Oct. 27, 1936. E. N. BAKER 2,058,396

PHOTOINK PRINTING

Filed March 13, 1933

Fig. 2

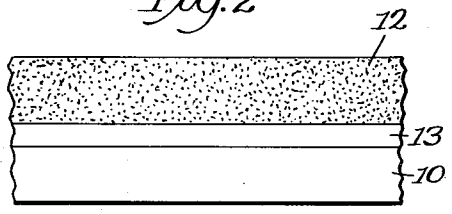


Fig. 1

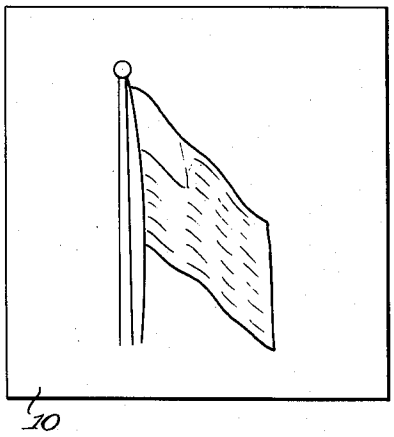


Fig. 3

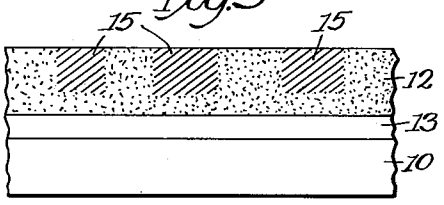


Fig. 4

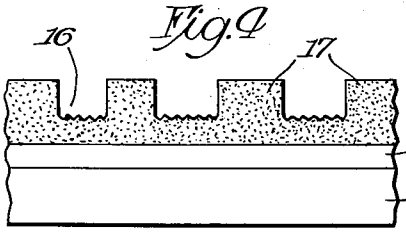


Fig. 7

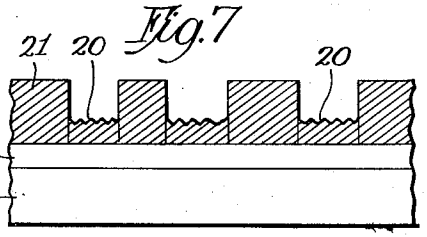


Fig. 5

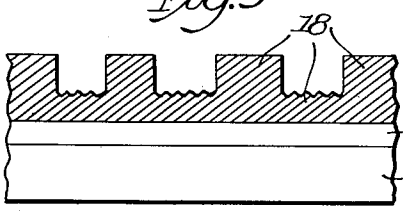


Fig. 8

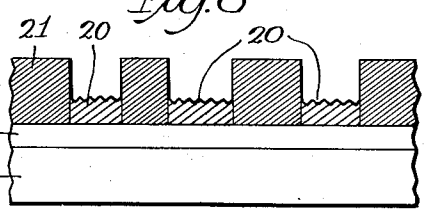
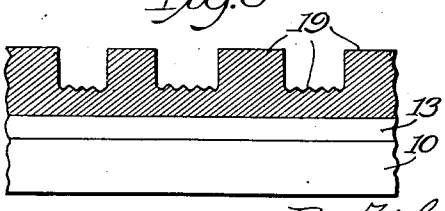


Fig. 6



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UNITED STATES PATENT OFFICE

2,058,396

PHOTOINK PRINTING

Elton N. Baker, Chicago, Ill.

Application March 13, 1933, Serial No. 660,476

4 Claims. (Cl. 95—5.4)

My invention relates to printing from plates produced by photographic processes and has more particularly to do with an improved method of producing planographic plates of this type.

An object of my invention is to provide a new and improved method of producing photo-ink planographic plates of either half-tone or "line" type, which method will be simple, inexpensive, and efficient to produce plates of excellent quality in a minimum of time and of sufficient durability to meet all ordinary requirements, which plates, if desired, may be used for the production of still more durable plates.

A further particular object of my invention is to produce such a process which is especially adapted for obtaining a plate directly on the medium which is photographically exposed, thereby avoiding loss of time and material such as is encountered in indirect methods.

In its preferred embodiments, my invention is practiced by photographically exposing in a camera, or by contact, a medium which for convenience and economy may be a paper base coated with a silver-halide emulsion or "colloid", or an ordinary photographic film having a similar coating. After such exposure, which may be in ordinary light or in artificial light, the image is developed on the base, which, hereafter in the specification and claims will be referred to as a "plate", but the negative image thus obtained is not fixed. The plate is subjected to a bath whereby the colloidal surface containing the developed silver image which constitutes the negative of the desired "picture" is etched out. The plate is then preferably redeveloped in a tanning developer to reduce the remaining silver salts throughout the colloidal layer. The plate then may be further "tanned" to harden the colloidal surface, after which it is ready for inking and printing.

My invention will now be described in greater detail in connection with the drawing forming a part of this specification, wherein:

Fig. 1 is a plan view of a plate embodying my invention, and

Figs. 2–6 inclusive, are sectional views of the same, on a greatly enlarged scale, at successive stages in the preparation thereof, the proportions as to relief being greatly exaggerated for purposes of clarity.

Figs. 7 and 8 are exaggerated sectional views of a plate embodying my invention prepared by alternative method steps.

The numeral 10 represents a base, which, as stated above, is preferably of an inexpensive flexible material, such as paper or photographic film, and is coated with an emulsion 12 of silver-halide salt in a colloid such as gelatin or the like. There is preferably provided an intermediate insulating layer 13 of baryta and gelatin.

(1) Making the Negative

The sensitized sheet, as shown in Figure 2, is exposed in the usual manner, preferably in a camera, to form a negative. As shown in Figure 3, wherein the areas 15 of the layer 13 of photosensitive material represent the areas which have been affected by light, it will be understood that the sensitized sheet may be used to reproduce a drawing, photograph, sign, or any graphic representation, or to reproduce pictorially an original object or scene.

The negative medium used is preferably either paper or film or the like because of their flexibility and economy. Other inexpensive non-flexible media, however, may be used. The negative medium employed should be of the process type to give extreme contrast adapted to the requirements of line and half-tone work.

The exposure and development of the negative is done in the customary manner but without the usual fixing operation. It is desirable that a non-tanning developer be employed, preferably a process developer yielding extreme contrasts. A regulation acetic acid stop bath is convenient for stopping development at the proper time and for neutralizing the alkaline condition of the emulsion as a result of development.

Spotting out pinholes and other retouching may be taken care of after development. Filled lines or muddy whites may be cleared by a weak chromate bleach. Pinholes or weak blacks may be touched up with a concentrated non-tanning developer. The negative is water rinsed and squeegeed to remove excess water from the surface before this retouching.

(2) Etching

The exposed plate which has been developed but not fixed is subjected to an etching bath for the purpose of removing the reduced portions 15 of the photosensitive coating 12. The etching operation results in a plate somewhat as illustrated in Figure 4, the cavities 16 representing the negative areas which have been etched out and the remaining portions 17 representing the positive areas of the representation.

This operation, as well as the remaining steps, can be carried out in normal light, although too active light action is not preferable until this etch

is completed. It may be desirable, however, to perform this operation in the dark-room when using negatives of relatively high light speed.

The etching bath has the property of decomposing and dissolving out the gelatin of the emulsion which contains the developed silver image but does not affect the gelatin in the unexposed portions. The depth of this etching action is dependent upon the depth of the silver deposit, the activity and temperature of the bath, and the length of time of etching.

The following formula has been used successfully for this operation:—

Water	32 ounces
Copper sulphate crystals	2½ ounces
Nitric acid concentrated	⅓ ounce
Potassium bromide crystals	15 grains
Hydrogen peroxide (3% solution)	2 ounces

Approximately one ounce of chrome alum may be added, if desired, to the above formula to prevent blistering of the paper.

Any chemical means of removing the colloid in exposed or reduced portions only, without removing the silver salts in the unexposed or unreduced portions, is in keeping with the general principles involved in this process.

The etching action should be completed in from three to five minutes, using the above formula, although the time factor is subject to considerable variation, all within the control of the operator.

The etch leaves the gelatin underneath the exposed portions which have dissolved away in a spongy, soft condition, while the unetched areas are unchanged. A short water rinse with a forced water spray clears the surface of adhering particles of gelatin as well as washing out most of the retained chemical of the etch bath.

In order to remove the chemicals completely and to neutralize the acid condition of the gelatin layer, immersion for about one minute in the following bath, followed by a short rinse, is desirable:

Sodium bicarbonate	1 part (by weight)
Water	16 parts

(3) Tanning

The negative image should now be practically invisible and there should be a very decided relief visible.

Although it is not required, it is desirable, in order to produce a rugged plate and one which will readily accept ink from a roller, to harden all the remaining gelatin by redeveloping in a tanning developer and then bleaching in a tanning bleach bath. A brief exposure of the "plate" to a strong actinic light through the back as well as onto the surface is sometimes of advantage when there is not a long lapse of time between tanning and etching.

A. Redevelopment

A tanning developer is used to redevelop the "plate". The development will, of course, give a much denser deposit of silver in the unetched portions which may not be obvious from surface examination but is evident when looked at through the plate at a source of light. Too clean a background is not desirable; in fact, the best plates frequently show a denser black in the etched areas on surface inspection. Development should not be prolonged much beyond the time necessary to give a thorough development of all silver salts, especially at the base. This step should not take longer than thirty seconds with the following preferred developer:

A.—Pyrogallic acid crystals	1½ ounces
Water	8 ounces
B.—Sodium carbonate	8 ounces
Water	80 ounces

For immediate use mix one part A with ten parts B.

Other tanning developers may, of course, be used.

A brief water rinse is given, followed by immersion in a weak acid solution (citric acid is preferred) to neutralize the alkalinity of the "plate" and to speed up elimination of the developer.

The redeveloped plate is indicated in Figure 5 wherein the colloid coating 18 has been partially hardened by redeveloping.

B. Bleaching

The "plate" is further tanned in a chromate bleach bath, for which either of the following formulas is satisfactory:

1

Potassium bichromate	3 drams
Hydrochloric acid	5 drams
Water	60 ounces

2

Chromic acid	150 grains
Potassium bromide	600 grains
Water	60 ounces

Bleaching should be complete in about one minute, resulting in a "plate" having a positive brown image with a background of lighter sepia tone. The surface of the "plate" should be quite tough and leathery.

The tanned plate is represented in Figure 6 wherein the numeral 19 represents the tanned emulsion coating.

(4) Inking

After being suitably mounted for stability, the "plate" can be inked up with a lithographic ink. Moisture applied to the plate first will dampen the background or etched portions and then ink will adhere only to the image or unetched portions 17, being repelled by the moisture in the background in the same manner as with lithographic plates on stone and grained zinc or aluminum.

(5) Printing, or Transferring

A. Direct printing

At present, printing directly from the "plate" onto paper stocks suitable for lithographic printing has been performed on a proof press of the cylinder impression type, manual dampening and inking being used. For short runs, for which there is a definite commercial demand, this procedure is entirely practical and profitable. However, the "plate", may be well adapted to longer runs on offset lithographic presses of the rotary type. This last application is especially true of the small so-called "office-device" type of offset lithographic press now on the market where the high cost and complicated process of platemaking is a decided disadvantage on short runs.

B. Transferring

Ink transfers onto metal plates, by my method, can be used to secure either planographic or relief printing surfaces. The method of treating these ink impressions to secure either a resist for etching the metal or to secure a lithographic

printing surface is a matter of general knowledge in the photo-mechanical trades and may vary considerably according to the requirements and nature of the plate.

Transfer methods have been utilized in the lithographic industry with a high degree of success and to some extent in relief etching with excellent results. The simplicity and economy of this new process of making a master transfer, united with the simple transfer method, introduces a genuine practical short-cut in photo-mechanical procedure.

ALTERNATIVE ETCHING BATH

As an alternative embodiment of my invention, I may use for the etching operation described above a bath of the following type:

Water	10 ounces
Ferric sulphate	1 ounce
Hydrogen peroxide	1 ounce

When using this bath the reduced silver in the exposed areas **20** (Figure 7) is not reconverted to a light-sensitive silver-halide salt, as occurs when using a bath of the type described above. These negative areas **20** are, therefore, not sensitive to exposure and when a plate of this type is subjected to redevelopment and tanning, as described above, the negative areas **20** remain in a very porous condition wherein they accept water even more readily than with the etch bath previously described. The positive areas of such a plate are represented by the numeral **21**.

A plate of this type is found to be highly satisfactory, giving very sharp contrasts. Figure 8 represents such a plate after completion of the tanning step.

Various modifications and variations coming within the spirit of my invention will doubtless suggest themselves to those skilled in the art. Hence, I do not wish to be limited to the precise form shown or uses mentioned, except to the extent indicated by the appended claims, which are to be interpreted as broadly as the state of the art will permit.

I claim as my invention:

1. A process of preparing a printing plate, comprising photographically exposing a plate having a surface of colloid containing a photo-sensitive silver salt and developing the plate to reduce the exposed silver salt, partially etching out the colloid containing reduced silver salt, thus leaving colloid on said areas, redeveloping said plate so as to reduce the remaining silver salts, and then submitting the plate to a chromate bleach bath to harden the surface thereof, whereby to form a lithographic printing plate wherein the etched portions will accept water and thus repel ink and the unetched portions will accept ink.

2. A process of preparing a plate capable of printing on a printing press with printer's ink, comprising photographically exposing a sheet having a coating of photo-sensitive silver salt in a colloid carrier, developing said exposed sheet without fixing at the time, subjecting said sheet to an etch bath so as selectively to remove only portions of the colloid from the surface of areas which are to be non-printing and to produce there a water-accepting surface without substantially affecting the ink accepting quality of the areas which are to be printing areas.

3. A process of preparing a plate capable of printing on a printing press with printer's ink, comprising photographically exposing a sheet having a coating of photosensitive silver salt in a colloid carrier, developing said exposed sheet without fixing at the time, subjecting said sheet to an etch bath so as selectively to remove only portions of the colloid from the surface of areas which are to be non-printing and to produce there a water-accepting surface without substantially affecting the ink accepting quality of the areas which are to be printing areas, and then hardening the entire remaining colloid.

4. A process of preparing a plate of a type which is a member of the group consisting of line and screen half-tone work, said plate being capable of printing on a lithographic printing press with lithographic ink, comprising photographically exposing a sheet having a coating of silver halide in an emulsion of a suitable colloid, developing said exposed sheet with a non-tanning developer, subjecting said exposed sheet to an etch bath so as selectively to remove those portions of the colloid which contain the developed silver image, re-exposing to diffuse illumination, thereby making developable the hitherto unexposed silver halide, and developing with a tanning developer, thereby producing a plate which will accept water upon the first exposed and etched areas and which will repel water and accept ink upon the unetched areas.

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