

UNITED STATES PATENT OFFICE.

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PROCESS FOR PRODUCING PRINTING-SURFACES.

No. 915,666.

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To all whom it may concern:

Be it known that I, OZIAS DODGE, a citizen of the United States, and a resident of Norwich, in the county of New London and State of Connecticut, have invented certain new and useful Improvements in Processes for Producing Printing-Surfaces, of which the following is a specification.

My invention relates to the production of printing surfaces, more especially printing plates.

It may be briefly said to consists in forming the picture or design on the surface of the plate by methods of photography and building up the exposed surface of the plate by electrolytic action forming either an intaglio or relief plate as may be desired.

I will describe the invention for the production of copper plates for printing purposes.

The copper plate is thoroughly cleaned and coated with a sensitive solution. I have found extremely useful for this purpose the following method of coating the plate. The plate, being thoroughly cleaned, is first coated with the following solution:—

Albumen from fresh	
eggs	2½ ounces.
Water	1 "
Chlorid of sodium	½ "

It is then coated with the following solution:—

Le Page's liquid glue	2 ounces.
Double chromate of potassium and ammonia	70 grains.
Ferrocyanid of potassium	4 grains.
Water	3 ounces.

For putting on solution number one the plate is perfectly clean and wet with cold water. It is then placed in a machine by which it may be rapidly whirled. The plate being held in the proper position the solution is poured upon it and drained off at one corner. It is again poured upon the plate and drained off at the opposite corner. The plate is then whirled, at first slowly and then more rapidly, until there is a thin film nearly dry upon the plate. In the same manner solution number two is then placed upon the plate and the plate whirled until dry over a gentle heat. The plate thus sensitized may be kept from three to four days in a dark

room, growing more sensitive the longer it is kept.

If a relief plate and half-tone is desired, I take a transparent negative and place the sensitized plate and the negative face to face in the printing frame, giving it an exposure to dry sunlight of from one to three minutes, or if an electric light is used from four to six minutes. The copper plate is then placed in a bath of eosin which gives it a bright scarlet color and allows the development of the picture to be watched. The plate is then held under cold water running from the tap and the image will rapidly begin to appear, and it will be observed that the picture will have a grain which will vary in size in proportion to the amount of light which the plate has received; that is, if the negative from which the plate was made was a half-tone negative the grain will vary according to the protection afforded to the plate by the negative. The plate is washed until the copper is clean in the deepest shadows. The plate is then flowed with wood alcohol and burned off and then held under a strong heat (380° F.) until the picture turns to a dark brown color. The picture is now insoluble in water and acid in exact proportion to the amount of light that permeated the negative. I then place the plate in a weak solution of chromic acid and etch it slightly. The only object of the etching is to roughen the surface of the plate so that the copper deposited to form the plate in the bath will adhere firmly thereto. The margins and other parts that appear white may be painted over with asphaltum varnish. I then place the plate in the electrotyping bath. The copper will be built up on the exposed surface of the plate. As the electro deposition proceeds the coating of varying solubility will give way in grains in the same proportion, and the place is supplied with copper, for, as has been said, the coating of the plate is insoluble in direct proportion to the amount of light that has permeated the negative. Therefore, the plate will vary in height and in size of grain from the highest flat surface which will print black to the lowest point of the original surface of the copper, which will remain white. After the plate comes from the bath it is cleaned in boiling water and lye and is then ready for printing in the ordinary press.

If an intaglio plate is desired, the process is the same with the exception that a transparent positive is used.

If the picture to be printed is black and white such as a pen and ink drawing, instead of the solutions heretofore described, I use the following solution to coat the plate:—

Albumen	2½ oz.
Le Page's liquid glue.....	2 "
Bichromate ammonia	70 grains.
Ammonia	7 drops.

The plate is coated in the manner heretofore described. I use now a transparent positive instead of a negative. Printing and development are the same as heretofore described. It will be seen therefore that the copper plate after cleaning will be exposed where the black lines of the positive were and consequently when placed in the electrolytic bath copper will be deposited upon those lines thus making a relief printing plate. The solution used in this process does not have the grain. To produce an intaglio plate a transparent negative would be used. Instead of these methods of producing the design upon the plate, I may photograph them upon the plate direct.

If a relief plate is desired, I prepare a copper plate as previously described and coat it with the solutions first described. After drying, the plate is coated with a solution of benzin and pure rubber being flowed and whirled as described until dry, when there will be left upon the surface of the plate a thin transparent film insoluble in water. This surface then receives a coating of gelatino-bromid emulsion containing,—

Potassium iodid	3 gr.
" bromid	8.7 "
Nitrate of silver	11.4 "
Gelatin	18 "

Water and ether in varying amounts as the conditions require.

To coat the plate with this emulsion it is slightly warmed, the emulsion poured on at one corner and around the plate and drawn off at the opposite corner. The plate is then dried with a slow steady heat in the dark room. The plates thus prepared are of an even creamy white color and will keep indefinitely in a dry atmosphere. The outer coating upon the plate is exceedingly sensitive to light and the speed of the plate may be made as high as any of the dry plates now sold to photographers. Upon the plate so prepared the picture can be taken in an ordinary camera by the ordinary photographic methods. After the proper exposure the plate is developed in a variety of ways, either with an alkaline developer or with a ferrous oxalate developer, the object

being to develop a dense negative with transparent whites. After developing the image, which development may be readily watched, it is fixed in a weak solution of ferricyanid of potassium or hyposulfate of soda. The plate is thoroughly washed and then dried to the extent of removing surface water. The plate being still moist is taken from the dark room and exposed with the film side toward direct sunlight for about 1½ minutes or with electric light about seven minutes. The plate is then placed in a tray of warm water (about 100° F), and as soon as the outer film begins to loosen the plate is lifted from the tray and the film taken off. This film may be preserved as a negative to print from by simply placing it flat upon a suitable glass support. The plate is then given a bath of benzin which dissolves the rubber coating and leaves the first coating upon the plate itself exposed and ready to be developed by cold water. The development and the subsequent steps of the process are the same as heretofore described, the result being a relief plate in half-tone suitable for printing in an ordinary press.

A still further method of using a plate on which the picture may be directly photographed is as follows,—A copper plate is first etched in a solution of—

Chlorate of potash	20 parts.
Hydrochloric acid	100 "
Water	880 "

It is then washed in warm water and placed in an electrotyping bath of silver and given a thin coating of silver. The plate on being taken from the bath should have a bright frosted appearance showing a grained surface under the glass. The silver surface is then covered with silver bromo-iodin containing a slight excess of iodine and becomes exceedingly sensitive to light. I now spread on the bottom of a box powdered iodine, and above the powdered iodine I place a piece of cardboard. The iodine will volatilize upon the cardboard. The cardboard is then turned over and the silvered plate is placed above it at a distance of about 1½ inches, the silvered surface of the plate facing the side of the cardboard which was exposed to the iodine. The plate will gradually receive a thin coating of iodine and the color will change. It should be taken out before it begins to turn gray. I then place the plate in a box in the bottom of which there is a mixture of bromine and calcium hydrate. The bromine acting upon the iodine on the surface of the plate converts it into bromo-iodide. The color now changes to steel gray and violet and the plate should be taken out and again subjected to the action of iodine as heretofore described for about one-third the original time. The plate is now ready for

use but is extremely sensitive to light and the operations above described are conducted in the dark room with only an orange light. The plates thus prepared can be exposed in the ordinary way in the camera and are sufficiently sensitive for instantaneous work.

In developing a plate it is placed in a wooden box or frame face downward. It is placed over an iron tray into which has been placed a thin layer of mercury. The temperature is now raised to 150° F and the vapor of mercury converts the parts acted on by light into an amalgam of mercury while the parts unaffected by light remain iodid of silver. The plate having reached the right stage, when the highest lights are perfectly white, is at once placed in the electrotyping bath when it will be found that the copper will deposit upon the amalgam or mercury while the iodid will remain unaffected. When the plate is sufficiently built up it is cleaned and the result is an intaglio grain plate suitable for printing.

As the methods of producing pictures by printing from negatives or positives or by direct photographs are those used in photography, I have selected as generically descriptive of them all for use in the claims the term methods of photography.

What I claim and desire to secure by Letters Patent is:—

1. The process of producing printing surfaces, which consists in producing a picture or design on the surface of the plate by photography and building up the surface of the plate upon or about the photographed lines on the plate by electrolytic action, forming either an intaglio or relief printing plate, substantially as and for the purpose set forth.

2. The process of producing printing surfaces, which consists in forming a picture or design on the surface of the plate by sensitizing the plate, exposing the plate to the object to be reproduced, developing the same, and then building up the surface of the plate upon or about the photographed lines by electrolytic action, to form either an intaglio or relief printing plate as may be desired, substantially as and for the purpose set forth.

3. The process of producing a printing surface which consists in coating the copper plate with a photographic sensitive solution, exposing the plate as sensitized to the object to be reproduced, developing the same, exposing the developed plate to electrolytic action, whereby an intaglio or relief printing

surface is formed substantially as and for the purpose set forth.

4. The process of producing a printing surface which consists in coating the plate with a photographic sensitive solution, exposing the sensitive plate to the object to be reproduced, developing the plate after it is exposed, immersing the plate in an electrotyping bath containing a copper solution, whereby an intaglio or relief printing plate is formed, substantially as and for the purpose set forth.

5. The process of producing a printing surface which consists in coating the plate with a photographic sensitive solution containing bi-chromate of potassium, exposing the sensitive plate, thereby rendering the parts of the coating that are acted upon by light insoluble, developing the plate after it is exposed, and then building up the exposed surface of the plate by electrolytic action to form either an intaglio or relief plate as may be desired, substantially as and for the purpose set forth.

6. The process of producing a grained printing surface, which consists in coating the plate with a photographic sensitive solution containing bichromate of potassium and common salt, exposing the sensitized plate to the object to be reproduced, thereby rendering the parts of the coat that are acted upon by light insoluble, developing the plate after it is exposed, thereby making a grained surface, and then building up the exposed surface of the plate by electrolytic action, whereby an intaglio or relief printing plate is formed, substantially as and for the purpose set forth.

7. The method of forming a picture or design on the surface of the plate, which consists in producing the said picture or design on the plate by photography, and by electrolytic action building up the exposed surface of the plate to varying heights, from the highest flat surface which will print black, to the lowest original surface of the copper, which will remain white, forming either an intaglio or relief printing plate, substantially as and for the purpose set forth.

In witness whereof, I have hereunto set my hand at Norwich in the county of New London and State of Connecticut, this 17th day of February, 1904.

OZIAS DODGE.

In presence of—

WILLIS A. BRISCOE,
JOHN P. HUNTINGTON.