantities of color materials. In producing a plate for textile use, these wells, by reason of excessive acid strength, run together, so that many of the semi-tones are lost and become full tones.

Part of the difficulty arises because of the fact that for printing on textiles an excess of color strength is used, since a large portion of this strength washes out when the color is fixed. This wash-out carries a considerable amount of the pigment material away with it, thus destroying fine gradations of tone. It would seem obvious that this difficulty could be overcome by applying greater masses of ink or dye for all parts of the design, that is to say, printing in full tone where half tone is required and printing in half tone where quarter tone is required, etc. If this device could be resorted to it would still be impossible to etch clear and definite ink wells in the photogravure plate to carry the then super-quantities of pigment.

The present invention enables a transfer of the desired pigment material to textile fabrics, preserving all the original tonal effects. The final printing element produced, namely the plate, is characterized by the fact that it contains disconnected pockets or wells, all very distinct but varying in size. The method or process of producing such a plate is in general as follows.

The pattern to be reproduced is first photographed through a screen in such manner that disconnected and clearly defined transparent spots or light areas appear on the negative, the spots being of various sizes, i. e. larger spots corresponding to the darker areas of the pattern and smaller spots corresponding to the lighter but shaded areas. The process is unique in that in taking such photographic negative, the negative is over-

exposed or light-intensified to such an extent that all areas of the negative, except for the variable sized light spots mentioned, are either very dark or entirely opaque. The succeeding steps of the process follow very closely the methods used in producing a photogravure plate, that is to say, the negative is transferred to a positive plate or film, to bring out a positive image; then this positive plate or film is used to form the usual resist, and the resist is used with a suitable corrosive element to etch the plate or roll.

The process has certain refinements not entirely essential, particularly in that the negative taken through the screen may be reduced in size from that of the subject to save plate cost.

The process includes the further refinement that a bromide print may be made from a reduced negative photograph of the subject or pattern, which bromide print may be readily retouched as desired, to bring out various desired contrasts in color and tone. The bromide is in such case photographed through the screen instead of the original subject.

The manner of printing from the plate or roll may be in accordance with photogravure printing; that is to say, an excess of pigment may be spread onto the plate then scraped off, except at the disconnected pockets, and then the subject may be printed either by contact with the plate or through the intermediacy of a take-off roll.

In order that the process may be more clearly understood, I have illustrated the various steps, as preferably practiced, in the accompanying drawing.

In the drawings, Fig. 1 shows in plan, a small section of a suitable pattern to be reproduced; Fig. 2 shows a reduced negative made from the pattern; Fig. 3 shows an enlarged print made from the reduced negative, which enlargement may be retouched or colored as desired to form a refined subject; Fig. 4 shows, in plan, a small section of a suitable screen; Fig. 5 is a plan view showing the appearance of a screen such as shown in Fig. 4 when properly focused onto a plate or film to bring out the desired light and dark effects on the negative; Fig. 6 is a diagram illustrating a full range of tone, such as used in halftone or lithographic printing; Fig. 7 may illustrate either the properly exposed negative or the appearance of a suitable carbon resist made from such negative through the intermediate step of making a positive plate or film, and Fig. 8 is a sectional perspective view of a small portion of the etched intaglio printing plate.

Fig. 1 illustrates a pattern to be produced on the plate. The pattern may have, for example, an entirely light zone 1, a shaded zone 2, a more deeply shaded zone 3 and a nearly black zone 4.

Assuming that this pattern does not show the desired color or shade contrasts, I may now take a photograph of the design on a reduced negative, such as N in Fig. 2, which, of course, has opaque, shaded and practically transparent portions corresponding to the zones 1, 2, 3 and 4 respectively. This negative is reduced in size mainly to effect saving in plate cost. A bromide print for retouching purposes, may now be made in any suitable size, for example, the size of the original pattern. The bromide print is designated B in Fig. 3, and the light, shaded and dark areas are designated 1′, 2′, etc.

Assuming that the bromide print has been suitably retouched to bring out the desired tonal effects and contrasts, I now make a reduced photographic negative of the bromide print, the reduction being optional and used to save plate cost. This negative is taken through a screen, such for example, as shown in Fig. 4. This is the usual cross-line screen commonly used to make half-tone plates for type or lithographic printing. In using such a screen, the proper distance from the film or plate is obtained as follows: First, the camera is focused to clear the image on the ground glass so that it appears as does Fig. 4; next, the screen is moved slowly away from the ground glass until dark squares appear on a white back ground, somewhat the reverse of Fig. 4; then the screen is moved still further away until a checker-board effect of light and dark squares results. This is the most suitable screen distance.

The size of screen selected when making the negative in reduced size, is according to the final screen effect desired on the resist or plate. For example, if a fifty line screen effect be desired on the finished plate and the negative is reduced to about one-ninth the size of the subject, a 150 line per inch screen is used in taking the negative.

The screen is positioned with relation to the negative and subject photographed so as to allow the light rays from the subject to criss-cross past the opaque lines of the screen, and the negative is maintained in exposure for a considerable length of time, varying with different subjects, until even the screen effect on the negative has been obscured in those zones which correspond to the entirely light portions of the subject. It will be understood that if the film or plate is exposed for the usual period of time, and assuming the subject has tones varying from light to complete black, the negative will have small transparent dots where the subject is blackest and small black dots where the subject is lightest. Now, by virtue of the over-exposure substantially half of the full range of tones are eliminated. In other words, the resulting negative has only those screen effects shown at the left side of the diagram of Fig. 6, designated by the dimension line D, that is to say, for the darkest tones of the orig-

inal, rounded, square transparent openings appear (see 4^a in Fig. 7) and for the next darkest portion 3 of the subject smaller and substantially round transparent spots appear (as at 3^a); for the still lighter zone, such as 2 in Fig. 1, very small round transparent spots appear (as at 2^a). In the zone of the negative corresponding to the zone 1 of the original subject, the over-exposure results in practically eliminating all dot effects, that is to say, this zone 1^a where the original subject was entirely white is now for all practical purposes entirely opaque. This is the natural result of over-exposing the entire negative.

Now, by reason of the fact of size differences in the dots, the design is maintained (in negative i. e. reverse, light and shade), irrespective of the fact that all of the background on the film or plate of the negative is opaque. It is important that the intensifying step be governed according to the subject, so that all the transparent dots be clear and sharp.

From the light intensified negative, I produce another plate or film photographically to bring out the design as a positive image. This is not illustrated, but it is simply the reverse of the effect of Fig. 7. In other words, for the large rounded squares 4^a, large dark or opaque spots will appear on the positive image plate or film. Likewise, the spots corresponding to 3^a and 2^a will be opaque and the remainder of the film or plate will be substantially transparent. This positive image plate or film is enlarged to the desired dimensions, assuming that the first negative was reduced, as mentioned. If the plate to be made is to have the same area as the original pattern, then the area of the enlarged positive image plate or film will be equal in area to such pattern. Properly exposed, the enlarged positive shows no shaded zones, except the disconnected opaque dots, which should be brought out clear and sharp.

The enlarged positive is now used to produce, as by contact print, the usual carbon resist, and the resist is applied to the plate, and thereafter the plate is etched.

Preferably, I apply the carbon resist to the copper roll, after this has been cleaned of all grease and tarnish and the roll is then etched through the resist with a suitable agent. such as perchloride of iron in a 40° (Baumé) bath. The etching usually requires from 10 to 15 minutes. In the finished plate, Fig. 8, there will result shallow pockets, such as 2^c of very small diameter, corresponding to the zone 2 of the subject, larger pockets 3^c, corresponding to the darker shaded zone 3, and deeply etched and still larger pockets 4^c corresponding to the very dark zone 4 on the subject.

It will be seen that the pockets may be etched to any suitable depth to retain the proper amount of pigment, even though this is loaded with starch, as previously explained, so as to allow for some removal of the pigment during the dye fixing process. During this etching, naturally the pockets become larger in diameter to some extent, but still not sufficiently large to run together and spoil the tonal effects.

It will be easily seen that because the resist will be substantially entirely dark and etch resisting, except for the dotted portions, a very clean and even scraping surface will be obtained on the plate or roll.

The invention is obviously suitable for work other than textile printing; for example, the intaglio plate produced by the method described may be used for wood, marble and like graining processes without substantial modification.

I claim:

1. The process of producing an intaglio printing plate, comprising taking a photograph of the subject to be reproduced through a screen, over-exposing the photograph to cause the design of the subject to be maintained on the photograph as variable sized disconnected transparent dots or patches, the largest dots or patches corresponding to the darkest zones of the subject, and thereafter using this photograph in a known manner to form the intaglio plate.

2. The process of producing an intaglio printing plate, comprising taking a negative photograph of the subject to be reproduced through a screen, over-exposing the negative to cause the design of the subject to be maintained on the negative as disconnected transparent dots or patches for the darkest zones of the subject, and thereafter using this negative through the medium of a positive plate or film, a resist and an etching fluid to form the intaglio plate.

3. The process according to claim 1, wherein the subject photographed as aforesaid comprises a retouched positive print made through the intermediacy of a reduced negative photograph of the original subject.

4. The process according to claim 2, wherein the over-exposed negative is materially reduced in size from the photographed subject, and the screen has a larger number of lines per inch than the screen effect desired on the finished plate, whereby the desired screen effect may be produced on the printing plate from a resist made as enlargement of the negative.

5. The process of producing an intaglio printing plate, comprising taking a photograph of the subject through a line screen in a camera focused to bring out the screen image in substantially checkerboard effect on the ground glass of the camera, over-exposing the photograph to cause the design of the subject to be maintained on the photograph entirely as variable sized disconnected transparent dots or patches, and thereafter using

this photograph in accordance with the usual etching methods to form the intaglio plate, whereby the plate has disconnected pockets of varying size reproducing the design of the subject.

6. The process of producing an intaglio plate, comprising photographing the subject in negative through a line screen with the camera focused to obtain a checker-board effect on the ground glass thereof, over-exposing the negative to cause the shaded and dark portions of the design of the subject to appear on the negatives as variable sized entirely disconnected transparent dots or patches, the largest dots or patches corresponding in position to the darkest zones of the subject and causing the negative, except for the dots or patches to be substantially opaque, and thereafter using this negative through the medium of a positive plate or or film, an etch resist and an etching fluid to form the intaglio plate.

7. As a new article of manufacture, a printing plate made photographically and by etching, said plate having a non-printing main surface of even height with a large number of depressed entirely disconnected pockets formed therein of varying size, the largest pockets corresponding in position to the darkest parts of the original subject photographed.

8. The process of producing an intaglio printing plate for design printing, comprising, taking a photograph of the subject to be reproduced, using a screen to break up the image on the photograph, light treating the photograph to cause the entire design of the subject to be confined on the photograph to substantially half of a complete screen tone range, and then using the photograph in a known manner, including the use of an etching liquid, to produce the intaglio plate, whereby substantially all the full tone areas of the subject will be represented on the plate by disconnected substantially uniformly shaped pockets and the lighter areas by smaller but disconnected pockets varying in size with the intensity of the shade of the latter areas.

In testimony whereof, I hereunto affix my signature.

LOUIS F. STIRLING.