

UNITED STATES PATENT OFFICE.

WILLIAM S. EATON, OF SAG HARBOR, NEW YORK.

ART OR METHOD OF ETCHING STEEL OR OTHER LIKE PLATES.

1,275,408.

Specification of Letters Patent. Patented Aug. 13, 1918.

No Drawing.

Application filed November 28, 1916. Serial No. 133,874.

To all whom it may concern:

Be it known that I, WILLIAM S. EATON, a citizen of the United States, residing at Sag Harbor, in the county of Suffolk and State of New York, have invented certain new and useful Improvements in the Art or Methods of Etching Steel or other like Plates, of which the following is a specification.

My invention relates to a method or art of etching steel or other like plates and more particularly to improvements in the art or method generally known as acid etching.

My invention is designed primarily to facilitate the rapid production of accurate master or pattern plates for use upon pantographic engraving or other similar machines.

Heretofore, such plates have been produced either mechanically by means of a pantographic engraving, or other machine, or by means of the acid etching method or art ordinarily employed in the production of photo-engraved plates for printing purposes. In plates so produced, however, the cut or etched lines have not been of uniform depth and have been found to be so rough as to interfere with the free movement of a tracing stylus therein, conditions attributable to the generally recognized difficulties inherent to the method used for producing etched plates as demonstrated by the utilization of similar methods in the production of printing plates.

Inasmuch as my invention relates more particularly to a method or art involving the practice of electro-chemistry I will refer only to the invention and the related art involving this subject.

Heretofore, in the production of printing plates by the acid etching process, it has been the practice to surface a copper or zinc plate with an acid proof coating known as a resist, the design to be etched being formed upon said resist by means of photographic methods or by means of tools removing the resist and exposing the portions of the plate to be etched through the resist. Plates so prepared are subjected to the action of a mordant or erodent, which when zinc plates are used consists of a nitric acid solution and when copper plates are used consists of a perchlorid of iron solution.

One apparatus used for subjecting plates to the acid is what is known as a tub, which consists of a tilting tank containing the acid in which the plate is submerged, the tank being rocked to cause the liquid to flow over the

surface of the plate in a manner to expedite the corrosive action of the mordant or erodent and at the same time minimize that tendency of the acid to eat under the resist with a result which is known as "undercutting."

Another apparatus used consists of a mechanism by which the erodent or mordant is forcibly projected in minute particles against the face of a plate prepared in the manner above referred to, this method being more rapid and more satisfactory than the tub method above referred to. The methods above referred to are the ordinary commercial methods used for acid etching plates for printing and similar purposes.

In the method or art above referred to, whatever the apparatus used may be, the removal of the metal results solely from the corrosive action of the mordant or erodent thus necessitating the employment of a fairly strong solution. One of the advantages of projecting the mordant or erodent against the plate is that this method permits the use of a stronger solution than the tub method thus expediting the production of a plate, reducing the tendency toward undercutting and securing a more uniform depth throughout the entire surface of the plate thus etched.

The method or art of my invention is such as to permit the submersion of the prepared plate in a bath of a mordant or erodent consisting of a much weaker solution than is ordinarily employed in acid etching, thus avoiding likelihood of undercutting and producing clean sharp edges in the etched portions of the plate. By my method or art I am enabled to rapidly remove the metal from all portions of the plate exposed through the resist and to a substantially uniform depth. The mordant or erodent used is of a nature which will permit of a prolonged use of the bath without such deterioration as will seriously impair its efficiency. Furthermore, there is an absence of those obnoxious and injurious fumes which have proven objectionable in the commercial practice of the ordinary acid etching methods and required in some instances, the production of special apparatus for the purpose of protecting the workmen.

An essential characteristic of my invention is the utilization of an electric current for disassociating the active agent of a mor-

dant or erodent from its vehicle and causing it to act directly upon the plate to be etched, the solution and the potential of the current being such as to avoid the evolution of gases.

I have found in actual practice that the solution which I use will combine with the metal of the anode and form a compound which will readily dissolve in the bath; and that the metal deposited upon the cathode will also gradually be dissolved so that the bath will be constantly renewed. I have also discovered that in a bath of the character hereinafter referred to, there are no by-products which might injuriously affect the plate being etched, and that the resistance of the solution does not vary materially.

By using a low potential current, I avoid decomposition of the water entering into the solution, and the presence of free oxygen at the anode, which oxygen I have found in actual practice has the effect of producing roughness in the edges of the etched portion of the plate.

The invention consists primarily in a method or art of etching steel or other like plates consisting in submerging a prepared plate in an electrolytic bath composed of a chlorid solution of a strength having little or no corrosive action upon the metal of the plate, said plate constituting the anode of an electric couple and passing an electric current through the electrolytic cell so formed, the voltage of said current being below the decomposition voltage of the electrolyte but sufficiently high to disassociate the chlorin from the liquid of the solution to cause the etching to be done by said chlorin while in a nascent state; and in such other novel steps and practices as are hereinafter set forth and described and more particularly pointed out in the claims hereto appended.

In the practice of my method or art, I prepare the steel or other metal plate for the etching bath, by coating the surface thereof with a resist such as is ordinarily employed in photoengraving and by removing portions of said resist to form the design upon said plate which is to be etched. This design may be produced photographically by the methods ordinarily employed in photoengraving or it may be produced mechanically by cutting away the resist by means of hand or machine tools in a manner to expose the metal surface of the plate, leaving the portions thereof which are not to be etched protected by the resist.

When the plate is thus prepared, I use it as the anode of an electrolytic cell, the cathode being of any desired electro-conductive material. The plate to be etched is submerged in the electrolyte in the cell which electrolyte is ordinarily a chlorid solution

of a density which would cause it to ordinarily have little or no corrosive effect upon the electrodes. The solution which I use is very much weaker than that ordinarily employed in acid etching.

In etching the plate, I use an electric current of low voltage, and have secured the most satisfactory results with a current below two volts, or a voltage below the decomposition voltage of the electrolyte used. This current I have found releases chlorin at the anode, which in a nascent state attacks the metal of the anode exposed through the resist and rapidly removes same. In the absence of any corrosive action of the electrolyte itself, there is no tendency toward undercutting and clean sharp edges result. Furthermore, conditions throughout all exposed portions of the plate are substantially identical, so that the corrosive or erosive action upon the plate progresses with substantial uniformity and gives substantially the same depth of cut at all points. I have not found it necessary to remove the plate for the purpose of renewing the resist, nor to produce the etching by a series of bites as in photoengraving.

In actual practice, I have found that I get the most satisfactory results in using a perchlorid of iron solution of a density of 22° Baumé. I prefer to use this solution because I have found that I secure no by-products therewith which have a tendency to increase the resistance of the cell or injuriously affect the plate. With this solution the chlorin salt formed at the anode is readily dissolved, and the electrolytic iron deposited upon the cathode is gradually dissolved, thus preserving the character of the solution and permitting the continued use of the bath without substantial variance in the results of the practice of the method or art.

By reason of the low voltage used oxygen is not freed at the plate being etched and no noxious fumes are present during the etching of the plate.

The strength of the solution used and the voltage of the current employed, may be varied in accordance with the materials used in the elements of the cell.

While I prefer to use a perchlorid of iron solution, it is not my intention to limit the invention to such a solution as other chlorid solutions which will not be so decomposed by a low voltage current as to produce by-products injurious to the plate, or to the bath, may be employed.

The essential characteristic of the invention is the employment of an electrolyte having a very feeble or no corrosive action upon the material of the plate being etched, but which with the passage of a low voltage current therethrough, will cause the active agent to be disassociated from the liquid

of the solution so that while in a nascent state, it will attack the exposed portions of the prepared plate and rapidly etch same.

Having described the invention what I claim as new and desire to have protected by Letters Patent is:—

1. A method or art of etching steel or other like plates consisting in submerging a plate having the portion of the surface thereof to be etched exposed and other portions thereof protected by a resist in an electrolytic bath composed of a chlorid solution of a strength having little or no corrosive action upon the metal of the plate, said plate constituting the anode of an electric couple and passing the electric current through the electrolytic cell so formed, the voltage of said current being below the decomposition voltage of the electrolyte but sufficiently high to disassociate the chlorin from the liquid of the solution to cause the etching to be done by said chlorin while in a nascent state.

2. A method or art of etching steel or other like plates consisting in submerging a plate having the portion of the surface thereof to be etched exposed and other portions thereof protected by a resist in an electrolytic bath composed of a perchlorid of iron solution of a strength having little or no corrosive action upon the metal of the plate, said plate constituting the anode of an electric couple and passing the electric current through the electrolytic cell so formed, the voltage of said current being below the decomposition voltage of the electrolyte but sufficiently high to disassociate the perchlorid of iron from the liquid of the solution to cause the etching to be done by chlorin while in a nascent state.

3. A method or art of etching steel or other like plates consisting in submerging a plate having the portion of the surface thereof to be etched exposed and other portions thereof protected by a resist in an electrolytic bath composed of a chlorid solution of a strength having little or no corrosive action upon the metal of the plate, said plate constituting the anode of an electric couple and passing the electric current through the electrolytic cell so formed, the voltage of said current being approximately two volts whereby the chlorin will be disassociated from the liquid in the solution to cause the etching to be done by said chlorin while in a nascent state.

4. A method or art of etching steel or other like plates consisting in submerging a plate having the portion of the surface thereof to be etched exposed and other portions thereof protected by a resist in an electrolytic bath composed of a perchlorid of iron solution of a strength having little or no corrosive action upon the metal of the plate, said plate constituting the anode of an electric couple and passing the electric current through the electrolytic cell so formed, the voltage of said current being approximately two volts whereby the chlorin will be disassociated from the liquid in the solution to cause the etching to be done by said chlorin while in a nascent state.

In witness whereof I hereunto affix my signature in the presence of two subscribing witnesses, this 14th day of November, 1916.

WILLIAM S. EATON.

Witnesses:

JUDITH PARDEE,
CLARICE FRANCK.