April 18, 1933. M. F. CONROY 1,903,778

ETCHING PROCESS AND COMPOSITION FOR USE THEREIN

Filed Sept. 8, 1930

FIG. 1.



Inked and Powdered Plate.

FIG. 2.

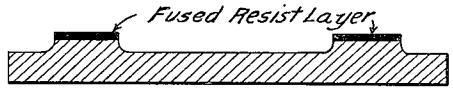
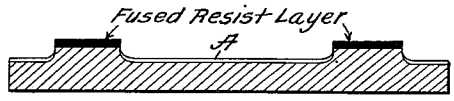


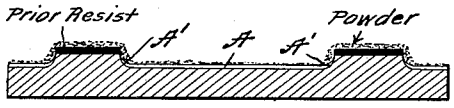
Plate after Burning In and Taking First Bite.

FIG. 3.



Application of Novel Composition Before Second Bite.

FIG. 4.



Powdered for Second Bite.

FIG. 5.

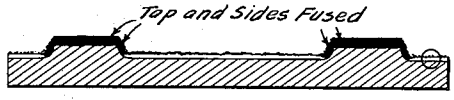


Plate Burned In Prior to Second Bite.

FIG. 5a.

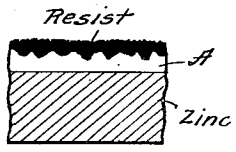


FIG. 6.



Plate after Second Bite using Novel Composition

FIG. 7.



Plate after Second Bite without using Composition

Inventor

Marcus F. Conroy,

By

Watson, Cole, Moran & Grindle

Attorneys

Patented Apr. 18, 1933 1,903,778

UNITED STATES PATENT OFFICE

MARCUS F. CONROY, OF LUZERNE, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO LUZERNE MOTOR COMPANY, OF LUZERNE, PENNSYLVANIA, A COPARTNERSHIP CONSISTING OF LEO B. CORGAN, WILLIAM F. CORGAN, AND MICHAEL H. CORGAN

ETCHING PROCESS AND COMPOSITION FOR USE THEREIN

Application filed September 8, 1930. Serial No. 480,614.

This invention relates to etching processes and compositions for use therein, and has for its general objects the provision of an improved process of this type as pursued in connection with the etching or photo-engraving of printing plates or the like, and the provision of a new composition of matter which is employed therein.

In the ordinary photo-engraving process as generally carried out, a plate of copper or zinc commonly called a "flat", is coated with a suitable enamel or sensitizing solution,—such as, for example, a bichromate albumen composition,—the thin film thus formed is dried, and the plate is then printed from a previously prepared negative in a well known manner. The printing process, and the subsequent developing, as will be readily understood, cause those portions of the film of sensitizing material which are exposed to the action of the light to adhere strongly to the plate to form a base for the resist material to be later applied. The developing of the plate is usually accomplished by immersion in water.

The developed surface of the plate is then rolled with ink and brushed with dragon's blood or other suitable or commonly employed topping powder, usually by the so-called "four ways" method in which the powder is brushed backward and forward in each of two directions substantially at right angles to each other, so as to ensure that the substantially vertical edges of the areas to which the ink has been applied, as well as the top surfaces thereof, shall be thoroughly coated. The high light areas and other portions which are to be etched are carefully brushed preferably with a very soft camel's hair brush, to free them from any of the powder which might have a tendency to adhere thereto.

The plate is then gently and evenly heated until the coating of ink and topping powder is "burned in" or melted together to form an acid resistant covering for the portions of the plate which are not to be cut away during the etching process.

The next step in the process comprises giving the plate what is termed the first "bite" or immersion in the etching bath. In the case of a copper plate, the bath is generally an iron perchloride solution and in the case of a zinc plate, with which the present invention is more concerned, the etching solution is usually composed of nitric acid. The first "bite" is also usually made in a more dilute solution and is of a shorter duration than subsequent immersions.

This first bite has its greatest effect on the high light areas of the plate, and in the ordinary methods, a routing tool is sometimes employed to cut away the larger of these areas to ensure that no part of them will make an impression upon the sheet during the printing operation in which the completed plate is finally used.

It will be understood that the operations just described, especially those of applying the powdered dragon's blood to the plate, brushing it four ways, and the careful brushing required in removing every vestige of the powder from the "bottoms" or portions of the plate to be etched, are very tedious processes requiring the attention of highly skilled experts and consuming a relatively great amount of time. This is especially true of the last named brushing process when practiced in connection with fine line or half tone work where these areas are very minute.

After the first "bite" is accomplished the plate is rinsed with water and again powdered four ways to apply a coating of resist to the newly exposed edges of the raised portions, in order to prevent undercutting of these edges and the consequent spoiling of the plate. It is highly important to again brush all of the powder from the areas to be etched so as to maintain a clean bottom. The plate is again "burned in" and then alternately etched and powdered,—usually until it has received four "bites",—and finally all of the resist is dissolved and washed off with benzol or other suitable clean-up dope and the finished plate is ready for mounting upon a block for use in a press, or prepared in any other manner for impressing its engraved design upon a sheet of paper or the like.

The method forming the subject matter of my invention is especially applicable to zinc plates which are etched in a nitric acid bath, and in the practice thereof the above described general process is modified as will be hereinafter described in connection with the accompanying drawing, in which the figures are greatly enlarged and somewhat diagrammatic cross sectional views of a plate during successive stages in the etching process.

In said drawing:

Figure 1 shows the plate or flat after being developed, rolled with ink, and powdered before the first bite;

Figure 2 shows the plate after being burned in and given the first bite in the etching bath;

Figure 3 shows the plate with my novel composition applied thereto;

Figure 4 shows the plate after being powdered for the second bite;

Figure 5 illustrates the plate after the burning in process prior to the second bite;

Figure 5*a* is a fragmentary, magnified view of the portion of the surface of the plate enclosed in the circle in Fig. 5 and showing the layers of resist and of my novel composition as they appear on the "bottoms" of the plate, and

Figure 6 illustrates the greater depth of cut and smoother "bottom" attained by the use of my process and composition as compared with

Figure 7 which illustrates a plate which has been treated without the use of my composition.

After performing the successive steps of sensitizing, developing, rolling with ink, powdering, brushing, burning in, and subjecting the plate to the first bite, (certain stages of this preliminary process being shown in Figs. 1 and 2), the plate is rinsed with water and then flowed with a solution which, for obtaining the best results, is composed of the following ingredients combined in the stated proportions:—

4 parts of a 42% solution of iron perchloride,

1 part of a 28% solution of acetic acid,

1 part of a 9% solution of nitric acid, and

3 grains of chromic acid U. S. P. X. (CrO_3) added to each quart of the mixture so composed.

It has been found that it is still possible to obtain results if the proportions of the ingredients of the same concentration are varied within the following limits:

4 to 5 parts of iron perchloride,

1 to 3 parts of acetic acid,

1 to 4 parts of nitric acid, and

3 to 6 grains of chromic acid U. S. P. X. (CrO_3) to the quart of the mixture.

This solution may be flowed on the plate in any known and approved manner, such as, for example, by tilting the plate in alternate directions, or by whirling it to distribute the solution evenly over the surface thereof by centrifugal force. The condition of the plate at this point is clearly shown in Fig. 3, the layer comprising my composition being indicated at A.

The solution has no effect upon the portions of the surface of the plate which are covered with the resist material, but attacks the exposed surfaces or "bottoms" of the plate to a limited extent, forming a film of corrosion thereon which is readily soluble in the subsequent etching baths. After the solution is flowed on the plate, the plate is dried and then powdered with the dragon's blood or other resist forming material, which is banked against the raised portions of the plate, as shown in Fig. 4, with very little attention given to the "bottoms" or etched portions.

The plate is next burned in, whereby the previous resist layer of ink and powder is fused on the top and sides of the relief portions with the newly applied layer of powder. As indicated in Fig. 5*a*, the fused resist powder forms a layer on top of the dried layer A which is composed of my herein described composition together with the corrosion caused by the solution attacking the metal of the plate.

It is to be noted at this point that before flowing my solution over the etched surface of the plate, it has been thoroughly wetted with water during the rinsing process, and due to capillary attraction this aqueous film runs toward the sides of the raised portions of the plate and lodging therein, serves to dilute the solution of my composition at these points, (designated A′ in Fig. 4). This phenomenon, together with other effects which will also be described, lessens the corroding effect of my solution on the sides of the lines, surfaces or dots comprising the raised portions of the plate and permits the applied resist to adhere to the sides and thus prevent undercutting by the subsequently employed etching solutions.

The effect of the solution in preventing the adhering of the resist powder on the sides of the raised portions is also minimized or prevented by the fact that gases which are generated by the action of my solution on the plate do not pass through the central portions of the film between the lines or dots, but up along the sides, thus causing the film of corrosion at these points to be of a weaker and more porous nature. These natural tendencies of my solution to make greater deposits on the "bottoms" of the plate than at the sides of the lines or dots have the effect of reducing the interference with the adhering properties of the powdered resist at these points where the latter is banked very heavily during their application by four-way

brushing. Furthermore, during the subsequent burning in processes the layer of ink and resist powder previously applied to the tops of the plate fuses together with the resist powder applied to the sides, and causes the new and augmented resist layer to extend over the edges and down the sides of the raised portions of the plate.

Then the plate is immersed again in the etching bath, whereupon the film of corrosion produced by my novel solution on the exposed areas is immediately dissolved releasing from the plate the particles of dragon's blood which adhered to the film during the powdering process. In this way, the etching bath during this and subsequent "bites" has a perfectly clean "bottom" to act upon,—and this without the usual tedious brushing of the powder as in the ordinary process. Furthermore, there exists no necessity for removing the protective composition and the applied resist layer from the "bottoms" by mechanical means such as brushing, etc., the entire film of corrosion and resist being removed automatically in the following etching bath.

Due to the obtaining of such clean "bottoms" by means of the use of my composition, there is accomplished not only a great saving due to the elimination or shortening of the tedious brushing and routing processes, but it is possible to obtain the ordinary four "bite" depth in but three "bites".

In the pursuit of my improved method, it will also be noticed how evenly and clearly all parts of the surface of the plate to be etched open up;—half tones opening up for the second "bite", whereas under the old methods, only the high lights open at this point. The fact that this solution keeps the plate open for later "bites" is important also in that there is thus eliminated the necessity for trying for excessive depth, as is now done, with a consequent loss of color and fine detail.

It is possible with the use of my solution as described herein, to etch any known type of plate or "flat", of whatever size,—whether of fine lines, coarse lines, half tones, crayon work, Ben Day prints or any other kind of work, either alone or mixed,—with ease and without the performance of special operations such as routing or the like.

It will be understood that the process and composition which have just been described are susceptible of such modification or variation as is comprised within the scope of the present invention as defined in the subjoined claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. The process of etching a printing plate or flat, which includes the step of applying a material to said plate after the initial etching to prevent a subsequently applied resist composition from adhering to those portions of said plate which are to be further etched, said material also being adapted to be removed during such subsequent etching.

2. The process of etching printing plates or flats, which includes the steps of applying a resist to portions of the surface of a plate, subjecting the plate to an initial immersion in the etching bath and treating the plate so that the subsequently applied resist composition may adhere to those portions of said plate which are to be further etched, during subsequent manipulative processes, but will be readily dislodged during such subsequent etching.

3. The process of etching printing plates or flats, which includes the steps of applying a resist to portions of the surface of a plate, subjecting the plate to an initial immersion in the etching bath, flowing the plate with a solution having the property of forming a protective film which renders subsequently applied resist composition non-adherent, the film and the resist composition both being adapted to be removed during a subsequent etching step.

4. The process of etching printing plates or flats, which includes the steps of applying a resist to portions of the surface of said plate, subjecting the plate to an initial immersion in the etching bath, flowing the plate with a solution having the property of forming a protective layer which renders subsequently applied resist composition non-adherent during further etching, powdering the surface of said plate, "burning in" the plate and again subjecting it to an immersion in the etching bath.

5. The process set forth in claim 2 as applied to a zinc plate.

6. The process set forth in claim 2 in which the plate is of zinc and an etching bath of nitric acid is used.

7. The process of etching a printing plate or flat which includes the steps of flowing said plate with a solution containing an iron chloride and acetic, nitric, and chromic acids, whereby a subsequently applied resist composition is rendered non-adherent to the surfaces to be etched.

8. The process of etching zinc printing plates which includes the steps of applying a resist to portions of such a plate, subjecting the plate to an initial immersion in a nitric acid etching bath, flowing said plate with a solution containing iron perchloride, acetic acid, nitric acid, and chromic acid, powdering said plate with a resist composition, heating said plate and again subjecting it to an immersion in the etching bath, whereupon the coating of resist composition will be dislodged from the portions to be etched.

9. The photo-engraving process which comprises the following steps:—applying a resist composition comprising a suitable ink

and topping powder, to a developed plate; subjecting said plate to an initial immersion in an etching bath; rinsing said plate with water; flowing the plate with a solution containing iron perchloride, acetic acid, nitric acid, and chromic acid; drying the plate; powdering said plate with dragon's blood; "burning in" the plate; and thereafter alternately etching and powdering the plate until the plate is sufficiently engraved.

10. The process of engraving zinc printing plates, which includes the steps of subjecting the plate to an initial etching in a nitric acid bath; rinsing with water; flowing with a solution containing iron perchloride, acetic acid, nitric acid, and chromic acid; drying the plate; brushing with powdered dragon's blood; "burning in" the plate; and subjecting the plate to subsequent etching.

11. The process of etching printing plates or the like which includes the steps of treating the plate with a composition which is adapted to form a film of corrosion over the portions of the surface of the plate which is to be etched; powdering the entire surface of the plate with a resist material; and subsequently subjecting said plate to an immersion in the etching bath, whereupon said film is dissolved, carrying away with it the coating of resist material thus ensuring a clean bottom for the etched surface.

12. A composition of matter for use in photoengraving processes comprising iron perchloride, acetic acid, nitric acid, and chromic acid.

13. A composition of matter for use in photoengraving processes comprising

4 parts of a 42% solution of iron perchloride,

1 part of a 28% solution of acetic acid,

1 part of a 9% solution of nitric acid, and

3 grains of chromic acid U. S. P. X. (CrO_3) added to each quart of the mixture so composed.

14. A composition of matter for use in photoengraving processes which is prepared by adding from 3 to 6 grains of chromic acid U. S. P. X. (CrO_3) to each quart of a mixture having the following composition

4 to 5 parts of a 42% solution of iron perchloride,

1 to 3 parts of a 28% solution of acetic acid, and

1 to 4 parts of a 9% solution of nitric acid.

In testimony whereof I hereunto affix my signature.

MARCUS F. CONROY.