UNITED STATES PATENT OFFICE.

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PRINTING-PLATE.

No. 854,675. Specification of Letters Patent. Patented May 21, 1907.

Original application filed July 7, 1902, Serial No. 114,682. Divided and this application filed November 14, 1904. Serial No. 232,761.

To all whom it may concern:

Be it known that I, EMANUEL SPITZER, a citizen of the Empire of Germany, residing at Munich, in the Kingdom of Bavaria and the Empire of Germany, have invented certain new and useful Improvements in Printing-Plates; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to printing plates and, in particular to photo-mechanical printing plates or surfaces.

The object of this invention is to provide printing plates made by photo-mechanical methods which will be readily adapted for printing from typographically, simultaneously with printed matter on the ordinary printing press and which, at the same time, will preserve all the fine gradations of light and shadow of the original negative, from which they are produced. Heretofore this object has been aimed at by exposing a plate prepared with a light-sensitive coating under the negative combined with a screen or under a negative broken up into dots or stipples by exposure behind a screen or by forming a grain or stipple on such light sensitive coating before exposing it under the negative. A typographical so called half-tone printing plate produced by these methods is however deficient in many respects. It is flat in appearance, lacks softness and it has lost much of the fine detail and the fine gradations of light and shadow to which the artistic appearance and relief effect of the orginal or of a photograph made directly from an ordinary negative are due. Besides, it cannot be accurately copied by the so called "half-tone process" on account of the impossibility of adjusting the screen or stipple to the exact position corresponding to the original, which is a matter of considerable importance in reproductions for scientific purposes.

All the above objections are eliminated in plates prepared according to my invention.

These plates are distinguished from the old so called "half-tone" relief printing plates by the peculiar arrangement of their relief portions or elevations which are higher, thicker and closer together for the darker portions, and at lower levels, thinner and farther apart at the lighter portions of the image, design or picture to be printed by said plate, the height, thickness and closeness of said elevations being graduated according to the degree of light or shade of said picture, without interruptions formed by any pattern foreign to the original. These distinguishing characteristics of the minute or microscopic elevations of the plate made according to my invention determine its capability of printing by the relief printing method and at the same time, preserve all the detail and the fine gradations of light and shade of the original or negative.

Other features of my invention will be set forth hereinafter and pointed out in the claims.

In my application Serial No. 114,682, filed July 7, 1902, of which this is a divisional application, I have described a process of preparing such printing plates and, for the purpose of a sufficient disclosure of this invention I will now describe said process.

I expose a metal plate or other plate or surface capable of being etched, coated with a light-sensitive film, such as bichromatized gelatin, glue or albumen, directly to a photo-negative without the interposition of a screen or similar device. The light sensitive film or layer should be smooth and substantially without any grain or stipple so as not to hinder the gradually and progressively hardening action of the light when copying. The copy obtained must not be subjected to any manipulations liable to obstruct or to impede the openness of the structure and the gradual and progressive etching capability necessary for my proceding.

The unaffected bichromate or other sensitizer used may be removed by washing the plate and then drying. I have found, however, that by exposing the plate to the action of an etching bath without washing out the sensitizer contained in the layer or film, I obtain a very fine result. The plate is then exposed to the action of an etching fluid by which action an infinite number of cavities is formed in the plate and simultaneously the tops of the small cones which remain standing between such cavities, are gradually and

progressively eaten away in such a manner, that at the end of the process this eating away of the tops of the cones has been the strongest in those portions or areas of the plate which have been the least exposed to the light. The tops of the cones will consequently lie in different levels corresponding to the lights and shades in the original.

Since in printing from such a plate by typographical printing methods the higher elevations of the etched plate will take more ink than those whose tops lie at lower levels, a grading off from a darker to a lighter ink or color effect corresponding to the various shades of the original, or the positive, is attained. This gradation of levels in the printing plate may be produced according to the purposes for which the plate is destined and may be so infinitesimal as only to be noticeable under the microscope—and yet will be effective in printing as above stated.

All of the above conditions and properties of the etched plate thus produced combine to produce an impression or picture in which the graded or blended effect of the light and shade of the original, as well as the contrasts of light and shade, or the plastic effect, peculiar thereto, are reproduced to a far higher degree than under any of the typographical methods of photo-mechanical printing heretofore known,—even when employing ordinary printers' ink and paper.

I find that by leaving the precipitated deposits formed by the action of the etching bath on the plate and not brushing them away or shaking them out during the etching process, I obtain the finest and most accurate effects since these products form the best protection against any injury to the finest parts during the etching process.

The negative employed may be made by any known or suitable photographic process and the plate to be etched may be of any one of the materials used for etching, such as a copper or zinc plate which may be ground and polished in any known or suitable way. The sensitized protecting coating or film for the plate and the etching baths may also be of any known or suitable composition for this purpose, such for example, as iron chlorid solution, or nitric acid with alcohol, and all of the above elements and materials may vary within wide limits and are to be adapted to the particular exigencies of each case.

The following example embodies what I consider the preferable manner of carrying out my invention: I coat a polished copper plate in the manner well-known with a layer or film of a mixture of from ten to twenty parts by weight of organic substance such as gelatin (which I prefer) or of one of its equivalents, *e. g.* glue or albumen, to one hundred parts by weight of water, with from three to eight parts by weight of bichromate of alkali, such as of potassium sodium or ammonium. This coating is dried by rotation or any other similar process, whereupon I expose the same directly and without interposing a screen under an ordinary negative, (film or preferably glass—negative) that is to say a negative, which has not been broken up into dots or stipples by the interposition of a screen or similar device. The time of exposure varies according to the density of the negative and the character of the light and shade of the object to be copied. An exposure of from five to fifteen minutes will generally be found sufficient. The film for the purposes of my process must be smooth and homogeneous, must be practically free from any grain and must contain no granular admixtures. After the exposure is completed the plate is, according to the purposes in view, either washed, rinsed and then dried or directly subjected to the etching fluid without previously applying to the coating any such manipulations liable to obstruct or to impede the openness of the structure of the copying layer and the gradual and progressive etching capability of the plate, necessary for my proceeding. Such manipulations would be rolling in and melting on of asphalt dust, enamelling and the like.

The strength or concentration of the etching bath is that usually employed in etching of this character and where a bath of iron chlorid, $FeCl_3$, which gives good results with a plate prepared as above is employed, the strength of the same varies between 30 and 50° Baumé. The etching operation is completed in about from one quarter to one hour. According to the nature of the subject and of the detail and shading thereof, several etching baths of different degrees of concentration are employed, as will be understood by those skilled in the art. The temperature of the etching bath or baths and the selection of the same are matters which are governed largely by the various conditions of the work and are matters of detail which those skilled in the art will readily select.

I find that, principally when I desire to obtain great niceties in the reproduction of the finest details in the shadings of the picture, the deposits formed by the etching fluid should not be brushed away or shaken out, since these products form the best protection against any injury to such details during the etching process.

As before stated, the minute elevations occupy different levels, only measurable by micrometer, according to the degree of light and shade which they are to reproduce, the lower elevations taking up less ink or color than the higher ones in the typographic printing process.

After the etching operation is completed as above, the plate is removed from the etching bath, and cleaned in the usual manner

and is then ready for printing from in the ordinary relief or typographic printing press, or by ordinary relief or typographic printing methods.

The relief printing plates or surfaces prepared according to the above process may be printed from directly together with the text or type, or separately, as the case may be, on any ordinary typographic reciprocating rotary or cylinder printing press.

The printing plates thus prepared may be reproduced by stereotyping or electrotyping methods, and the stereotypes or electrotypes so made, having the same identifying characteristics as the original plates, are of course also covered by the claims for the former.

The plates or surfaces so prepared may be also used for merely ornamental purposes, for signs and the like.

In speaking in the specifications and claims of: "without interruptions formed by any pattern foreign to the original" only such interruptions are, of course, understood as would be produced before completion of the etching process. Such manual work as done by the polishing steel, "roulette," chisel and the like, or by an after-etching of parts of the etched plate in order to produce stronger or softer effects, is not excluded.

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

1. A plate showing a photo-mechanically produced image, the minute parts of which lie in different levels and are graded in size, closeness and depth corresponding to the different degrees of light and shade in the original, without interruptions formed by any pattern foreign to the original.

2. A metallic plate having an image, the minute parts of which lie in different levels and are graded in size, closeness and depth corresponding to the different degrees of light and shade in the original, without interruptions formed by any pattern foreign to the original.

3. An etched plate having an image, formed in its surface, by minute parts which lie in different levels and are graded in size, closeness and depth to produce the different effects of light and shade, without interruptions formed by any pattern foreign to the picture which it is desired to print.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

EMANUEL SPITZER.

Witnesses:
ULYSSES J. BYWATER,
PAUL PHILIPPSON.