A. PAYNE.

PREPARATION OF SURFACES SUITABLE FOR PHOTO ENGRAVING OR PHOTO ETCHING.

APPLICATION FILED MAR. 5, 1909.

992,898. **Patented May 23, 1911.**

Fig. 1.

Fig. 2.

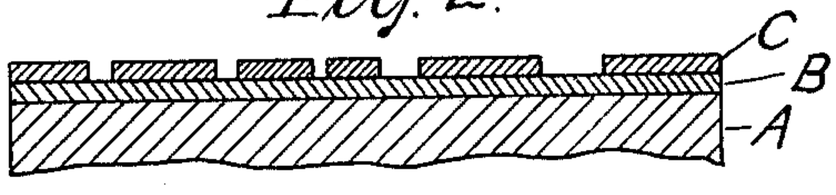


Fig. 3.

Fig. 4.

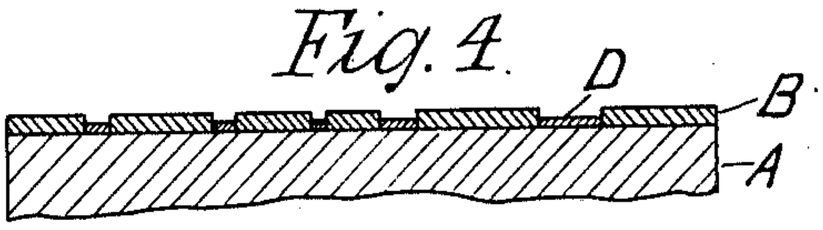
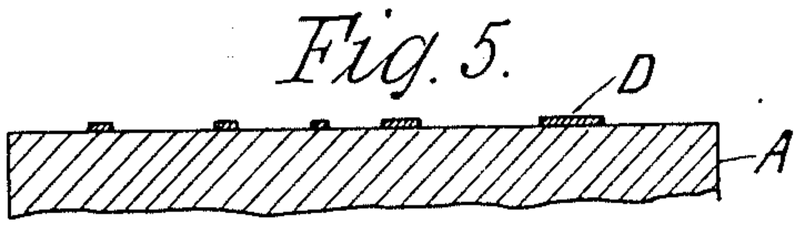


Fig. 5.



Witnesses
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UNITED STATES PATENT OFFICE.

ARTHUR PAYNE, OF WHITLEY BAY, ENGLAND.

PREPARATION OF SURFACES SUITABLE FOR PHOTO-ENGRAVING OR PHOTO-ETCHING.

992,898. Specification of Letters Patent. Patented May 23, 1911.

Application filed March 5, 1909. Serial No. 481,292.

To all whom it may concern:

Be it known that I, ARTHUR PAYNE, a subject of the King of England, and residing at Whitley Bay, in the county of Northumberland, in England, have invented certain new and useful Improvements in the Preparation of Surfaces Suitable for Photo-Engraving or Photo-Etching, of which the following is a specification.

My invention comprises improvements in and relating to the preparation of surfaces suitable for photo-engraving or photo-etching, and the object is to provide an improved surface or plate of that class which may be placed in the camera and the required image obtained direct upon the surface to be engraved. In prior methods in this art it has been previously proposed to use an emulsion coated upon a flexible support such as metal from which the sensitized film may be separated by an intermediate layer of albumen or some silicate productive of adhesion merely for the purpose of preventing the film from blistering; also to use a copper plate covered with a graining film or etching ground which is coated with emulsion and finally to use a metal plate coated direct with the emulsion.

According to the present invention I interpose between the metal base and the outer film of sensitized emulsion an intermediate substratum of collodion or other homogeneous substance, this substratum acting to prevent chemical action between said sensitized emulsion and the metal plate and serving also as a resist for the etching fluid, which is necessary by the present day rapid methods of etching, for example with a strong spray of acid.

In the accompanying drawings, Figure 1 shows the plate developed with glycerin and immersed in potassium bichromate and rinsed. Fig. 2 shows the plate developed in hot water. Fig. 3 shows the plate with the resist film removed (as by spirit) and ready for etching as an intaglio plate. Fig. 4 shows the plate with electrolytically deposited metal and the emulsion film cleaned off the plate. Fig. 5 shows a plate as shown in Fig. 4 after the resist film has been removed, the plate being now ready for etching.

In above figures A indicates the metal plate, B the resist and insulating film, C the gelatin bromid emulsion film and D the electrolytically deposited metal or ink.

When my process is used in the production of printing blocks either in line or half tone, and for intaglio or relief printing processes, I take the copper or zinc or other metallic plates such as brass or steel that are also occasionally used, and polish the face of the metal and clean it free from grease by any of the well known methods at present in use. The polished or grained surface of the metal plate is then coated with a substratum for which purpose I may use a 2 per cent. collodion such as is made by dissolving pyroxylin in a mixture of equal parts of methylated ether .720 and ethyl alcohol .90% and I prefer to slightly color this collodion by the addition of a small quantity of a strong solution of the anilin dye known as brilliant green in ethyl alcohol. I do not, however, restrict myself to the use of this particular dye and it is not an essential part of the invention that any dye should be used for it is only used as a convenience and the plain undyed collodion serves as an efficient substratum. Though I refer to the use of a collodion substratum yet I do not restrict myself to this in particular for other substrata that prevent chemical action between the emulsion and the metal and act as a "resist" to the etching fluid may be used such as bitumen, gum dammar, celluloid, dragon's blood or gum shellac either singly or in combination, for instance a more suitable substratum or "resist" is made by dissolving 3 ozs. gum dammar in 15 fluid ounces of benzol and mixing it with a solution of 150 grains of pyroxylin dissolved in 15 fluid ounces of amyl acetate, this solution being suitably colored with a solution of an anilin dye in alcohol or other suitable solvent. I next proceed to coat the surface to which the substratum has been applied with a very thin film of fine grained gelatino-bromo-iodid silver emulsion prepared with a hard gelatin preferably without the addition of chrome alum or other hardening agent, and if required the emulsion may be made color sensitive by any of the usual methods. This thin film of emulsion must allow the light to penetrate through the film to the substratum so that when the plate is exposed in the camera and afterward devel-

oped the silver image will have penetrated right through the film to the substratum. Though I specify the kind of emulsion I prefer to use yet I do not limit myself to this because emulsions may be used prepared with other silver haloids or different combinations of the same or other haloids of silver and with gelatins of varying degrees of hardness.

The above description describes the manner in which the plates are prepared and they are used in the following manner. The prepared plate is exposed in the camera in the usual manner either with the use of a half tone screen when such is required for the production of half tone printing blocks, or without the half tone screen when line blocks are being made. It is then developed by the timing system of development either with an acid developer such as ferrous oxalate, or an alkaline developer such as glycin. I prefer to develop the plate for three minutes with the following glycin developer used at a temperature of 65° F.

Sodium sulfite cryst	1¼ ounces.
Glycin	½ ounce.
Potassium carbonate coml: anhyd:	2½ ounces.
Potassium bromid	30 grains.
Distilled water	30 fluid ounces.

But other times of development, other temperatures, and differently compounded developers may be used so long as the image is sufficiently developed that it penetrates the film; though for some special applications of the invention this penetration is not always essential. The plate is then washed with running water for half a minute. From this point onward the manipulations vary according to the particular work for which the process is being used.

If the object is to obtain a positive image from a negative "original," such as in the making of a positive half tone relief block from a continuous tone negative; or if an intaglio line or half tone block is being made from a positive "original," then after the photographic image is prepared as stated in "General manipulations" it is fixed by immersing the plate in a fixing bath (made by dissolving 4 ounces of "hypo" in 20 fluid ounces of water) for about half a minute which is usually sufficient to thoroughly fix the thin film of emulsion. The film in then washed with water, about one minute's washing usually being sufficient with running water, and the plate is then ready for immersion in the "hardening" bichromate solution which is referred to later on. Or the plate may be sufficiently rinsed with water after development to remove the developer from the film, and then immersed in the "hardening" bichromate solution, without being "fixed."

If a negative image has been obtained upon the plate and it is required to convert it into a positive image, or vice versa, the washed negative (or positive) prepared as described in "General manipulations" is treated for a suitable time, usually half a minute, with a "reducer" such as the well known "reducer" made by dissolving permanganate of potash 15 grains, sulfuric acid 75 minims, distilled water 20 fluid ounces, which dissolves all the developed silver image out of the film and leaves the undeveloped silver haloids in the film. The plate is then washed with running water for about half a minute and exposed to daylight, or other suitable actinic light, for a few say five seconds, and the plate again developed, preferably in daylight or strong actinic light, with ferrous oxalate developer, or the before mentioned glycin developer, or any of the well known developers which do not render the gelatin insoluble so as to prevent subsequent development with hot water. The plate must be developed with the glycin or other developer until the image is developed right through the film, and three to five minutes is usually sufficient when developing in daylight with the glycin developer at a temperature of 65° F., but a slightly prolonged development is not harmful. The plate is again washed with running water for half a minute and then "fixed" in the manner already described, the plate again being washed with running water until free from "hypo," usually for about one minute, and then it is "cleared" by means of the well known "hypo and ferricyanid reducer" or by a very weak solution of the before mentioned acidified permanganate "reducer," the object of the "clearing" being to remove all traces of the previously developed silver that may have been left on those portions of the image or "resist" which will be subsequently dissolved away with hot water; for the presence of any slight veil or fog in the clear portions of the image would harden the gelatin when it is immersed in the bichromate solution and prevent the resist being properly developed. This plate is then washed with running water for about one minute.

Assuming that a good clear image is obtained by either of the above mentioned methods as already described and that the lines or clear spaces are quite free from "fog" it is immersed for three minutes in a 5% solution of potassium bichromate dissolved in water with or without the addition of a small quantity of potash alum. This solution has the well known property of hardening the gelatin in the presence of the metallic image, or other solutions that have a similar catalytic action may also be used for this purpose. The plate is then rinsed with water and developed like a carbon print in hot water of a temperature of

about 120° F., first allowing the film to remain in the water for a minute or two and then assisting the removal of the soluble portions of the film by agitating the plate in the water, or by gently brushing the surface of the film with a soft camel hair brush or similar soft material while the film is immersed in the hot water.

When all the soluble gelatin has been removed, the plate is fastened to a "whirler" (such as is used by process workers) and the surplus water driven off by centrifugal force, then the plate is dried at a gentle heat by revolving it face downward over a "hot plate" or a flat Bunsen burner. The film rapidly dries and when dry is cooled and the collodion or other substratum removed from those portions of the plate that are not protected by the gelatin resist by gently wiping the surface of the film with a pad of cotton wool moistened with a solvent of the substratum, or by immersing the plate in the solvent and then immediately washing it with water and removing the scum, if necessary, by gentle rubbing with a pledget of wet cotton wool. A mixture of equal parts of Meth: ether .720+ethyl alcohol 90% may be used for collodion and for celluloid, Meth: ether .720 for gum dammar, benzol for bitumen and alcohol for dragon's blood and gum shellac. When the collodion substratum is used, it is advisable to finally wipe the plate with a pad of cotton wool moistened with ethyl alcohol after the collodion has been removed with the mixture of ether and alcohol.

If it is required to convert the negative image into a positive image or vice versa the prepared plate is immersed into a bath such as is used in the electro-deposition of metals and a coating of a suitable metal is deposited either by means of, or without, an electric current, upon the face of the metal plate to be etched, (the particular metal deposited would be one that is not affected by the etching solution used and so protects the metal plate where it is deposited,) the gelatin or substratum resist preventing the metal being deposited except where the metal is exposed. When a suitable thickness of "metal resist" has been deposited upon the plate, it is removed from the bath and washed, the gelatin and substratum resist being then removed from the plate, leaving the "metal resist" on the plate. The plate is then etched in the usual manner.

As an example:—A negative image is prepared upon a zinc plate from a line drawing in such a manner that if this plate were placed in the etching bath an intaglio plate would be obtained, but in the preparation of a positive image the plate receives a coating of copper by immersing it in a copper cyanid bath with the prepared surface facing a copper plate and passing an electric current through the solution in the usual manner. The gelatin and substratum resist is then removed and the plate etched in an etching bath of nitric acid of about 5% to 10% strength as usual. Other suitable metals than copper may obviously also be used. The copper is deposited from a hot or cold solution of copper cyanid or such as is usually used for this purpose, the following solution being a suitable formula:

Water	80	fluid ounces.
Soda bisulfite	1	ounce.
Potassium cyanid 30%	3½	ounces.
Copper acetate	1¼	"
Ammonia .880	¾	fluid ounce.

Dissolve the bisulfite and cyanid separately in small quantities of the water, place the copper acetate in a mortar and moisten with a little of the water, rub it into a thin paste and add the cyanid solution. Add the bisulfite solution to the bulk of water, then add the acetate solution, and lastly add the ammonia. Any of the usual electroplating solutions of copper cyanid may be used in lieu of above.

I deposit the silver from a solution of silver cyanid used in the usual manner.

By first etching the metal plate and then electrically depositing a metal upon the plate before removing the resist, metallic plates may easily be prepared with pictures and designs in inlaid metal.

This process may also be used for the production of engraved metallic plates for ornamentation, such as illuminated or memorial brasses, or for ornamental metallic fittings of any description, or for name plates, engraved dials, etc., either in intaglio or relief made in the manner already described, and if required the hollows may be filled in with colored wax or other suitable material.

This process may be used in engraving or etching glass or similar substances by preparing the surface to be engraved with a suitable substratum and light sensitive emulsion which is exposed in the camera and then treated as before mentioned to form a suitable resist.

What I claim as my invention and desire to secure by Letters Patent of the United States is:—

The process for obtaining surfaces suitable for photo-engraving or photo-etching and adapted for use directly in the camera, consisting in coating a metal plate with a homogeneous substratum, applying to the surface of the latter a film of light-sensitive emulsion compound of metallic haloids and gelatin, the aforesaid substratum being of such a nature as to prevent chemical action between the emulsion film and metallic base, and to act as a resist to etching fluid, exposing the plate in a camera, developing the image taken, immersing the plate in a solu-

tion adapted to harden the emulsion in the presence of the metallic image, removing soluble portions of the emulsion, removing the substratum from the plate where not protected by the emulsion, depositing a metallic coating upon unprotected parts of the base and finally removing the remaining substratum and emulsion.

In witness whereof I have signed this specification in the presence of two witnesses.

ARTHUR PAYNE.

Witnesses:

CUTHBERT EVERATT,

CHARLES STEPHEN GARDINER.