

UNITED STATES PATENT OFFICE

2,650,877

PROCESS OF PRODUCING ETCHED
PRINTING PLATES

Mahlon Richard Boyer, Metuchen, N. J., assignor
to E. I. du Pont de Nemours and Company,
Wilmington, Del., a corporation of Delaware

No Drawing. Application December 9, 1949,
Serial No. 132,199

6 Claims. (Cl. 95—5.7)

1

This invention relates to photography and more particularly to a method of making gelatin relief images or resists suitable for making printing plates, etc. The invention also relates to the preparation of etching printing plates and cylinders using the resist.

An object of this invention is to provide a practical method of making gelatin relief images or resists. A further object is to provide a practical method of making etching printing members, e. g., plates and cylinders using such resists. A still further object is to provide such methods which can be used with the usual equipment in printing establishments. Still other objects will be apparent from the following description of the invention.

The invention in one of its broader aspects comprises exposing a flexible photographic film element having an outer light-sensitive silver halide emulsion layer and a hydrophobic support through a screen and then through a photographic image, e. g., a continuous tone positive. The exposed film is then developed in an aqueous, non-hardening, developer solution, fixed in a thiosulfate fixing bath, washed, bleached in a hardening bleach bath, washed and dried. The gelatin surface of the film is then squeezed into contact with the surface of a metal printing member, e. g., copper, aluminum or zinc plate or cylinder and the support removed, e. g., by dissolving it in a suitable solvent. By washing with hot water the unhardened gelatin is removed to form a resist. The resist, which is affixed to the surface of the metal plate, is then etched with an acidic solution whereby the image is reproduced in the surface of the metal printing plate or cylinder. The residue of the hardened gelatin resist is then washed off by suitable solution, e. g., an aqueous acetic acid solution of moderate to high concentration which may contain sodium chloride.

Various types of photographic film elements may be processed in accordance with the method outlined above but the invention is especially useful with dry-stripping films wherein the gelatin silver halide layer is coated on a relatively thin permanent support which is in turn adhesively joined to a temporary support by means of a dry-stripping layer. The supports should be made of a hydrophobic material so that the resulting composite element will have good dimensional stability. The permanent support should be readily soluble in commercial solvents so it may be effectively removed from the gelatin layer adhering to the surface of the metal

2

printing member by a simple washing operation. The gelatin silver halide emulsion layer is generally not directly coated onto the film support but first a thin gelatin substratum is applied in order to improve the anchorage.

When a cellulose ester film, e. g., cellulose acetate, cellulose acetate propionate, cellulose acetate butyrate, cellulose nitrate, cellulose propionate, etc., is used in the support for the gelatin silver halide emulsion layer it can readily be removed with commercial solvents for such esters. Mixtures of acetone and ethyl or methyl alcohol and mixtures of acetone and the monomethyl or monoethyl ether of ethylene glycol are especially useful. Acetone can be used alone if desired but because of its high degree of volatility is somewhat difficult to handle. The monoethyl ether of ethylene glycol is an excellent single solvent for the permanent support.

When the photographic film used is a stripping film, the temporary support may be stripped after the differentially hardened emulsion layer is made to adhere to the printing surface and the permanent support is later removed by dissolving it.

The invention will be further illustrated but is not intended to be limited by the following examples.

Example 1

A photographic stripping film consisting of a cellulose acetate film base bearing on one surface, in order, a layer of cellulose nitrate, a thin substratum of gelatin and a gelatin backing layer and on the other surface, in order, a stripping layer composed of water-insoluble ethyl cellulose and cellulose nitrate, a thin cellulose nitrate film, a gelatin anchoring substratum and a light-sensitive gelatin silver halide emulsion layer was exposed for a period of 20 seconds at ten foot candles through a round dot gravure screen and then exposed through a positive photograph for 20 seconds at ten foot candles. The exposed film was then processed as follows:

(1) Developed for three minutes at 65° F. in a solution of the following composition:

	Grams
50 N-methyl-p-aminophenol sulfate	1.5
Hydroquinone	15.0
Sodium sulfite	60.0
Potassium carbonate	64.0
Potassium bromide	4.5
55 Water to 1 liter.	

3

(2) Fixed for two minutes in a 20% aqueous solution of sodium thiosulfate;

(3) Washed in water at 60° F. for 30 minutes;

(4) Bleached for two minutes in a solution made by admixing the following components:

Potassium bichromate.....grams-- 20.0
Hydrochloric acid.....ml-- 10.0
Potassium bromide.....grams-- 5.0
Water to 1 liter.

(5) Washed in water at 60° F. for a period of 30 minutes and then dried at 68° F. at 55% relative humidity.

The gelatin surface of the bleached film was squeegeed into contact with the surface of a wet, copper plate. The temporary support being outermost was then stripped from the nitrocellulose support and the latter was removed by dissolving it in a washing solution consisting of 60% acetone and 40% ethyl alcohol. A gelatin relief image was then made by washing the gelatin layer with water at 125° F. for five minutes. The resist was dried and then treated with 38° Baumé iron perchloride solution for a period of about 17 minutes whereby the photographic image was reproduced on, viz., etched into, the surface of the copper plate. The residue of the relief image was washed off with 28% aqueous acetic acid.

Example II

A photographic stripping film of the kind described in Example I was exposed as described in that example except that a conventional screen having a space to line ratio of 2½ to 1 was used. The exposed film was then processed and used to make an etched copper plate as described in Example I with similar good results. The residue of the relief image, however, was washed off by means of a 28% aqueous acetic acid containing a large amount of sodium chloride.

Example III

A film of the type described in Example I was processed exactly as described in that example except that the permanent support was removed by soaking in the monoethyl ether of ethylene glycol and swabbing with cotton soaked in the same solvent.

The invention obviously is not limited to the specific developer solution or period of development prescribed in the foregoing examples. To the contrary, various other commercial non-hardening developers can be used in like manner. The period can be varied to produce optimum or desired results a practical range being 3 to 15 minutes. A suitable developer for changes in contrast is the soft working developer made by admixing the components:

	Grams
N-methyl-p-aminophenol sulfate	0.5
Hydroquinone	5.0
Sodium sulfite (anhydrous)	40.0
Sodium carbonate (monohydrate)	12.0
Potassium bromide	1.0
Water to 1 liter.	

Similarly other hardening bleach baths can be used in place of the specific one in the above examples. A suitable additional bath has the following composition:

Potassium bichromate	grams-- 10.0
Hydrochloric acid	ml-- 10.0
Water to 1 liter.	

Water-soluble bromides, e. g., sodium, potassium or ammonium bromide are preferably present in

4

the bleach bath when copper printing members are used.

In the washing operation following bleaching when the gelatin relief image or resist is formed the temperature of the water and the time of treatment may vary. Temperatures from 105° F. to 145° F. and times from three minutes to 30 minutes are practical ranges.

The etching treatment may be varied depending upon the particular type of metal plate or cylinder used. The etching may be conducted with a single solution or in several solutions of different strength, e. g., iron perchloride solutions varying from Baumé 45° and ending with Baumé 35° can be used. An advantage of the present invention is that a single Baumé iron perchloride solution preferably about 38° can be used instead of the five solutions used by photo-engravers.

The invention is especially useful in processing the dry stripping films of the types described in copending application Ser. No. 125,198, filed November 3, 1949. It is not limited to such stripping films, however, but can be used with various other types. Suitable additional ones are described in U. S. Patents 2,266,435, 2,275,617 and 2,391,171.

The processes of this invention have the advantage that the usual carbon tissues used in the gravure industry can be eliminated with their attendant disadvantages. An important advantage of the invention is that it enables the technician in the gravure art to use one etching solution with the same result previously attained with several solutions of varying concentration. A further advantage is that the silver salts enable the technician to view the nature of the photographic reproduction before the etching operation is carried out. Still other objects will be apparent to those skilled in the art.

As many widely different embodiments of this invention can be made without departing from the spirit and scope thereof, it is to be understood that the invention is not to be limited except as defined by the claims.

What is claimed is:

1. A process of making an etched printing plate which comprises exposing separately through a screen and a photographic image a film element having an outer light-sensitive gelatino silver halide emulsion layer and a hydrophobic support, developing said film in a non-hardening photographic developer solution, fixing the developed film in a non-hardening fixing solution, bleaching the fixed film in a hardening bleach bath, pressing the bleached silver salt gelatin layer into contact with the surface of a metal printing member, removing the support from the latter layer, washing the unhardened gelatin from the bleached silver salt gelatin layer and treating the relief image with an acid etching bath whereby an image is etched into the surface of said printing member.

2. A process of making an etched printing plate which comprises exposing separately through a screen and a photographic image a film element having an outer light-sensitive gelatino silver halide emulsion layer and a hydrophobic cellulose derivative support, developing said film in a non-hardening photographic developer solution, fixing the developed film in a non-hardening fixing solution, bleaching the fixed film in a hardening bleach bath, drying the bleached film, pressing the bleached silver salt gelatin layer into contact with the wet surface of a metal printing member,

5

removing the support from the latter layer, washing the unhardened gelatin from the bleached silver salt gelatin layer and treating the relief image with an acid etching bath whereby an image is etched into the surface of said printing member.

3. A process of making an etched printing plate which comprises exposing separately through a screen and a photographic image a film element having an outer light-sensitive gelatino silver halide emulsion layer and a hydrophobic cellulose derivative support, developing the exposed film in a non-hardening photographic developer solution, fixing the developed film, washing the fixed film, bleaching the resulting film in a hardening bleach bath, washing the bleached film, drying the bleached film, pressing the bleached silver salt gelatin layer into contact with the wet surface of a metal printing member, removing the support from the latter layer, washing the unhardened gelatin from the bleached silver salt gelatin layer and treating the relief image on the metal printing member with an acid etching solution whereby the photographic image is etched into the surface of the printing member.

4. A process as set forth in claim 3 wherein the surface of the metal printing plate is composed of a metal taken from the group consisting of copper, aluminum and zinc and iron perchloride solution of 45° to 35° Baumé is used as the etching bath.

5. A process of making an etched printing plate which comprises exposing separately through a screen and a photographic image a stripping film element having an outer light-sensitive gelatino silver halide emulsion layer

6

carried by a hydrophobic cellulose derivative support which is adhesively joined to a temporary support by a dry-stripping layer, developing said film in a non-hardening photographic developer solution, fixing the developed film, bleaching the fixed film in a hardening bleach bath, drying the bleached film, pressing the bleached silver salt gelatin layer into contact with the wet surface of a metal printing member, stripping the temporary support from the remaining support, dissolving the latter support, washing the unhardened gelatin from the bleached silver salt gelatin layer and treating the relief image with an acid etching solution whereby an image is etched into the surface of said printing member.

6. A process as set forth in claim 5 wherein the surface of the metal printing plate is composed of a metal taken from the group consisting of copper, aluminum and zinc the acid etching bath is an iron perchloride solution of about 38° Baumé.

MAHLON RICHARD BOYER.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,482,612	John	Feb. 5, 1924
1,709,569	Gorsky	Apr. 16, 1929
2,100,224	Snyder	Nov. 23, 1937
2,325,519	Koch	July 27, 1943
2,391,171	Lane	Dec. 18, 1945

FOREIGN PATENTS

Number	Country	Date
190,501	Great Britain	Dec. 27, 1922