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PRINCIPLE OF THE DAGUERREOTYPE.

Paris, August 21st

I write to you to report,—though of necessity hastily,—the proceedings of the *Académie des Sciences* of Monday last, when M. Arago, in the presence of a crowded audience, which had besieged the doors of the Institute three hours before the commencement of the sitting, divulged the secret of M. Daguerre's invention, which has now, as you are aware, become public property. Three drawings having been exhibited, by way of specimens, M. Arago began by recapitulating the discoveries,—or rather hints toward discoveries,—of former chemists; he afterward dwelt upon the progressive experiments of M. Niepce, since carried out by M. Daguerre. As, however, your columns already contain notices of these, I will come at once to the publication of the secret of the perfect invention; and in order to give you this as fully and clearly as possible, I send you an abstract from the report published in yesterday's *Journal des Débats*.

M. Arago stated that, according to M. Daguerre's process, copper plated with silver is washed with a solution of nitric acid, for the purpose of cleansing its surface, and especially to remove the minute traces of copper, which the layer of silver may contain. This washing must be done with the greatest care, attention, and regularity. M. Daguerre has observed, that better results are obtained from copper plated with silver, than from pure silver; whence it may be surmised, that electricity may be concerned in the action.

After this preliminary preparation, the metallic plate is exposed, in a well-closed box, to the action of the vapor of iodine, with certain precautions. A small quantity of iodine is placed at the bottom of the box, with a thin gauze between it and the plate, as it were, to sift the vapor, and diffuse it equally. It is also necessary to surround the plate with a small metallic frame, to prevent the vapor of iodine from condensing in larger quantities round the margin than in the centre; the whole success of the operation depending on the perfect uniformity of the layer of ioduret of silver thus formed. The exact time to withdraw the sheet of plated copper from the vapor, is indicated by the plate assuming a yellow color. M. Dumas, who has endeavored to ascertain the thickness of this deposit, states that it cannot be more than the millionth part of a *millimetre*. The plate thus prepared, is preserved with great care from the faintest action of light. It is, in fact, so sensitive, that exposure for a tenth part of a second is more than sufficient to make an impression on it.

At the bottom of the dark chamber, which M. Daguerre has reduced to small dimensions, is a plate of ground glass, which advances or recedes until the image of the object to be represented is perfectly clear and distinct. When this is gained, the prepared

plate is substituted for the ground glass, and receives the impression of the object. The effect is produced in a very short time. When the metallic plate is withdrawn, the impression is hardly to be seen, the action of a second vapor being necessary to bring it out distinctly;. the vapor of mercury is employed for this purpose. It is remarkable, that the metallic plate, to be properly acted upon by the mercurial vapor, must be placed at a certain angle. To this end, it is enclosed in a third box, at the bottom of which is placed a small dish filled with mercury. If the picture is to be viewed in a vertical position, as is usually the case with engravings, it must receive the vapor of mercury at an angle of about 45°. If, on the contrary, it is to be viewed at that angle, the plate must be arranged in the box in a horizontal position. The volatilization of the mercury must be assisted by a temperature of 60° (of Reaumur.)

After these three operations, for the completion of the process, the plate must be plunged into a solution of hypo-sulphite of soda. This solution acts most strongly on the parts which have been uninfluenced by light; the reverse of the mercurial vapor, which attacks exclusively that portion which has been acted on by the rays of light. From this it might perhaps be imagined, that the lights are formed by the amalgamation of the silver with mercury, and the shadows by the sulphuret of silver formed by the hypo-sulphite. M. Arago, however, formally declared the positive inability of the combined wisdom of physical, chemical and optical science, to offer any theory of these delicate and complicated operations, which might be even tolerably rational and satisfactory.

The picture now produced is washed in distilled water, to give it that stability which is necessary to its bearing exposure to light without undergoing any farther change.

After this statement of the details of M. Daguerre's discovery, M. Arago proceeded to speculate upon the improvements of which this beautiful application of optics was capable. He adverted to M. Daguerre's hopes of discovering some farther method of fixing not merely the images of things, but also of their colors; a hope based upon the fact that, in the experiments which have been made with the solar spectrum, blue color has been seen to result from blue rays, orange color from orange, and so on with the others. Sir John Herschel is sure that the red ray alone is without action. The question arose, too, whether it will be possible to take portraits by this method? M. Arago was disposed to answer in the affirmative. A serious difficulty, however, presented itself:—entire absence of motion on the part of the object is essential to the success of the operation; and this is impossible to be obtained from any face exposed to the influence of so intense a light. Daguerre, however, believes that the interposition of a blue glass would in no way interfere with the action of the light on the prepared plate, while it would protect the sitter sufficiently from the action of the light. The head could be easily fixed by means of supporting apparatus. Another more important desideratum is, the means of rendering the picture unalterable by friction. The substance of the pictures executed by the Daguerreotype is, in fact, so little solid—is so slightly deposited on the surface of the metallic plate, that the least friction destroys it, like a drawing in chalk; at present, it is necessary to cover it with glass.

From his numerous experiments on the action of light on different substances, M. Daguerre has drawn the conclusion that the sun is not equally powerful at all times of the day, even at those instants when his light is the same above the horizon. Thus, more satisfactory results are obtained at six in the morning than at six in the afternoon. From this, too, it is evident that the Daguerreotype is an instrument of exquisite sensibility for measuring the different intensities of light, a subject which has hitherto been one of the most difficult problems in Natural Philosophy. It is easy enough to measure the

difference in intensity between two light viewed simultaneously: but when it is desired to compare daylight with a light produced in the night—that of the sun with that of the moon, for example—the results obtained have had no precision. The preparation of M. Daguerre is influenced even by the light of the moon, to which all the preparations hitherto tried were insensible, even when the rays were concentrated by a powerful lens.

In physics, M. Arago indicated some of the more immediate applications of the Daguerreotype, independently of those which he had already mentioned in Photometry. He instanced some of the most complex phenomena exhibited by the solar spectrum. We know, for example, that the different colored rays are separated by black transversal lines, indicating the absence of these rays at certain parts; and the question arises whether there are also similar interruptions in the continuity of the chemical rays? M. Arago proposes, as a simple solution of this question, to expose one of M. Daguerre's prepared plates to the action of a spectrum: an experiment which would prove whether the action of these rays is continuous or interrupted by blank spaces.

I shall only add, that M. Daguerre has entered into a contract with Giroux, the celebrated toyman, for the practical application of his discovery—and that it is said he has already *in petto* some new results of importance, which he will submit to the *Académie* at an early opportunity.

[End of text.]

EDITOR'S NOTES:

R. Derek Wood informs that this text is: "a translation into English of the last half of Dr. Alfred Donné's account in *Journal des Débats*, thus providing a good practical description." See R. Derek Wood, "A State Pension for L. J. M. Daguerre for the Secret of his Daguerreotype Technique," *Annals of Science* 54:5 (September 1997): 489–506. Wood's article is also provided, along with an array of other very useful information, in Wood's web site, *R. D. Wood's Midley Essays on the History of Early Photography*.[1]

The *Athenaeum* text was reprinted in *New-Yorker* 8:2 (28 September 1839): 19–20.

For another account published the same day, see "The Daguerre Secret," The Literary Gazette (London) No. 1179 (24 August 1839): 538–39.[2]

Also worthy of note is the Arago's discussion of portraiture and Daguerre's suggestion regarding "the interposition of a blue glass." Such a blue glass was used in the early portrait studio endeavors of Alexander Wolcott and John Johnson, Their techniques were also adopted by the early portrait studio of Richard Beard. Regarding the use of blue glass, see also Gilman & Mower, *The Photographer's Guide; in which the Daguerrean Art is Familiarly Explained* (Lowell: Samuel O. Dearborn, printer, 1843): 15;[3] John W. Draper, "On the Process of Daguerreotype, and its application to taking Portraits from the Life," *London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science* (London) 17:109 (September 1840): 217–25;[4] John F. Goddard, "Application of the Daguerreotype to the Taking of Likenesses from the Life," *Chemist; or, Reporter of Chemical Discoveries and Improvements* (London) 2:17 (May 1841): 142–43;[5] John A. Anderson, "The Daguerreotype," *American Photography* (Boston) 9:12 (December 1915): 683–84.[6]

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