

UNITED STATES PATENT OFFICE.

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ART OF PRODUCING PRINTING-SURFACES FOR USE IN PRINTING-PRESSES.

No. 862,805.

Specification of Letters Patent.

Patented Aug. 6, 1907.

Application filed December 16, 1905. Serial No. 292,102.

To all whom it may concern:

Be it known that I, SPENCER CARLETON, a citizen of the United States, and a resident of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in the Art of Producing Printing-Surfaces for Use in Printing-Presses, of which the following is a specification.

The invention relates to improvements in the art of producing printing surfaces for use in printing presses and the like.

The object accomplished by the invention is to produce, by an expeditious and comparatively inexpensive process, a very superior printing surface, the impressions from which are more faithfully true to the original than those produced by methods at present in use.

While in no sense confining the invention to use in the production of half-tone printing plates, I will describe the same as applied to such production, since thereby a clear understanding of the invention and its advantages may be had.

The methods at present in use for producing half-tone plates are well known and it is also well known that in the practice of such methods great expense is necessarily incurred due to fine hand-work required to be applied to the originals, to the negatives and to the plates, prior to, during and after the etching, to reproduce the original as faithfully as may be.

The present methods of producing half-tone plates also usually involve the employment, in the camera, of a plate prepared by the collodion process. This, even when in the form of emulsion, is relatively insensitive, and therefore slower in operation, than the gelatin dry plate which I propose. Moreover, the wet collodion plate, whatever its exposure in the camera, fails to reproduce gradations of light and shade with delicacy approaching that of the dry plate.

A further disadvantage in existing processes in general lies in the use of a plate (metal, stone or glass) having upon, or applied to its surface a layer, or what we may throughout this specification designate a "coating", comprising asphalt, fats, waxes, silicates, gums, resins, sensitized glue, gelatin or the like, the use of some of which necessitates a baking step or "burning in", and in all cases the application of long and delicate manual treatment of the plate prior to, during and after the etching. These steps consequent to the use of said "coatings" involve, not only time and expense, but also risk to final success. It may be added that the tendency of such "coatings" to receive impressions imperfectly constitutes a continual source of failure in existing methods. Fidelity to the original as well as quality and artistic merit of the engraving produced suffer therefrom. I may mention also one

very objectionable feature of some etched plates as heretofore manufactured, is due (especially when the result is not prevented by the use of dragons blood or the like) to undercutting or undermining of the lines, dots, stipples or grains of the image. In this way some of these lines or dots may be entirely eaten away and lost during the etching. In every instance they become roughened and uneven, thereby impairing the quality of the printing surface. When a dove-tail is formed by the undercutting, perfect electrotpe copies of such plates can be made only with great difficulty, if at all. To avoid these and other objectionable features, processes of to-day frequently have to resort to successive partial etchings,—that is after a short action of the etching medium it is necessary to stop, wash and dry the plate, and cover the tops and sides of the lines or dots with a resinous powder. The plate has then to be heated to melt the powder, which thereby becomes impervious to the etching media and protects the sides of the lines and dots from undercutting. But the heating must be done with greatest care lest the bottoms of the grooves between the lines or dots be filled and further etching be prevented. The partial etching step and the protecting step must be repeated in alternation until the plate is finally etched to the desired depth. All this is time consuming, troublesome and not always successful.

A property presented by half-tone plates produced by present processes is that the stipples or dots are imperfect in outline, appearing rounded or irregular in section when intended to be square-shouldered. From this results a loss of "color" as it is termed, that is, a loss of fine gradations of light and shade, with less faithfulness to the original.

The disadvantages enumerated are nearly if not entirely eliminated by my process and many new and important qualities thereby gained for the final product. I will therefore concisely describe a satisfactory method of putting my process into practice. Equivalent or substitute methods or means will be mentioned further on. As previously stated I describe the process as applied to half-tone engraving for convenience in exposition only.

The first step in the practice of my invention as applied to half-tone engravings, is to photograph the original picture, drawing or other object, usually with the interposition of the customary or any suitable "screen" or equivalent means. The sensitive plate will by preference be the usual dry plate.

The second step of my process includes the preparation of the plate upon which is to be printed, by the action of light, the image appearing on the negative.

I avoid the use of "coatings" upon, or applied to the plate, with their consequent manipulations and disadvantages. By the term "coating" as used in this

specification we mean a substance or substances physically laid upon or applied to the surface of the plate but not an integral part of same. For this we substitute a substance or substances chemically united to and incorporated with the surface of the plate, being so united or bound that the combination becomes a new substance or material; this latter by such union thereby acquiring sensitiveness to light. I print directly upon a sensitized metal surface. By "sensitized" I mean rendered sensitive to the action of light. I first provide a metal plate, preferably of copper, of suitable dimensions and see that it is well cleaned, smooth and polished. This metal plate or copper plate, as I may for convenience call it, is then silver plated by any of the usual plating processes, and is then again thoroughly cleaned and polished preparatory to being sensitized and having the image printed thereon from the negative. A convenient way to sensitize the metallic surface is to expose said metallic surface, which in this instance is silver, face downwards to the vapor of iodine. Solutions or compounds of iodine may be made to serve a similar purpose. The surface may be rendered more highly sensitive by subjecting it to the action of bromine (or its compounds) as well as to the iodine. This also may conveniently be done with vapor of the sensitizer.

The third step in the practice of my process is to impress the image upon the sensitized metal surface of the plate. This I usually do by printing through the halftone negative by means of light, to accomplish which I simply tightly apply the negative against the sensitized metal surface and expose the same to the action of light.

The fourth step in the practice of my process is the rendering of the image on the sensitized metal surface resistant to the action of the etching medium and also the development of the image, when required or desired, and this is performed, preferably, with the use of mercury, the latter being in a small vessel and subjected to a suitable temperature and the said plate being held face downward over the mercury. In this use of mercury the latter performs two functions, to-wit: as a developer and as a "resist" to the action of the etching medium. I find it convenient, though not at all essential, to "fix" the image on the plate by means of hyposulfite of soda or other suitable medium. By the fixing process the tendency of the parts less acted upon by the light to resist the action of the etching medium is removed.

The fifth step in my process involves the etching of the plate. The etching medium attacks that portion of the surface unprotected by the "resist". The instance I am citing being the application of my process to half-tone engraving, the etching medium attacks the surface between the dots created primarily by the screen in the camera, until finally the plate bears the image in the form of projecting dots or studs, the tops of these dots or studs being coated thinly with mercury. I may say that the picture on the plate, after the latter has been taken from the etching medium is a picture in mercury dots, portions of the plate between these dots, but not under them, having been eaten away. The etching into the plate is then continued to the desired depth. The etching process may be expedited by the use of an electric current.

The fifth step in my process may also be expedited and improved by using a varying electric current, or by varying the direction of the current or by using an alternating current. Ordinarily after the etching has continued for a certain time, either with or without the current, and before proper penetration or depth has been attained, the process stops because of the formation on the plate of a substance which seems to resist the action of the etching medium. It is at this point that I vary the direction of the current or if a current has not up to that time been used I apply the current in a direction reverse to the ordinary, making the plate the cathode, preferably with copper as an anode. The reverse current is continued for a short period and its effect is that the plate may be withdrawn from the bath and, after wiping, a feat which could not be performed without completely ruining the plate except for the action of the reverse current, the etching may be continued to a sufficient depth without hindrance. The wiping of the plate, as just hereinbefore referred to, is for the purpose of removing the formed substance from the surface of the plate. By this means the plate will be found to be very cleanly etched. The etching may be completed, that is, carried to the desired depth in the copper plate, with entirely satisfactory results in the electrolytic bath, with the plate as an anode, in the presence of the current. I find it, however, convenient to obtain the deeper etching by removing the plate from the action of the current as soon as the unprotected portions have been completely penetrated. I then immerse the plate in an ordinary etching bath until etched to the desired extent.

A surface comprising an image formed in raised or relief dots, stipples, studs, grains, or the like, in which gradations of light and shade are represented by the relative size and proximity of these dots, stipples, studs, grains and the like, may be called a "disconnected printing surface". Reproductions therefrom may be made at will by the usual methods of printing.

The advantages of my invention are manifold, not only as to the methods of producing half-tone printing plates, but also as applied to the production of line, intaglio and other printing plates and engravings.

My process very greatly simplifies and cheapens the cost of producing printing plates and engravings and eliminates many of the steps which consume the greatest amount of time and labor. In the first place my process dispenses with most, if not all, of the hand work applied to the original, to the negative, and to the plate itself prior to, during and after the etching, such as retouching, redeveloping, clearing, intensifying, fine etching, tool engraving and burnishing, to which plates, especially half-tone, as at present manufactured, are necessarily subjected to obtain the best results.

In accordance with the present invention it is perfectly practicable and highly desirable to use the dry plate, film or equivalent in the camera. The disadvantages in loss of "color" and faithful reproduction of the original, resulting from the use of the slower and less sensitive collodion plate have been mentioned. One of the great advantages of my invention therefore resides in the fact that in practice the dry plate, film,

or equivalent may be utilized with entire convenience and satisfaction. A special convenience resulting from this advantage lies in its applicability to more direct reproductions. For this purpose a portable or any convenient camera, in connection with dry plates, films or equivalent, and a "screen" or its equivalent, may be used with perfect success to copy directly original objects, such as landscapes, living and natural objects, statuary and the like. The advantages of this short-cut are obvious. It is well known that every recopying or transfer between the original subject and the final printing plate results in loss of "color" and detail.

I am well aware that in this art the use of a dry plate has been tried to some extent. My invention renders the use of the dry plate, film or equivalent, not only a possibility, but gives superior results and is successful in regular practice.

Through the discard of "coatings" upon or applied to plates I avoid many difficulties, such as all "burning in", mechanical transfers and etching in successive partial steps. By my process the plate may be etched to completion in one operation.

It is obvious that with the use of the more sensitive dry plate and a highly sensitized metal surface the resultant product will be a far more faithful reproduction both in "color" and in detail of the original subject.

I would call attention to the fact that it is through the increased sensitiveness and the retention, unharmed throughout the etching, of fine gradations of "color" and detail, secured in the sensitized metal plate, that the finer qualities of the dry plate negative may be made available in regular practice.

No special care is required in the etching of my plate since in accordance with my invention and my experience the plate prepared as hereinbefore described is in no danger of being injured in etching.

The mercury forms a perfect "resist" and the etching is always along the valleys between the dots, lines or the like.

In the plates manufactured in accordance with my invention the lines, dots or stipples are not undercut or undermined by the etching medium, but have clean, sharply defined edges, with side surfaces which incline outwardly and downwardly at each line, dot or stipple. The intervening spaces form regular valleys, which may be etched as deeply as desired without any danger whatever of undercutting. This is a feature of the utmost importance in this art.

A feature resulting from the practice of my process and the employment of a sensitized metal surface is that the stipples, or dots are perfect in outline, appearing square-shouldered in section, in lieu of stipples or dots which are imperfect in outline, appearing rounded or irregular in section when intended to be square-shouldered, the trueness of the stipples or dots improving the "color", detail, faithfulness and often the artistic value of the engraving and being impossible of full attainment in processes employing "coatings" upon the plates. The absence of rounding and eating away of the dots is true for the plates of my process whatever the "screen" or equivalent employed for disconnecting the surface.

While the dry plate or film will by preference be used the invention in its broader scope is not limited thereto.

The disconnection of the surface or formation of the dots or stipples on the plate is due to the employment of a "screen" and I use the term "screen" in a generic sense and mean thereby to include within the scope of my process any and all of the several means and methods, either singly or in combination, which have been devised for producing the stipple effect. The sensitized metal surface, disconnected by the "screen" or any suitable means, may be placed in the camera and the image photographed directly thereon. For the purpose of the subsequent steps in my process either a "latent" or a "printed out" and visible image upon the sensitized metal serves.

The invention in its broader scope is not limited to the method or means referred to for sensitizing the metallic surface, since other halogens or their solutions or compounds may be used for this purpose and it being my intention not to confine the invention, in its broader scope, to any special metal surface nor to any special method or means for sensitizing said surface, except that in accordance with my invention I do sensitize a metal surface and omit the application of sensitive "coatings" and the like thereto. For example I find it quite practicable and at times most convenient to sensitize a metal such as copper directly, using therefor the sensitizing method described, or a solution of bromine or bromide of copper. This plate may be exposed in the camera or have the image printed upon it while in either a wet or dry state. The development may be by mercury or by any of the usual developers of commerce or even by a dilute acid, the image built up by the developer acting as a resist in etching.

I have described hereinbefore the best method known to me for carrying my invention into effect for half-tone engravings and the method described will be found to be entirely satisfactory, but I do not confine my invention in its broader scope exclusively to half-tone engravings, nor to the use of a copper plate as a base, nor to the employment of a silver surface on a copper or other plate, nor to any special means or methods of producing the sensitized metal surface and rendering the image resistant to the etching medium, since I believe I am the first to produce a relief "disconnected printing surface" by means of a sensitized-metal surface for use in printing engravings, and also the first to impress, by means of light, directly upon a sensitized-metal surface, employing a half-tone photographic plate, negative or positive, for the purpose of engraving, and also the first to print an image upon a sensitized-metal plate, without the aid of a camera, by the action of light passing through a transparent or translucent body bearing said image. This process of directly sensitizing a metal surface without the use of "coatings" may readily be applied to curved or uneven surfaces, or otherwise as requirements may suggest. Hence it is peculiarly adaptable for rollers, cylinders, and other like devices; for the contributory plates or rollers used for embossing; for lithography; for wall paper and fabric printing; for "three-color" and other color printing processes. For curved surfaces, films, "stripped" or otherwise, are advantageous.

The sensitized metal surface may be used for the pro-

duction of either intaglio, plane or relief surfaces; particularly for relief half-tone printing plates. It may be applied to metal, glass, stone, earthenware, pottery, porcelain, wood, and other surfaces. The use of the sensitized metal plate is equally serviceable for the reproduction of lines, full-tones and any and all of the purposes of the art, replacing with advantage transfer and other existing methods in use for these purposes. I desire also to say that the negative produced by the camera, using the term "negative" in a popular sense, may be transferred to another transparent plate which may be called a positive, considered in a more technical sense, and the printing on the sensitized metal surface be performed through this positive of the image primarily produced by the camera, either plate, in the sense of this application being considered as a half-tone negative.

I do not limit my invention exclusively to the production of half-tone plates nor otherwise than as may be indicated in the claims.

What I claim as my invention and desire to secure by Letters-Patent, is:—

1. The method of producing a relief disconnected printing surface comprising the production of a sensitized-metal surface, producing thereon by the action of light an image in dots or stipples, rendering the image resistant to the action of an etching medium, and etching the plate.
2. The method of producing a relief disconnected printing surface comprising the production of a sensitized-metal surface, producing thereon by the action of light an image in dots or stipples, rendering the image resistant to the action of an etching medium by a material serving as a developer and as a resist, and etching the plate.
3. The method of producing a relief printing surface comprising the production of an image on a transparent or translucent body, producing a sensitized-metal surface,

applying said body directly to said surface and printing said image thereon by the action of light passing through said body, rendering the image resistant to the action of an etching medium, and etching such surface.

4. The method of producing a relief disconnected printing surface comprising the production of a half-tone photographic negative, producing a sensitized-metal surface, printing thereon by means of light the image of the negative, rendering the image resistant to the action of an etching medium, and etching such surface.

5. The method of producing an etched surface comprising the production of a sensitized-metal surface, producing thereon by the action of light an image in dots or stipples, rendering the image resistant to the action of an etching medium, and etching the surface in a bath in the presence of an electric current.

6. The method of producing an etched surface comprising the production of a sensitized-metal surface, producing thereon by the action of light an image in dots or stipples, rendering the image resistant to the action of an etching medium, etching the surface, for a certain period, in a bath in the presence of an electric current, reversing the electric current for a certain period, the plate then being the cathode, removing the formed substance from the surface of the plate, and continuing the etching to the proper depth.

7. The method of producing an etched surface comprising the sensitizing of a metal surface, producing thereon by the action of light an image, rendering the image resistant to the action of an etching medium, etching the surface in a bath for a certain period, applying a current of electricity to the bath with the plate as a cathode, removing the formed substance from the surface of the plate, and continuing the etching to the proper depth.

Signed at New York city, in the county of New York and State of New York this 14th day of December A. D. 1905.

SPENCER CARLETON.

Witnesses:

CHAS. C. GILL,
ARTHUR MARION.