

UNITED STATES PATENT OFFICE.

ERNEST EDWARDS, OF MIDDLESEX COUNTY, ENGLAND, ASSIGNOR TO THE
HELIOTYPE COMPANY.

IMPROVEMENT IN PHOTO-MECHANICAL PRINTING.

Specification forming part of Letters Patent No. 133,701, dated December 10, 1872.

To all whom it may concern:

Be it known that I, ERNEST EDWARDS, of Lincoln Terrace, Willesden Lane, in the county of Middlesex, England, have invented Improvements in Photo-Mechanical Printing, and Apparatus to be used in such Printing, parts of which apparatus are also applicable to other purposes, of which the following is a specification:

This invention has for its objects improvements in obtaining, by means of light, surfaces for printing from by means of greasy or other inks, and in the apparatus used for this printing, and for inking surfaces for printing from prepared in this or in other ways. The invention relates especially to the method of printing which is based on the principle that when a film of gelatine, albumen, or analogous substance is treated with a bichromate and exposed to light under a negative, the parts acted on by light refuse to absorb water, but take greasy ink, and those that have been partly acted on by light partly absorb the water and partly refuse the ink.

This invention consists—

First, of a method of hardening the gelatine film, whereby firmness of line and freedom from all grain are obtained, and a large number of impressions may be obtained from one surface without loss of quality.

Second, of the methods of removing the printing films of gelatine from the surfaces on which they have been prepared to those on which they are to be placed during printing at the printing-press.

Third, of methods of obtaining level or flat surfaces in the printing-films.

Fourth, of new methods of inking printing-surfaces, both as regards the composition of the inking-rollers and of the ink.

Fifth, of a method of obtaining depth and vigor of shadow, and of obtaining more than one tint from the same film.

Sixth, of methods of obtaining such printing-films, either reversed or not, from the same negative.

Seventh, of a method of producing a wash or stain upon the parts of the picture which are not printed in greasy inks.

Eighth, of improved methods of printing pictures from gelatinous films in two or more colors.

First, for the purpose of hardening the film upon a surface of metal, wood, stone, glass, or porcelain, I place a layer of gelatine gum, albumen, fibrine, or analogous substance, and I harden and render it insoluble in water by the addition of ammonia-alum, or other alums, chrome-alum, tannin, or chlorine. This layer is rendered sensitive to light, during its preparation or subsequently, by treatment with a bichromate. It is then dried and exposed to light under a negative, and is then freed from bichromate by washing in water, when it is ready for printing, or may be placed on one side for future use.

Second, in order to remove the gelatinous printing-film, (which I call the form,) from the surface upon which it has been prepared to that upon which it is to be placed for printing in the printing-press, I rub the surface upon which the film is to be formed, as already described, with a solution of wax, or of collodion, or India rubber, or other substance which will allow of the removal of the gelatinous film after it has become dry. This film may be exposed to light on either surface for the purpose of forming a picture, and it has then to be attached to the support upon which it is to remain during printing at the press. This support may be of such a substance as metal, glass, porcelain, enamel, ebonite, or collodion, and the form is attached to it by placing the two surfaces which are to be attached in contact under water or other fluid quickly withdrawing them, and getting rid of the superfluous water by rapid pressure, which I prefer to effect by means of a scraper having a tongue of India rubber. Glycerine, sugar, castor-oil, or other oil may be added to give flexibility to the film, which may be removed from and attached to its supports at any convenient stage of the operations, either before or after exposure to light. The following is a convenient formula, but I do not confine myself to the particular proportions of the parts, which I vary as may be found advisable. A solution of one ounce of gelatine, five grains of chrome-alum, and half a dram of bichromate of potash is to be made in twelve ounces of water at 100° Fahrenheit, and poured over a level glass plate. After the gelatine has set I dry it at a temperature of 70° to 75° Fahrenheit. When dry, it is stripped from the glass plate,

and then printed on by exposure to light under a negative. When the details of the image appear the printing is complete and the back of the film is exposed to light. It is then placed under water upon a polished pewter plate coated with a solution of India-rubber and quickly withdrawn. The two surfaces are pressed into contact and the plate is steeped in water until the bichromate is soaked out, and is then ready for printing from in a printing-press. All the operations while the form is dry, before the bichromate has been washed out, must be conducted by non-actinic light, and it may be kept until wanted, and then laid down upon a plate, as described. Any desired grain may be procured upon the prints by making the form upon ground glass or other suitable substance.

Third, it is desirable that the surface of the form or printing-film should be level or in little relief, in order that the inking-roller in passing over it may readily reach and deposit ink in the bottom of the depressions (representing deep shadows) as well as in those less deep. The parts which have not been exposed to light remain absorbent of water, (and thus repellent of ink, which is the desired object;) but when damped they swell considerably in consequence of such absorption, and so would remain too much elevated above the non-absorbent parts. In order to obviate the relief thus produced, I take the gelatinous film so standing in relief and I press it by heavy pressure with a plane surface into the surface of a plate of soft metal, which I use as its support during the subsequent process of inking and printing from it. By this means the relief is all at the back of the film, and is embedded in the metal plate, while the front or printing-surface of the film remains level. Another method by which I attain the same result is by attaching the front or printing-surface of the film to a level surface, and then allowing the film to absorb water and so to swell in the absorbent parts. The relief is thus entirely at the back of the film, and in this condition I back it up with plaster of Paris, cement, or other suitable material, which will serve as a support for it in the printing-press whilst the other surface of the film, (when removed from the flat surface to which it has been temporarily attached) remains level for inking and printing from.

Fourth, in ordinary lithography there is a great adhesion to the plate both from the ink and the roller, which applied to my process sometimes results in the tearing up of the gelatine-film. To obviate this, and also obtain a finer surface, I use rollers made of a composition of glue, gelatine, albumen, or other analogous body, and treacle, glycerine, or other analogous body, to which is added a considerable proportion of oil or grease, or oil combined with an alkali. Sometimes I add chrome-alum, or a similar substance, tending to produce insolubility of gelatine, so as to render the composition of which the roller is formed tougher

or more durable. The quantity of oil or grease may be varied to suit various cases, and I use rollers made in this way for the purpose of inking in ordinary and lithographic printing, as well as in the methods described, and in analogous methods of printing from gelatinous forms. In making the ink for use with the gelatinous forms, I prefer to use lithographic ink thinned down with tallow and olive or other oil, avoiding as far as possible the use of lithographic varnish or boiled oil.

Fifth, in order to obtain depth and vigor of shadow, and at the same time to obtain more than one tint from the same form, I take advantage of the fact that if the ink is mixed too stiff it will only adhere to the deepest shadows, and requires the addition of a thinning agent before it will adhere to the half-tones. For this purpose I prepare two or more inks of different degrees of stiffness and of the same or different colors; the stiffest is first applied to the form and adheres only to the deepest shadows; the next stiffest is then rolled in, which does not affect the ink already on the plate, but which also adheres to the half-tones, and so on.

Sixth, to obtain non-reversed pictures from ordinary negatives, I make a much deeper impression by light on the gelatinous film, which I ink on the reverse side to that which has been in contact with the negative. Sometimes I render a gelatinous film insoluble by the addition of a solution of about three parts of perchloride of iron and one part of tartaric acid in one hundred parts of water. After exposure to light the parts acted on by light become again absorbent, and the film can be printed from in the way already described, but the process must be conducted in a place where actinic light is excluded. Transparent positives are necessary for printing by this method.

Seventh, to produce a wash or stain upon the parts of the picture which are not printed in greasy inks, I add to the water which is used for damping the gelatinous form a sufficient quantity of a suitable dye or stain. The surplus water so colored having been removed in the way already described, sufficient has been absorbed by the gelatinous form to produce on the paper when printed a perfectly-uniform tint upon the parts which are usually left white, while the parts of the form which are inked with greasy inks print in the usual way.

Eighth, in order to obtain pictures printed in two or more colors, I produce in the usual way a number of photographic negatives from the same subject exactly alike in size, and as many as the colors in which the pictures are to be printed. I then paint out in the usual way with an opaque substance, in each negative, all except the part required to be printed in the particular color to which the negative refers. A printing-form is then made from each negative, and each form is inked with a suitable color. Pictures are

obtained by printing each picture upon each form in succession, and the proper adjustment of the picture is obtained by means of marks on the forms, or on the press, or on the negatives themselves. Two or more colors may be used on each form by using inks of different thicknesses, as described in the fifth and eighth parts of this invention.

Sometimes I use only one negative and a series of "masks," each mask covering all the negative except the part which is intended to be printed of a particular color. Sometimes I obtain transparent positives from the negative, and use them to obtain printing-forms, painting out whatever parts are not required, as already described.

Another method by which I produce pictures of several colors is by making a printing-form and producing therefrom a number of prints in a pigment or ink of a color the actinic effect of which is equal to that of the paper on which they are printed—for instance, light blue upon white paper. One portion of each of these prints, which is intended to be of a particular color, is then worked up by hand in black and white. These prints are then photographed and printing-forms made, upon which only the parts worked up in black and white appear, and the pictures are printed upon each of these forms in succession; or, sometimes I "mask" out in the gelatinous form those parts of the picture not required for each particular color.

The second, third, fourth, fifth, sixth, and seventh parts of this invention are applicable not only to printing from the improved gelatinous films, hardened in the way described in the first part, but to other modes of printing.

I claim as my invention—

1. The method of hardening gelatinous films for the purpose of printing from them, by means of alum, tannin, or chlorine, substantially as described.

2. The methods of removing gelatinous films, for printing from, from the surfaces on which they have been prepared to those on which they are to be placed, substantially as described.

3. The methods of obtaining level or flat surfaces on gelatinous films for printing from by embedding such films in soft metal by pressure, or by attaching the printing-surfaces to level plates, and, after swelling them with water, backing them up with cement or plaster, substantially as described.

4. The methods of making printing-rollers, for the purpose of inking gelatinous films for printing from, of gelatine or other analogous body, to which is added a considerable proportion of oil or grease, or oil combined with an alkali; also, of adding to such rollers

chrome-alum or other substance tending to produce insolubility of gelatine, substantially as described.

5. The method of inking gelatinous films for printing from with two or more inks of different degrees of stiffness and tint, substantially as described.

6. The methods of obtaining pictures not reversed, from photographic negatives, by means of gelatinous films inked upon the reverse side; or, by rendering the gelatinous film insoluble by means of a solution of perchloride of iron and tartaric acid and exposing it under a transparent positive until the parts exposed to light become soluble or absorbent, substantially as described.

7. The methods of producing washes or stains upon pictures obtained from gelatinous surfaces, for printing from, in the parts not printed in greasy inks, by adding to the water with which such gelatinous surfaces are damped a sufficient quantity of a suitable dye or stain, substantially as described.

8. The methods of obtaining pictures from gelatinous surfaces photographically prepared for printing from, in two or more colors, by preparing a number of photographic negatives of the subject and painting out in each negative all but the part to be printed in the color to which the negative refers; and by then obtaining gelatinous surfaces, for printing from, from such negatives, and by inking each such surface with a different color and printing the pictures from each surface in succession, substantially as described; or, by obtaining a sufficient number of such gelatinous printing-surfaces from one negative by masking or concealing all the parts except that which is to be produced on each such surface, and then printing the pictures from each such surface in succession, substantially as described; or, by taking a gelatinous surface upon which an image of the subject has been prepared and printing from it a series of pictures in a color of the same actinic effect as the paper upon which they are printed, and by working up in black and white that portion of each of such pictures which is intended to be of a particular color; then by obtaining a photographic negative of each such print and making from it a gelatinous surface for printing from, and by inking each such surface with a different color and printing the pictures from each such surface in succession, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ERNEST EDWARDS.

Witnesses:

EDMUND EDWARDS,

CHARLES JAMES WINTERSGILL.