

UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN PROCESSES OF PRODUCING GELATINE RELIEF-PLATES FOR PRINTING.

Specification forming part of Letters Patent No. **163,514**, dated May 18, 1875; application filed June 2, 1874.

To all whom it may concern:

Be it known that I, WILLIAM H. MUMLER, of Boston, in the county of Suffolk and State of Massachusetts, have invented or discovered certain new and useful Improvements in the Art of Producing Relief-Plates to Print from, which plates I term "Photo-Electrotypes," of which the following is a specification:

Many experiments have been made with the view of reproducing engravings and other prints by means of the printing-press, without the trouble and expense of re-engraving the subject, and several inventions have been worked more or less successfully, all of which are founded upon the discoveries of Mungo Ponton, an English chemist, in 1839, and M. Poitevin, a French engineer, in 1855, viz., that bichromatized gelatine, when acted upon by light, became insoluble in water, and also that it possessed the properties of lithographic stone, and might be used as such.

In order to more clearly set forth my invention, or its distinguishing features, as compared with the various processes now in use, I will here give a short summary of the main features of the more prominent processes now in use.

In photo-lithography and photo-zincography a transfer is made on stone or zinc, respectively, by means of gelatine, and the printing is done from the surface of the stone or zinc by means of lithographic ink and press.

In photo-galvanography the gelatine film or plate, after having the picture printed thereon, and the parts not acted upon by the light swollen by water, is made to serve as the basis of electrotyping.

In the Woodburytype a sheet of gelatine from which the parts not acted upon by light have been washed away is used as the means of obtaining, by hydraulic pressure, a metal mold. This mold is filled, for every impression, with gelatine containing coloring matter, and the print is really an embossing of colored gelatine on the sheet of paper.

In photo-collographic printing, or the heliotype process, the printing is directly from the flat level surface of the sheet of gelatine, in the same manner that lithographs are printed from stone, the superfluous chemicals contained in those parts not previously acted

upon by the light having been washed out without washing away the gelatine.

My improved process differs from all these, and will be best understood by a description of the various operations in detail which go to make up the complete process, which I will now proceed to give as follows:

In the preparation of the gelatine plate I use the following ingredients, in about the proportions named below: Gelatine, one ounce; fresh water, seven ounces; glycerine, two drams; saturated solution of bichromate of potash, two drams. These ingredients are placed in a vessel and subjected to a gentle heat, and when thoroughly dissolved and mixed the mass is poured upon a smooth, level metal or glass plate, provided with ledges raised about one-fourth of an inch above its upper surface around its outer edge, until the fluid mass is even with the tops of said ledges, the surface of said plate having been previously prepared by rubbing it with tallow to prevent the gelatine from adhering thereto. The plate, with the gelatine thereon, is then put away in a dark room to dry. When thoroughly dry the gelatine film is removed from the glass or metal plate and placed under a photographic negative, and exposed to the light under the direct rays of the sun a sufficient length of time to print thereon a picture from the negative in contact therewith. It is then removed from under the negative, and secured to a base of glass, metal, or other suitable material, with the face or printed side uppermost, by means of liquid glue, or any other suitable adhesive material that can be used in a cold state. The upper surface is then made level and true by grinding the surface with emery paper or cloth, or other suitable abrading material, attached to a block of wood or other suitable material having a true and level surface.

To prevent the emery or other abrading material from scratching, I rub the surface with tallow until all the interstices are filled. The plate of gelatine, with the picture printed thereon, is then treated with acetic acid by pouring it upon its upper surface, and brushing such surface with a soft bristle brush, to assist the acid in dissolving the gelatine not

acted upon by the light. Those parts acted upon by the light, being rendered insoluble thereby, are unaffected by the acid, and, as a consequence, are left standing out in relief by the gradual dissolving or eating away of those parts not acted upon by the light. When a sufficient depth has been obtained, or when the acid has dissolved or eaten away the gelatine as deep as the light has penetrated, (which is indicated by a slight curving or crooking of the straight lines,) the acid must be immediately washed off with water at about blood-heat. If any trace of acid should remain it may be neutralized by exposing the plate to the fumes of ammonia.

If sufficient depth has not been obtained by this one treatment the interstices or parts eaten away by the acid may be filled or coated with a paste composed of mucilage or other suitable gum and bone-black; or said parts may be coated with india-ink, black shellac-varnish, or any opaque or semi-transparent substance which will prevent the passage of the actinic rays of light through the same, and that may be readily removed again without injury to the gelatine plate.

Up to this time all the operations upon the gelatine plate, except while under the negative, must be performed in a dark room, or in an anti actinic light. The plate covered or partially covered with the bone-black paste or other protective coating may now be exposed to the actinic light without the negative, the paste or other coating preventing the light from acting, except upon the lines left standing by the acid, and which are not covered by the paste.

This exposure may continue for an indefinite time, or until the raised lines become very hard and the light has penetrated and acted upon the gelatine to a sufficient depth. It is then taken into the dark room again, where the paste or other coating is removed by applying thereto the proper solvent for the coating used—as, for instance, if the paste of mucilage and bone-black be used, cold water will dissolve it, and if a varnish be used to hold the coloring matter to render the coating opaque, alcohol should be used as a solvent. When this has been done the plate is again treated with acetic acid, as before. The plate may then be dried in the light until it becomes hard in all its parts, at which time it is ready to electrotype in the same manner as a wood-cut is electrotyped.

It is well known that the face-surface of type, wood-cuts, and other plates from which printing is to be done, must be true, straight, and level, in order that good work may be produced therefrom; but this has never been fully or satisfactorily accomplished in any of the processes of producing prints by means of gelatine plates, from the fact that in removing the gelatine from the original surface on which it was dried, and fastening the same to its base, it is very difficult to pre-

serve the level surface, as well as the fact that the gelatine film, when dry, is not sure to be of an even thickness, its upper surface sometimes being quite irregular and uneven.

Another difficulty heretofore encountered by experimenters in trying to produce gelatine relief-plates has been that the outer edges of the lines left standing in relief after treating the plate with a solvent turn or curve upward, and thereby destroying the even level surface thereof, the effect of which is to make the lines, when printed, rough and imperfect. This difficulty is evidently occasioned by the partially insoluble nature of the outer crust or coating of the gelatine film, which in all the known processes is preserved intact. This outer crust, from some cause, is partially insoluble, and of a more contractile nature than the rest of the plate.

To obviate these objections, to give to the gelatine plate a true, straight, and even surface, and prevent the turning up of the edges of the lines, I grind the face-surface of the gelatine plate after the picture has been printed thereon, and after the gelatine film has been permanently secured to its base, as previously described.

Another great difficulty heretofore met with has been occasioned from the use of hot water as a solvent for the parts unaffected by the action of light in printing the picture on the gelatine plate, which has heretofore been the practice.

Gelatine has a great affinity for hot water and is easily dissolved therein, and in using it to cut away the parts of the plate not acted upon by the light the heat from the water penetrates the whole plate, and partially dissolves or softens the whole plate and throws the lines out of shape.

To obviate this difficulty I use acetic acid in a cold state as a solvent, which affects the gelatine plate only so far as it has not been acted upon by actinic light, acetic acid having no effect upon bichromatized gelatine that has been exposed to the action of actinic light when said acid is used in a cold state; but in the same cold state said acid is a very ready solvent of gelatine, however hard, if it has not been exposed to the action of actinic light, and, therefore, it follows that the lines, however fine, are preserved intact and prevented from being thrown out of shape.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The process herein described of obtaining level, straight, and true surfaces on gelatinous films, from which to produce relief-plates for printing from, by grinding the surface of said film with emery-cloth or other suitable abrading material properly extended upon and secured to a true flat surface of wood or other suitable material, substantially as described.

2. The process of producing relief-surfaces upon gelatine plates by photographing or

printing from a photographic negative the picture to be reproduced upon the surface of said gelatine plate, grinding the surface of the plate either before or after printing thereon the picture, and then treating it with acetic acid, substantially in the manner herein set forth and described.

3. The process herein described of producing gelatine relief-plates by photographing or printing from a photographic negative or positive upon the surface of the gelatine plate the picture to be produced in relief, treating the plate with acetic acid until it has eaten away the gelatine to as great a depth as possible without injury to the lines, removing the acid and coating, or filling the parts acted upon by the acid with a paste made of bone-black and any suitable gum, or with india-ink, black shellac-varnish, or other opaque or semi-transparent substance, then exposing the plate to the direct rays of light without the negative or positive plate, and, after removing the paste or other opaque or semi-

transparent substance, treating the gelatine plate with acetic acid a second time, substantially as described.

4. In the process of producing gelatine relief-plates, treating the plate, after a partial relief has been produced, to a coating of bone-black paste, india-ink, black shellac-varnish, or other opaque or semi-transparent substance, substantially in the manner herein described, for the purpose specified.

5. The method of preventing the emery or other abrading material from scratching the surface of the gelatine plate by filling the interstices of the abrading-surface with tallow or equivalent material, substantially as described.

Executed at Boston this 29th day of May, 1874.

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Witnesses:

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