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In an earlier issue of the periodical, the editor, Thomas Sutton, spoke of this forth-coming article, "In an early number we intend to bring that shamefully neglected process the Daguerreotype under consideration. . ." (1:5 [25 April 1856]: 33.)

PHOTOGRAPHIC PROCESSES.

THE DAGUERREOTYPE PROCESS.

By the Daguerreotype process we obtain a direct Positive on a silvered metal plate.

The picture is produced by means of the impalpable fumes of iodine, bromine and mercury, acting on a plate which has been polished to the utmost. The photo-chemical reactions consequently occur in an inappreciably small quantity of material, which is spread on the photographic tablet with a uniformity not to be obtained by any other means. Hence it follows that a fine Daguerreotype exhibits microscopic perfection of detail, and perfect gradation of shades. I have examined Daguerreotypes under a microscope having a magnifying power of 30 times linear, and 900 times superficial, without perceiving any loss of definition, or any symptoms of crystalline or molecular arrangement of the matter composing the image.

Other processes, when compared with this, are coarse and imperfect. Paper positives will scarcely bear the severe scrutiny of unassisted vision, and glass positives exhibit, under the magnifying power which I have described, innumerable imperfections. It appears therefore that of all known methods of representing a natural object, the Daguerreotype process is the most perfect and the most scientific.

In a fine Daguerreotype, the utmost delicacy of line is combined with perfect gradation of shade; the details of the deepest shadows are as legible as those in full light; and the most elaborate finish is blended with exquisite softness of effect. In tone, nothing can be more beautiful than the varied hues of gold and purple which the image presents when viewed in different positions, in a strong light.

Unfortunately however, the very circumstance which gives such perfection to the result, viz: the polish of the plate, brings with it certain objections in an artistic point of view; and these objections are considered by many to be so serious that they are willing to rest content with an inferior photograph on a different tablet Hence the present popularity of the glass and paper processes. But the accomplished photographer, who sees in every process its own peculiar merits, will hardly rest satisfied with a sketchy production, when called on to exhibit the utmost perfection of his art. I would therefore

earnestly call the attention of my readers to this elegant and beautiful process, at present so undeservedly cast into the shade by others of more pretension, but less real merit.

The manipulation of the Daguerreotype process is extremely easy and certain. It involves the following five operations, viz:

1st.—To clean and polish the plate.
2nd.—To render it sensitive.
3rd.—To expose it in the Camera.
4th.—To develop the image.
5th.—To fix the image.

The finished picture is placed in a frame or passe-partout, behind a glass. The image is permanent, and cannot be rubbed out by the finger; nothing but a chemical solvent will obliterate it.

The silvered plates generally employed in this process are manufactured in France, England, and America. I should say, from my own experience, that the English plates are the best—but they are dear. The amateur had better make his first experiments on the American plates of Scovill & Co., or on the cheaper kinds of French plates, of which there are many varieties. He must choose them as free from scratches and specks as possible, as these defects cannot be remedied. The plates are made by laying a thin sheet of silver foil on a copper plate, and then passing it between rollers, by which means the two metals are made to adhere perfectly. The silver should contain no alloy. When the same plate has been used several times, the silver wears off, and the plate should then be re-silvered by the electrotype process; but all scratches and specks are faithfully copied, so that this process does not afford a remedy for these defects. A scratched plate is useless, except for experiments. The plates may be cut to any shape by a strong pair of scissors.

In what follows, I assume the plate to he the quarter size.

1st Operation.—To clean and polish the plate.

If necessary, cut a little bit off each corner, and bend the edges in a plate bender.

To clean the plate, procure some Canton flannel, and a box of prepared rotten stone with a muslin strainer. In a pint bottle mix one part nitric acid and twenty parts distilled water.

If the plate has been used before, and has been submitted to the gilding solution, the image must be removed by a. liquid sold under the name of "Gilding Dissolvent," the directions for using which will be found on the lable of the bottle.

If the plate has by accident been in contact with mercury, it must be heated over a spirit lamp until the whole of the mercury has been volatilized and expelled.

Then proceed to clean it in the following manner:

Cut the Canton flannel into pieces about two inches square. Lay one of them on the plate, and pour on the back of it a few drops of dilute nitric acid; rub the damped flannel all over the plate, going well up to the corners. Then powder a little rotten stone on the plate, and rub it all over with the bit of flannel with a circular motion until it is clean. Beware of scratching the plate. By scratches I do not mean the fine circular marks left by the rotten stone, and which are removed on the buff, but the deep cuts made by a crystal of sand or dust on the flannel. When the plate is clean, it presents the grey appearance of unpolished silver, and is free from stains or marks. When you have cleaned the face of the plate, clean the back with the same piece of flannel, and then with a fresh piece of flannel rub the face again until it is dry. The clean plate must not be touched by the fingers.

To polish the plate, procure some prepared charcoal and a couple of Buffs. Tie up about an ounce of the charcoal in a piece of cambric, and keep it in a box with a lid, in order that no dust may stick to it. The buffs are made in the following manner. Procure two pieces of wood 16 inches long, 6 inches wide, and 1 inch thick. Screw a strong handle on the back, at the end of each. Cover one with fine velveteen, and the other with cotton velvet. When not in use keep them face to face.

Powder some charcoal all over each huff with the dabber, and rub them together. Then, taking the velveteen buff in the left hand, and resting the end of it on a table, lay the clean plate face downwards on it, and with the fingers of the right hand on the back of the plate, rub it up and down the buff vigorously, in every direction, sideways, longways, diagonally, until you have polished it, and removed the circular marks of the rotten stone. Change continually the position of your fingers on the back of the plate, and in order to prevent them from slipping off on to the buff, breath on them occasionally, or wear a leather glove. If they slip on to the buff, immediately powder some charcoal on the spot.

When the plate is thoroughly polished it looks black, and not grey. Polish well up to all the corners and edges, and then put it away into the plate box. Clean and polish enough plates for the day's use, before proceeding to manipulate. A plate may be cleaned and polished in two or three minutes in the way which I have described, but it is hard work, and should be handed over to an intelligent assistant. The remaining processes are extremely neat and elegant; much more so than the collodion or paper manipulation.

2nd Operation.—To render the plate sensitive.

Powder some charcoal on the velvet buff and rub the polished plate lightly up and down for half a minute. The fine lines left by the buff across the plate, must be horizontal, when you are looking at the picture; remember this when giving the last rub to the plate.

The plate is now ready to receive the sensitive coating.

Procure a double coating box, containing two compartments, one for iodine, the other for bromide of lime; and furnished with reflectors. See that the sliders fit air-tight over the glass pans. Put an ounce of iodine into one pan, and a four ounce bottle full of bromide of lime into the other. Spread them evenly over the bottom, and lay some cotton wool thinly divided, over the iodine, in order that the fumes may be filtered as it were, and rise more equally.

Place the coating box between yourself and a small window, shaded by a white blind, and open the back shutters of the coating box so that a feeble white light may enter, and be reflected from the mirrors.

Place the plate face downwards over the iodine, draw out the glass slider and observe by means of the mirrors, the changes of colour which the plate assumes. These occur in the following order, viz: pale yellow, deep yellow, rose colour, steel colour, the original colour of the plate; after which the colours recur in the same order as before.

Leave the plate over the iodine until it assumes the deep yellow colour bordering on rose. This may occupy from one to three minutes according to circumstances. Then pass it on to the bromine. Leave it over the bromine untill it assumes a blue steel colour. This may occupy from 20 seconds to 2 minutes according to circumstances. Then shut the back shutters of the coating box, and draw a yellow blind formed of three layers of yellow calico, before the window. Return the plate to the iodine and let it remain from 10 to 25 seconds according to circumstances. I cannot be more exact than this. The reader must make his own experiments.

The white light which falls on the plate while you are observing the colour, produces an effect, for the plate is certainly sensitive at that time, but the second exposure to iodine

obliterates that effect, and renders it harmless. If therefore any accident occurs in taking a picture, even should it be exposed to broad daylight in its sensitive state, the effect of the light may be obliterated by exposing it once more for a few seconds to iodine. The plate need not be cleaned, polished, and sensitized again.

The plate is now ready for the camera, and the sooner the picture is taken the better. I am not prepared to say how long a sensitive plate will “keep;” perhaps half an hour in the slide. Mr. Kilburn told me that he once sent an assistant from London to the Crystal Palace at Sydenham, with a box of sensitive plates placed face to face, and the pictures were developed 12 hours afterwards with perfect success.

3rd Operation.—To expose in the camera

The exposure in the camera is effected in the usual way. The time of exposure is a matter which can only be determined by trial. The details in the deepest shadows may always be obtained by sufficient exposure; it is a mere question of time; but the lights become blue and solarized by over exposure. It is difficult therefore to include successfully very violent contrasts of light and shade, and this should not be attempted as a rule, for the great charm of this process consists in the beauty of the half tones. In landscapes however, the blue solarization of the sky is an improvement to the picture, and the blue tint generally softens down to a warmer tone on the horizon, which gives a very charming effect. My first experiments in this process were made with M. Iller, at Florence, and the views we obtained from the bridges of that lovely City, were equal to anything I have seen in the art. These views combined every requisite of a fine picture. Effects of haze on distant mountains, a winding river with bridges and buildings reflected in it, and an elaborate foreground full of picturesque objects. To all this the Daguereotype process, within a space of 6 ins. X 4 ins., did such ample justice as I believe no other process could; and every time I look at such works, I discover amidst the details some fresh object of interest. They are a never ending source of delight.

As I intend in a future number to give an article on the subject of photographic portraiture, I will defer until then some remarks which might otherwise be appropriately introduced here. I pass on therefore to the development of the image.

4th Operation.—To develop the image

Employ a mercury box of any shape provided with a thermometer. I generally use an iron box made on the American principle. Filter about a table spoonful of mercury into the pan, through a filter with a very small bore; but do not let the filtered mercury fall from a height into the bath, as it oxidizes in passing through the air, and the globules on reuniting become covered with a grey film of oxide, which floats on the top, and prevents the vapour from rising so quickly as if the surface were clean.

No picture is visible when you remove the plate from the camera. Place it over the mercury, and heat the mercury with a spirit lamp to a temperature of about 140° Fahrenheit. In a few minutes the picture will be developed. The time will depend entirely on the size of the box; a large box requiring more time than a small one. From three minutes to a quarter of an hour are about the extreme limits of the time required. Remove the plate and examine it now and then by a yellow light. Push the development as far as possible in order to get out all the details. If you over-develop the picture, or much overheat the mercury, the shadows will be covered with minute specks or pellicles. If the plate has been exposed to too much diffused light, a white film of mercury will be deposited on it, which will obscure the details, or injure the vigour and intensity of the

blacks. If you under-develop the picture, the lights will want solidity and the details of the shadows will be defective.

When the image has been developed in the mercury box, the plate may be exposed to moderate daylight; and the fixing process may be deferred till a convenient opportunity.

5th Operation.—To fix the picture.

The fixing process includes two operations. The first consists in removing the coating of iodine and bromine, by means of hyposulphite of soda. The second consists in gilding the image by means of a hot solution of sel d'or, which has the effect not only of improving the tone, but also of cementing the image firmly to the plate, so that it cannot be rubbed off with the finger.

Make a solution of pure hyposulphite of soda in distilled water; the strength is not material; say one ounce hypo to four ounces water. Filter it carefully into a small upright glass bath, like that used for nitrate of silver. Hold this obliquely in the left hand, and let the plate slide in, with its back on the under side of the bath. I recommend this mode of immersing the plate in the hypo, because if the plate is immersed in a horizontal bath, it sometimes happens that two waves of fluid meet in covering it, and this forms a line across the picture, which cannot afterwards be removed. If the back of the plate is dirty, it contaminates the hypo and occasions stains on the face; hence the importance of cleaning the back of the plate. The hypo very quickly removes the steel colour of the iodine, and leaves the mercury, which forms the lights of the picture, adhering to the silvered plate, the black polished silver forming the shadows of the picture. When the steel colour has disappeared, pour the fluid into the funnel, let the plate slide out of the bath into your hand (taking care that the face of the picture does not touch the glass), then holding it horizontally, pour on it filtered rain water, from a bottle having a cork into which a small glass tube is inserted. This washing removes the last traces of hyposulphite of soda.

In this state, the picture may be easily wiped off the plate.

The next operation consists in gilding and fixing the picture.

Place the plate (still wet) on a levelling stand furnished with screws. Then pour on it the following solution of sel d'or:

20 oz. distilled water
1 gramme (15 grains) sel d'or

The sel d'or of Fordos and Gelis, or of Engler and Gaudin I have always found good, and of uniform strength. I have never met with an adulterated sample by either of these makers.

Pour the solution into a small funnel having a tuft of cotton wool in the neck, and let it filter drop by drop on to the plate. Cover the plate with as much fluid as it will hold.

Light a spirit lamp with a large wick, and holding it underneath the plate, heat the fluid to the boiling point. Do not let the flame remain for two seconds on the same spot, but pass it rapidly from place to place, and from corner to corner. Watch the changes of tone which the picture assumes. After a few seconds it darkens slightly, and then begins to clear up. The lights become whiter and the shadows blacken. After a time bubbles show themselves in the boiling fluid. The toning and fixing has now about reached its maximum. Do not let any bubbles adhere to the plate; a spot would occur wherever this happened. To prevent this, strike the table every now and then with your left hand, to communicate vibration to the plate, and detach the bubbles.

When the picture has been sufficiently toned, take it by one corner in a pair of nippers and pour off the fluid. Pour on it distilled or filtered rain water out of a bottle as before, and then dry it over a spirit lamp in the following manner:—

Hold it in the nippers, inclined at an angle of about 45° to the floor; begin with drying the upper corner, and proceed gradually downwards. As the fluid dries off, a line of wet gradually recedes downwards before the lamp; follow this up by blowing on the plate, and remove the last drop from the lower corner by a piece of blotting paper.

If the amateur finds a difficulty in drying the plate, he may let it dry spontaneously, in a vertical position, resting on blotting paper.

The picture is now finished. It cannot be rubbed off with the finger; it is fast and permanent. Put it at once in the passe-partout. But before sealing it up, blow off any dust there may be upon it by means of an indian rubber syringe, kept for the purpose.

It sometimes happens that the plate on drying becomes covered with minute black spots. These may be removed by a very simple method communicated to me by Mr. Kilburn. Immerse the plate in water, put it on the levelling stand, and pour on it a dilute solution of cyanide of potassium. This will remove the spots. Wash it in water, and dry it as before.

There is a circumstance in the manipulation of this process to which I am anxious to call attention, as it puzzled me for a length of time. It is this:—The room in which the plate is sensitized should not be colder than that in which the picture is taken, or than the external air when taking a view. For if a cold plate be taken into a warm situation the dew condenses upon it, and although a picture may be obtained in the mercury box, (and apparently a good picture), it is nevertheless impossible to fix or tone that picture properly, and it assumes a greenish tint, and is easily rubbed off the plate.

Such are the details of this very elegant process; which I believe to be the easiest and most certain of all, and at the same time the most perfect. I have seen positives on paper, exhibiting all the qualities of tint which an artist could desire, and much beauty of detail which he would find it difficult if not impossible to imitate. I have also seen positives on glass which have delighted me exceedingly, and my sincere admiration of which I am quite willing to admit. But I give the preference to a fine Daguerreotype; which for delicacy of detail and exquisite modulation of tone, stands I believe unrivalled, and unapproachable.

I think it a mistake to colour a fine Daguerreotype. “To gild refined gold or paint the lily” is not more absurd. A printed portrait on paper may sometime be retouched with advantage, but the human hand can add nothing to the beauty of a daguerreotype; it can but obliterate details or fine gradations of shade. Let us then accept it as it is. Granted that the polish of the plate is in one sense an objection; but polish is but the perfection of smoothness, and the smoothness not only of the tablet, but of *the material of the image*, is the cause of the perfection of the picture in this process. Other photographic processes may achieve more boldness of effect, but that is due to the coarseness of the tablet in the case of a positive print, and to the coarseness of the material of the image, in the case of a glass positive.

In order fully to appreciate the beauty of a daguerreotype, it should be viewed in sunshine with your back to the light. The ultimate tint depends in great measure on the observance of the proportions of iodine and bromine in the sensitive coating.

A daguerreotype is permanent; the picture cannot be rubbed off the plate; the plate cannot be broken by accident; the picture will bear microscopic investigation. Other

processes have their merits, but this is the triumph of the photographic art, and a boon to science.

THEORY OF THE PROCESS.

Here we encounter some difficulties; hut the little which has been satisfactorily made out I will endeavour to state clearly.

The fumes of the iodine and bromine are supposed to combine with the silver, and form a bromo-iodide of silver, which exhibits a smooth amorphous surface. The light acting on this, crystallizes and roughens it, but no decomposition occurs. The following experiment proves this. Take a picture on a sensitive plate, then cut it in half; leave one half in the dark, and the other half exposed to yellow light for some time; then develop both halves together. No image will be obtained on the half plate which was exposed to yellow light; for it is a curious fact that yellow light restores the amorphous condition of the parts previously crystallized by white light. Now this could hardly occur, if the white light had *decomposed* the bromo-iodide of silver, and liberated any of the volatile elements. On the other hand, the prolonged action of white light so completely crystallizes the sensitive film that it exhibits the appearance of grey crystals, which are insoluble in hypo. But this does not prove that any- decomposition has occurred, or that these grey crystals are metallic silver: for they may have become transparent, and the light in passing through them, and suffering reflection at the silver surface may become polarized or changed in its physical conditions, and so exhibit the appearance described; while the same substance may under one condition be soluble, and under another condition insoluble in the same fluid. I do not believe that under any circumstances, either iodide, bromide, or chloride of silver, in their pure form, are decomposed by light; and I conceive the change produced by light in these substances to be purely molecular.

The mercurial vapour attaches itself to the roughened surface, where light has acted, and forms the lights of the picture, by becoming amalgamated with the silver. But how does this happen? Dr. Frankland (Phot. Notes, page 59) supposes that a portion of the mercury becomes iodized at the expense of the silver, which is liberated and amalgamates with the remainder of the mercury. But I think it possible that no iodide of mercury may be formed, but that the mercurial vapour may attack the silver plate by passing between the crevices of the crystallized iodide. I have said that a few seconds of exposure to iodine vapour will obliterate all trace of an impressed image. This may happen in consequence of the iodine filling the crevices between the crystals, and not allowing the mercury to pass.

The hyposulphite of soda dissolves the bromo-iodide of silver, and leaves the mercury attached to the silver.

The boiling solution of sel d'or appears to act by elective affinity, in the following manner.

Sel d'or is a double hyposulphite of gold and soda. An atom of silver of the plate changes places with an atom of gold of the solution. The sel d'or therefore becomes converted into a double hyposulphite of silver and soda, and gold is precipitated. The gold, silver, and mercury form an amalgam which adheres tightly to the plate, assisted perhaps by the expansion and subsequent contraction of the metal on cooling. This forms the lights of the picture, purple under one aspect, and golden under another. The shadows, where no mercury exists, are blackened and enriched by the precipitation of gold.

Such appears to be the theory of this very beautiful process.

EDITOR OF PHOT. NOTES.

[End of text.]

EDITOR'S NOTES:

Thomas Sutton (1819–1875) began his photographic career in 1847. In 1855 he associated himself with Blanquart-Evrard in the production of calotypes. He was a prolific writer on photography. For eleven years he edited *Photographic Notes*, a journal which he had founded with Blanquart-Evrard. (Information from Wikipedia.[1])

A variant of this text was incorporated into Thomas Sutton, *A Dictionary of Photography* (London: Sampson Low, Son, & Co., 1858): 152–59.[2] The text again appears in the second edition: Thomas Sutton and George Dawson, *A Dictionary of Photography* (London: Sampson Law, Son, and Marston, 1867): 80–87.[3]

1. http://en.wikipedia.org/wiki/Thomas_Sutton_(photographer)
2. http://books.google.com/books?id=1m0DAAAAQAAJ
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