CLASSICS OF SCIENCE:

The Daguerreotype

Physics

The SCIENCE NEWS-LETTER would be greatly interested to learn of any successful modern daguerreotypes made by the following original directions. Address "Classics Editor, Science Service, 21st and B Streets, N. W., Washington, D. C."

PRACTICAL DESCRIPTION OF THE PROCESS CALLED THE DAGUERREOTYPE, which consists in the spontaneous reproduction of the images of natural objects, in the Camera Obscura; not with their colours, but with great delicacy in the gradation of the tints. By Daguerre. Translated for the Journal of the Franklin Institute, by J. F. Frazer (November, 1839).

Description of the Process

The drawings are made upon thin sheets of silver, plated upon copper. Although the copper serves principally to support the plate of silver, the union of these two metals promotes the perfection of the result. The silver should be as pure as possible. . . . The thickness of the two metals should not exceed that of a stout card.

The process is divided into five operations.

The first consists in polishing and cleaning the plate, so as to render it fit for receiving the sensitive coating.

The second, in applying this coating.

The third, in submitting the plate thus prepared, to the action of the light in a camera obscura, in order to receive upon it the picture from nature.

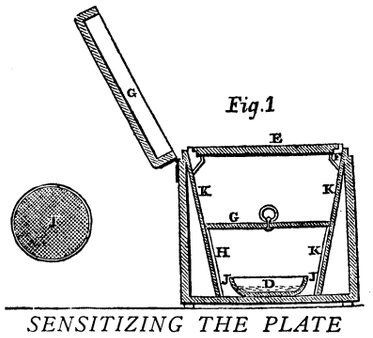
The fourth, in causing this picture to appear; it not being visible when first taken from the camera obscura.

Finally, the fifth has for its object the removal of the sensitive coating which would continue to be modified by the light, and would tend necessarily to destroy the impression altogether.

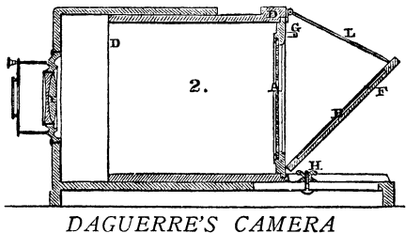
First Operation

This requires a small flask of olive oil; very fine carded cotton; pumice ground exceedingly fine, tied up in a piece of muslin sufficiently thin to suffer the pumice to pass through it easily, when shaken; a bottle of Nitric Acid diluted with water in the proportion of one part (by measure) of acid, to sixteen parts (by measure) of distilled water; a frame of iron wire upon which the plates are put in order to heat them by means of a small spirit-lamp; and finally a small spirit-lamp.

As was before mentioned, the drawings are made upon silver-plate. The size of the plate is limited by the



SENSITIZING THE PLATE



DAGUERRE'S CAMERA

size of the apparatus. It must in the first place be well polished. For this purpose, it is sprinkled with pumice (shaking it without touching the plate) and is rubbed gently, in a circular direction, with cotton soaked in a little olive oil. In this operation the plates are laid upon a sheet of paper which must be renewed from time to time.

The pumice is re-sprinkled and the cotton renewed several times. . . .

When the plate is well polished it must be freed from the oil, which is done by sprinkling it with pumice and rubbing it dry with cotton, rubbing always in curves; a good result cannot be obtained by rubbing otherwise. A small plug of cotton is then made, which must be wet with a little acid diluted with water as above mentioned. . . . The plate is then rubbed with the plug, taking care to spread the acid perfectly over the whole surface of the plate. . . .

The plate is then sprinkled with pumice and rubbed very lightly with fresh cotton.

The plate must then be submitted to a high heat. For this purpose it is placed upon a frame of iron wire, raised to a proper height by legs, the silver above, and the spirit-lamp is passed backwards and forwards along the under surface of the plate, so close that the flame may be broken upon it. After having passed the lamp for at least five minutes under every portion of the plate, a light, whitish coating forms upon the surface of the silver.—The action of the heat is then withdrawn. . . .

The plate is then quickly chilled by placing it upon a cold surface, such as a marble table. When it is cold it must be again polished, which is quickly done, since it is only necessary to remove the whitish coat which has formed upon the silver. . . . When the plate is well burnished, it is rubbed, as above mentioned, with the acid diluted with water, sprinkled with a little pumice, and rubbed very lightly with a plug of cotton. The acid must be renewed three times. . . .

Second Operation

For this operation we must have: The box figured in Figure 1; a rectangular frame of wood; four small metallic strips of the same nature as the plate; a small hammer and a box of small nails; a little iodine.

After the plate has been fixed upon the frame by means of the metallic strips and small nails which are driven with the hammer designed for that purpose, the iodine must be placed in the capsule which is at the bottom of the box. The iodine must be divided in the capsule in order that the focus of emanation may be larger, otherwise, an iris would form at the centre of the plate which would prevent the obtaining an uniform coating. The wooden frame is then placed, the metal downwards, upon the small brackets fixed at the four angles of the box, and the cover is shut. In this position it must be left until the surface of the silver is covered with a perfect coating of a golden yellow colour. . . . The time necessary for this operation cannot be determined, for it depends upon several circumstances. . . .

When the plate has attained the proper colour it must be placed in a frame which fits into the camera obscura. The light of day must be prevented from striking upon the plate; for this purpose, therefore, we use a candle, the light of which has much less action; this light must not, however, be suffered to strike too long upon the plate, upon which it will leave marks. . . .

Third Operation

No apparatus is necessary for this operation except the camera obscura, Figure 2. The third operation is that in which the picture is obtained by means of the camera. Objects illuminated by the (*Turn to next page*)

The Daguerreotype—*Continued*

sun must be selected as far as possible, because the operation is under these circumstances much more prompt It may easily be conceived that as the result is caused by the light alone, the action will be quicker, in proportion as the objects are more strongly illuminated, and are naturally whiter.

After placing the camera obscura opposite to the landscape, or whatever other object we may desire to copy, the important point is to arrange the focus so that the objects may be defined with great clearness, which is easily done by drawing out, or pushing in, the frame of the ground glass which receives the image. When great precision has been attained . . . the frame of the glass is then withdrawn (taking care not to derange the camera) and replaced by the apparatus which contains the plate and which fits exactly into the place of the glass. When this apparatus is properly adjusted, by means of the small copper buttons, the opening of the camera is closed, and the interior doors of the apparatus opened by means of the two semi-circles. The plate is then ready to receive the impression of the view, or object, which has been chosen. Nothing remains but to open the diaphragm of the camera, and count the minutes by the watch.

This operation is one of great delicacy, because nothing is visible, and it is utterly impossible to determine the time necessary to produce the effect, since this depends entirely upon the intensity of the light from the objects which we wish to copy; this time may vary, at Paris, from three to thirty minutes. . .

Fourth Operation

For this we must have a bottle of mercury containing at least 2 pounds; a spirit lamp; a glass funnel with a long neck; the apparatus, figured in Figures 3, 4.

Enough mercury is poured, by means of the funnel, into the capsule placed at the bottom of the apparatus, to cover the bulb of the thermometer. This requires very nearly two pounds. From this time we can use no light except that of a candle. The board upon which the plate is fixed is withdrawn from the frame (the cover of which preserves it from the contact of the light) and slid into the grooves of the black plate (Figure 3). This black plate is then replaced in the apparatus upon the brackets, which retain it at an angle of 45°, the metal below, so that it can be seen through the glass; the cover of the apparatus is then gently closed, so as to prevent the concussion of the air from causing the particles of mercury to fly about. When everything is thus arranged, the spirit lamp is lit and placed under the capsule containing the mercury, and there left until the thermometer (the bulb of which is plunged into the mercury—and the tube passes outside of the box) indicates a heat of 140° Fahr. (60° Cent.); the lamp is then quickly withdrawn; if the thermometer has risen rapidly, it will continue to rise without the assistance of the lamp; but we must be careful not to let it rise above 167° Fahr. (75° Cent.)

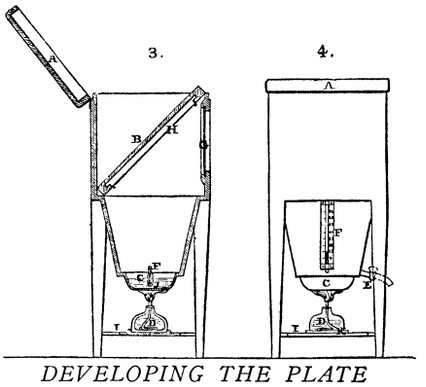
The impression of the image exists upon the plate but is not visible; it is not for some minutes that it begins to appear. . . . The plate must be left until the thermometer has again descended to 113° Fahr. (45° Cent.); it is then withdrawn and this operation is terminated. . . .

Fifth Operation

The object of this operation is to remove the coating of iodide, which would otherwise, when the impression had been too long exposed to the light, continue to decompose and destroy the picture.

For this operation we must have a saturated solution of common salt, or a weak solution of pure hyposulphite of soda; an inclined plane or frame; two tinned copper pans; a kettle of distilled water.

The salt water is poured into one of the basins to within about one inch of its edge; the other is filled with ordinary pure water. These two liquids must be heated, but not to boiling. The solution of common salt may be replaced by a solution of pure hyposulphite of soda, this is even preferable, because it removes the iodide entirely, which the solution of salt will not always do, especially when the impressions have been made for some time.



DEVELOPING THE PLATE

The plate is first dipped into the pan containing pure water . . . then, without suffering it to dry, it is plunged into the salt-water. If the plate is not dipped in the pure water before plunging it into the solution of salt or hyposulphite, these will make ineffaceable stains. . . .

We then take the inclined frame, and the kettle, which must be very clean, and in which distilled water has been boiled. The plate is taken from the pan of water, and placed at once upon the inclined plane; then, without giving it time to dry, distilled water, very hot, but not boiling, is poured upon the surface of, and from above, the plate, so that, in descending, the water may form a sheet over its whole surface, and carry with it the whole of the solution of salt or hyposulphite, already much weakened by the immersion of the plate in the first pan.*

After the washing, the picture is finished, nothing remains but to preserve it from dust and from vapours which might tarnish the silver. The mercury which causes the image to be visible, is partly decomposed, it adheres to the silver, resists the water poured upon it, but cannot sustain any rubbing.

To preserve the impressions, they must be put under glass and cemented in; they are then unalterable, even in the sun.

Louis Jacques Mande Daguerre was born at Cormeilles, France, in 1789, and died at Petit-Brie-sur-Marne, July 12, 1851. He was first an inland revenue officer, then became a scene painter for the opera in Paris. At the age of 33 he and Bouton opened the Diorama in Paris, a place of amusement, where he arranged unusual scenic and lighting effects. Later he opened a similar place in London. Daguerre then became interested in the possibility of fixing the camera image. In 1839 he received word from J. Nicéphore Niepce that he was working along the same lines, using asphalt and oil of lavender. The two worked together until Niepce's death, four years later. Daguerre finally succeeded in the project. In 1839 his Diorama was destroyed by fire. The same year, for the perfection of his daguerreotype, the inventor was made an officer of the Legion of Honor. He and Niepce's heir were granted annuities on condition that the process be printed. It was accordingly published by the government August 2, 1839.

*If the hyposulphite solution be used, the water should be less warm than with the common salt.