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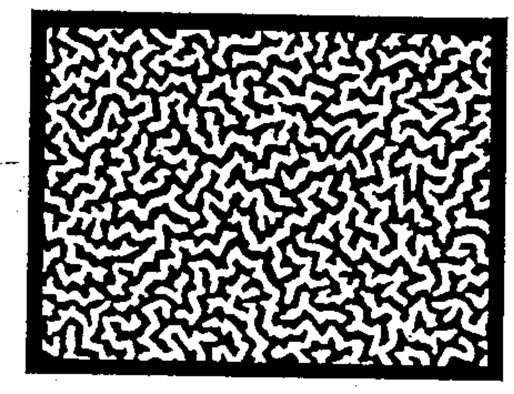
E. ORTMANN.

PHOTOGRAPHIC REPRODUCTIVE PROCESS.

APPLICATION FILED JUNE 21, 1901.

NO MODEL.



WITNESSES

Frank A. Lowe

Rose Ow

INVENTOR

Ernst Ortmann

By Fisk & Thomas

Attorneys

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UNITED STATES PATENT OFFICE.

ERNST ORTMANN, OF DETROIT, MICHIGAN.

PHOTOGRAPHIC REPRODUCTIVE PROCESS.

SPECIFICATION forming part of Letters Patent No. 744,223, dated November 17, 1903.

Application filed June 21, 1901. Serial No. 65,519. (No model.)

To all whom it may concern:

Be it known that I, ERNST ORTMANN, a citizen of the United States, residing at Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Photographic Reproductive Processes; and I 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 pertains to make and use the same.

My invention relates to an improvement in photographic reproductive processes, particularly in photomechanical printing processes described in the following specification and more particularly pointed out in the claims.

Before entering into a detail description of my invention I will outline briefly the state of the art as heretofore practiced in order that a more perfect understanding may be had of the position occupied by my invention in the reproductive arts.

The so-called "heliotype" process (*Lichtdruck*) had or still has its characteristic features in the peculiarity of reproducing by the several steps in its manipulation the unbroken tints or tones of the original picture, which, while only maintaining to a certain extent the color value of the original, made it possible for the printer by the aid of his press to reproduce copies with more or less rapidity. The editions that can be obtained by the employment of this process are very limited, due to the etching solution acting on the thin gelatin layer and the action of the printer's roller and press.

Closely relating to the heliotype process is one whereby ordinary photographic gelatinous dry-plates (gelatin-argentic dry-plates) are immersed in a bath containing a solution of a chromate salt, (bichromate of potash dissolved in water.) Said plates (or films) are rapidly dried, exposed in the usual way, the soluble chromate washed out, dried again, and finally prepared for printing with roller and printer's ink. From my experiments with this process I am convinced of the unreliability of the gelatin-argentic combination for treatment with roller and ink. In fact, it often happens that the very unstable gelatin-argentic film suffers destruction before a copy can be secured in the press. This process was published (about 1890) by M. Bolagng, Dr. Schnaus, and others.

The necessity for more uniformity in the copies and greater speed in obtaining them than was possible by employing the gelatinous printing-surface produced the invention known as the "Meisenbach" or half-tone process, employing a line screen or grating whereby the tints of the original are broken into dots or dashes, which when printed upon a metallic plate and afterward etched produces a type printing-plate, but lacking the artistic beauty of the heliotype process.

In order to give more brilliancy or color value to the so-called "half-tone" engravings, many expedients have from time to time been resorted to—for instance, reëtching, tool-engraving, the employment of double negatives, and other manipulations—all with more or less success.

I shall now proceed to describe my invention, which is designed to overcome the objections and the limitations of the processes before referred to.

One of the principal objects of my invention is the creation of a uniform and sharply-defined grain or stipple by chemical action alone, which result is brought about as follows:

Any of the various gelatin-argentic dry-plates on the market will answer my purpose where delicate details are to be reproduced; but where a more open stipple is required I prefer to use my own prepared plates, inasmuch as this enables me to deposit on said plates (or flexible films) any desired thickness of the gelatin-argentic emulsion, because a thin coating in connection with the treatment hereinafter described will produce a fine grain or stipple, whereas a thicker coating by the same treatment will produce an open grain or stipple, according to the quantity of emulsion applied to the surface. Any of the various combinations of the gelatin-argentic emulsions employed in the manufacture of dry-plates will give good results. I prefer, however, either one of the following formulas:

1. (A) Three hundred grains bromide of ammonia, (weight,) seven hundred and fifty grains gelatin, (weight,) ten ounces distilled

water, (fluid;) (B) four hundred and fifty grains silver nitrate, (weight,) ten ounces distilled water, (fluid.)

2. (A) Three hundred and sixty grains bromide of potash, (weight,) ten grains iodid of potash, (weight,) four hundred grains gelatin, (weight,) eight ounces distilled water, (fluid;) (B) four hundred and fifty grains silver nitrate, (weight,) eight ounces distilled water, (fluid.)

"A" is dissolved by dipping the container in hot water until contents is melted. "B" is dissolved at normal temperature and gradually added to "A." The emulsion may be filtered and is then ready for use, or it may be poured into a suitable container, allowed to set, cut into slices and kept in a cool place until needed. The addition of a small portion (say from two to four per cent., by weight, to the dry gelatin used in the formulas above) of dextrine, gum-arabic, or albumin is of advantage, as clearness and vigor are aided thereby. Instead of the bromides, the chlorid of ammonium may be used, or the bromide and chlorid combined in the proportions as given above under "A" in formulas 1 and 2. It is obvious that the proportion may be varied. Before coating the plates or films should be leveled in the usual manner.

One fluid ounce of the filtered emulsion on an eight-by-ten-inch surface will suffice for a medium fine stipple or grain. After coagulation of the coating the plates are set aside to dry. The dry-plates are then immersed in a bichromated bath. I prefer to use from two to five ounces (weight) of bichromate of potash (or bichromate of ammonium) to one hundred ounces (fluid) of water, in which bath the plates or films are left until the coating is saturated, which may take from five to twenty minutes, according to the thickness of the layer. More of the bichromate will increase contrast; less will produce softness. The addition of a hygroscopical salt—such as chlorid of calcium, chlorid of sodium or ferrocyanid of potash—will accelerate the formation of the stipple or grain, as will be explained hereinafter. I use from one to two per cent., (by weight,) more or less, according to circumstances, to the volume of the chromate-bath. The plates having drained sufficiently are then dried, preferably in a suitable drying-oven. The plates or films are then exposed to white light until all the details in the resulting positive have appeared. The next and most important step in the procedure is now the process of developing the exposed plates, which may take place after the exposure is completed, or the plates may be immersed in water and the soluble bichromate removed before development. The latter course I prefer. Any of the developers used by photographers for the development of gelatinous dry-plates may be employed as the action of the developer is the very same, and I therefore do not limit myself to any particular one, but the following formula will be found satisfactory:

(Pyro stock solution:) Water, twelve ounces, (fluid;) oxalic acid, twenty grains, (weight;) bromide potash, thirty grains; pyro, one ounce, (weight,) and water to make sixteen fluid ounces.

(Soda stock solution:) Water, twelve ounces, (fluid;) soda sulfite, crystals, four ounces; carbonate of soda, two ounces; carbonate of potash, one ounce; dilute two ounces of stock No. 2 with seven or eight ounces of water for cold weather and ten to fourteen ounces of water in summer.

To three or four ounces of dilute No. 2 add from one and one-half to two and one-half drams of No. 1. The more pyro the denser the stipple, and vice versa.

During the developing procedure the positive will gradually turn to a negative. The positive parts of the picture caused through the action of the light have been changed from bichromate to chromic oxid, which will remain indifferent to the action of the developer, whereas those parts not affected by light will absorb the developer, changing the bromide or silver (or other silver-salt combination employed) into metallic silver, causing those parts to become opaque. After the development is completed, the extent or duration of which must be left to the judgment of the operator, as different subjects require more or less development to secure satisfactory results, the developed plate is rinsed and placed in the fixing-bath, which is also identical with the fixing-bath of dry-plates in general. I prefer, however, to use the so-called "sour fixing-bath," which is composed of hypo-sulfite of soda, sixteen ounces, (weight;) water, forty-eight ounces, (fluid;) sulfite of soda, two ounces; water, six ounces; sulfuric acid, one dram, (fluid;) water, two ounces; chrome-alum, one ounce; water, eight ounces. Dissolve and add in rotation as given.

After fixing the plates or films are washed sufficiently to eliminate the hypo. I thus produce a duplicate negative in which the continuous tones or gradation of the original negative (or positive) are discontinued or dissolved into an opaque stipple or grain with transparent intersections. It is obvious that a copy from said stipple-negative will cause a stippled positive, which I produce on any sensitized surface, preferably on metal or lithographic stone for making photostipple engravings or photostipple lithographs.

I wish it to be distinctly understood that I do not confine myself to the production of stipple negatives or positives, but contemplate the production of stipple-screens, which I use as so-called "mother" plates, which give excellent results in a variety of cases where stipple reproductions are desired in preference to lines or gratings.

The process for making stipple-screens is precisely the same as detailed heretofore with

the only variation that in the production of stipple-screens a general and even exposure over the entire surface of the plate or film is required instead of exposing behind a negative or positive. In regard to the formation of the stipple or grain the general theory is as follows: When a bichromated gelatinous film or layer is exposed to white light, the bichromate will be converted into chromic oxid, whereby the gelatin more or less loses its peculiarity of absorbing water relative to the duration of exposure or to the quantity of light received by the sensitive layer and the amount of chromic oxid thus produced. If the light is allowed to penetrate the entire film or layer, the formation of chromic oxid is complete, causing the gelatin to resist the water, whereas a short exposure will form chromic oxid on the surface only relative to the action of light, leaving the bichromated layer underneath in its original state. When said exposed film or plate is submitted to a water-bath, the unaffected gelatin will absorb water and being fixed on a rigid support seeks to force its way through the more or less resisting stratum of the chromic oxid, changing or separating the original smooth surface into minute divisions—in other words, into a stippled or grained surface. The addition of a hygroscopical salt, as pointed out before, will accelerate the absorption or water, increasing the energy of expansion, and thus causing the formation of a larger stipple or grain. It is obvious that the presence of silver salt is necessary for the development of the exposed plates or films.

What I claim is—

1. The within-described method of manufacturing photographic printing-plates consisting in coating the plate with chemicals adapted to produce an opaque stippled surface on the plate by the action of light and developer without the aid of a screen by first, submitting the plate to the action of light, and then to the developer, substantially as described.

2. The within-described method of producing stipple printing-plates, consisting of first preparing the plates with a coating of gelatino-argentic emulsion, then submitting the plates so coated to a bichromate-bath, then exposing the plates, then washing out the soluble bichromate, then developing the plate whereby the washed-out portion takes the developer and becomes opaque to form the stipple, substantially as described.

3. The within-described method of producing stipple printing-plates, consisting of first preparing the plate with a coating of gelatino-argentic emulsion, then submitting the plate so coated to a bichromate-bath, then drying the plate, then exposing the plate, then washing out the soluble bichromate, then developing the plate whereby the washed-out portion takes the developer and becomes opaque to form the stipple, substantially as described.

4. The within-described method of producing stipple printing-plates, consisting of first preparing the plate with a coating of gelatino-argentic emulsion, then submitting the plate so coated to a bichromate-bath, then drying the plate; then exposing the plate, under a negative, then washing out the soluble bichromate, then developing the plate whereby the washed-out portion takes the developer and becomes opaque to form the stipple, substantially as described.

5. The within-described process of producing stipple printing-plates, consisting of preparing the plate with a coating of sensitized material, then submitting the plate to a bath in chemicals adapted to cause the emulsion to divide into two sets of minute divisions when exposed to light, one set impervious to water, the other set of divisions adapted to take the developer and develop into an opaque stipple; then washing out the soluble chemicals after first exposing the plate to the action of light, then developing the plate whereby the divisions impervious to water refuse the developer and the other set of divisions that take the developer develop into an opaque stipple, then fixing the plate, substantially as described.

6. The within-described method of producing stipple printing-plates, consisting of first preparing the plates with a coating of sensitized emulsion, then submitting the plates so coated to a bichromate-bath, then exposing the plates, then washing out the soluble bichromate, then developing the plates whereby the washed-out portion takes the developer and becomes opaque to form the stipple, substantially as described.

7. The within-described method of producing stipple printing-plates, consisting of first preparing the plates with a coating of sensitized emulsion, then submitting the plates so coated to a bath adapted to form an opaque stipple, then exposing the plates, then washing out the soluble chemicals, then developing the plate whereby the washed-out portion takes the developer and becomes opaque to form the stipple, then fixing the plate, substantially as described.

In testimony whereof I sign this specification in the presence of two witnesses.

ERNST ORTMANN.

Witnesses:
S. E. THOMAS,
C. H. FISK.