



Fig. 1: "Mr. Nelson," by Southworth and Hawes, ca. 1850. Daguerreotype: half-plate. (Collection of Kenneth E. Nelson)

# THE CUTTING EDGE OF YESTERDAY

by Kenneth E. Nelson

We have seen the views taken in [wherever] by the "Daguerreotype," and have no hesitation in avowing, that they are the most remarkable objects of curiosity and admiration, in the arts, that we ever beheld. Their exquisite perfection almost transcends the bounds of sober belief. Let us endeavor to convey to the reader an impression of their character..."<sup>1</sup>

Indeed, everything ever written about the daguerreotype could begin with these lines, which appeared in the *Knickerbocker*, *New York Monthly Magazine* in response to an 1839 showing of Daguerre's views of Paris. If a common picture is worth a thousand words, then all the words heretofore expended on the daguerreotype are still an incomplete description.

Even though I've been a student of the process for fourteen years, daguerreotypes still transcend the bounds of my sober belief. Sober belief still gives over to intoxicated relief when I slip a plate into the fixing bath and bring a new daguerreotype to the light of day. With every plate I have ever brought to the fixer comes the same question: Is this process as resistant to change as it appears? (The question is really an oversimplification of my complex set of moods and thoughts that are most accurately described as "transcending the bounds...") This essay is a personal effort to explore and contrast modern daguerreian images and technique with historical counterparts on several defined topics, not to provide "answers," but to better frame my question. In the name of continued wonderment, the last thing I want to do here is settle anything!



Fig. 2: "Anne Cartier-Bresson," by Kenneth E. Nelson, 1980. Daguerreotype: 4x5 inches (roughly half-plate). (Collection of K. Nelson)

## The "Look and Feel" of the Picture

The defining characteristic of the daguerreotype is that it doesn't look like any other kind of photograph. It is the only photographic process ever devised that relies on carefully "growing" the light-sensitive silver halide in-situ on the support by reaction of the pure elements. It is also dependent totally on the interplay of scattering and specular reflection of light to define the image, rather than on a combination of reflection and absorption, as are the common photographic print processes, or on interference phenomena, as are Lippmann plates and holograms. This efficiency of reflection gives daguerreotypes their astounding brilliance, and also their frustratingly specific viewing requirements.<sup>2</sup>

It stands to reason that when I create an image using the same procedures that were used in the 1850s to make daguerreotypes, my image (theoretically) ought to look like a daguerreotype. But what are we looking at? The difference from the theoretical might range from the effects of 140 years on the appearance of an older daguerreotype, to the effects of modern, super-pure reagents on my new plates. To this end, I am consistently surprised at how much my pictures resemble their 19th century counterparts in terms of image tone, brilliance, and depth (figs. 1 and 2).

Anyone who has seen a modern albumen print from a W.H. Jackson negative by the Chicago Albumen Works is immediately struck by the tonal range and depth of the new print, especially when compared to a period example. James Reilly of the Image Permanence Institute in Rochester, New York, has shown that all albumen prints made in the 19th century have faded markedly.<sup>3</sup> Modern observers have thus developed an inherently biased perception of "good" vs. "faded" albumen prints, derived from what we have had to look at. Our "fadeometers" get rudely recalibrated at the first sight of a Chicago Albumen Works rendition.

Little such rude reassessment takes place on viewing a fine modern daguerreotype. Indeed, followers and practitioners of the modern daguerreotype develop ever greater respect for the current quality and condition of 19th century specimens as we learn and appreciate the skills

necessary to merely make pictures with the process, let alone match that high quality. But what can we know about the original quality of 19th century daguerreotypes? Many old daguerreotypes have suffered obvious degradation from the effects of atmospheric pollutants ("tarnish"), and/or coverglass corrosion byproducts. Additionally, Dr. M. Susan Barger of the Johns Hopkins University has found the effects of chemical cleaning (tarnish removal) on the vast majority of the hundreds of daguerreotypes she has examined with the scanning electron microscope.<sup>4</sup> It is well established that chemically cleaning daguerreotypes, either with potassium cyanide or acid-thiourea solutions, results in permanent damage to the image (usually a loss of image contrast due to a roughening of the polished silver that establishes deep black), that this effect is cumulative, and that the procedure opens the plate to continued degradation at accelerated rates.<sup>5</sup>

So, have the paragons of daguerreian skill I hold as my "study collection" been tarnished and/or cleaned, and thus rendered less beautiful than they might be? In some cases, I know the answer is "yes." For other examples, I don't want to know, because it is a rare day when I can approach their tonal depth and power with one of my plates. I have seen examples by contemporary artists that are technically finer than any 19th century daguerreotype I have ever seen, but not one that has so completely redefined the daguerreotype process quality standard as the products of the Chicago Albumen Works have done for their medium.

## The Daguerreotype Apparatus

All the "improvements" that modern materials have brought to daguerreotyping equipment have affected the structure of the image not a whit. The equipment of the modern daguerreotypist is designed to produce the same image as was produced in 1850. My equipment is scaled directly from 19th century wooden examples, while that of Robert Schlaer of Santa Fe, New Mexico, incorporates modern plastics and metals in novel designs. We both still grow halides in-situ on polished silver with iodine and bromine vapor, and render images visible with the vapor of hot mercury (figs. 3 and 4).

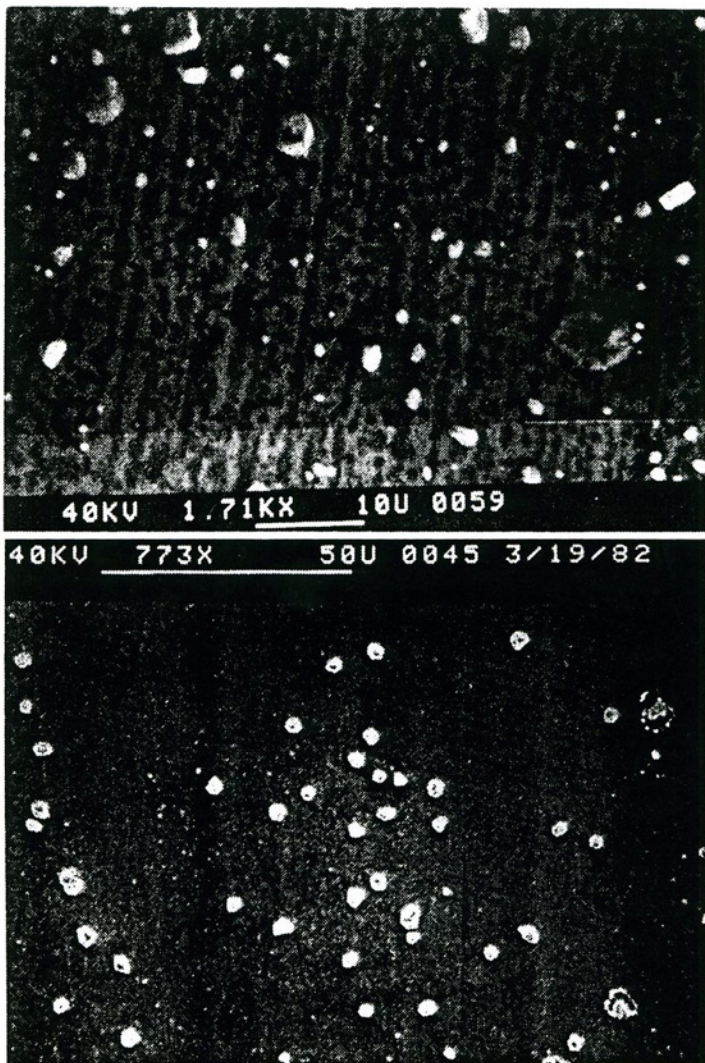


Fig. 3 & 4: (Top) Electron microscope image of a midtone area of a 19th century daguerreotype. Lighter image particles are seen on the dark background of the plate. (Micrograph by Dr. M. Susan Berger)  
(Bottom) Electron microscope image of a daguerreotype made by Irving Pobboravsky in the 1980s, showing a similar midtone area. (Micrograph by Dr. M. Susan Berger)

Modern equipment emphasizes the health of the daguerreotypist, while making his and her task easier and safer in many ways. In contrast with our predecessors, contemporary daguerreotypists employ fume hoods, mercury detection patches,<sup>6</sup> respirators, and non-toxic (i.e., non-cyanide) silver plating baths. We use powerful, high-speed electric motors to drive our primary plate buffing wheels, but still finish our plates with traditional cotton-velvet buff sticks. Electric fans ventilate our work areas, and specifically regulated electric current deposits silver on our plates and heats our mercury and gilding solution. Electric blow-dryers designed for quickly and gently drying our hair instead do their quick and gentle duty on our finished plates.

The toxicity of the chemicals used in the daguerreotype process was well-known in the 19th century, but apparently rarely precautioned.<sup>7</sup> In the late 20th century, the issue of toxic chemical exposure is inflammatory if not incendiary, and local release of chemicals such as mercury to the environment is often tightly regulated. The precautions taken by contemporary daguerreotypists are stringent in the preservation of personal health, and under controlled conditions, the release of dangerous substances to the environment while making daguerreotypes is insignificant.<sup>8</sup> Our precautions, however, must admit the potential catastrophe: what if one were to drop, shatter, and splash a one-pound bottle of elemental bromine in the basement lab? Continued development of daguerreotype equipment MUST include the requirement of maximal retention of our essential volatile chemicals.

### The Daguerreotype Plate

Daguerreotype plates produced in the 19th century were usually manufactured by the process called "Sheffield plate," pioneered in Sheffield, England, around 1742. In the Sheffield process, a wafer of silver was bound to a thicker ingot of copper and carefully heated in a special oven until they were fused. The fused block was cooled and rolled into a thin sheet that could then be cut and formed. Sheffield plate was the principal material used in silverplated house and tableware until about 1845, when electro-

plated silver gained acceptance as a reliable (and less expensive) substitute.<sup>9</sup> Despite its declining use in silverware after 1845, Sheffield plate remained the silver of choice in the daguerreotype trade, and was widely manufactured throughout the daguerreian era.

Electroplating and daguerreotype are very nearly contemporaneous. Electrodeposition of copper in a galvanic cell was first identified by De la Rive in 1836, and the phenomenon became known as the "galvano-plastic process."<sup>10</sup> By 1840, application of the process was already quite sophisticated, as exemplified by the publication of Spencer's *Instructions for the Multiplication of Works of Art in Metal*, by *Voltaic Electricity*. "Electrotyping," as this method became known, was mentioned frequently in daguerreotype manuals as a way to copy daguerreotypes, but always in the realm of curiosity rather than practice.<sup>11</sup>

Electroplating was first employed by individual daguerreotypists in the 1840s to deposit (or "galvanize") a thin layer of their own fine silver atop the commercial Sheffield-process plate shortly before use. Galvanizing was quickly adopted by daguerreotypists, and widely praised for the qualities it imparted to the daguerreotype plate. In an advertisement for the French firm Christofle, American daguerreotypist Warren Thompson noted "that silver deposited by the galvanic process is highly favorable for daguerreotypes, the whites being much less liable to solarize and the darks more transparent and more perfect in their details ..."<sup>12</sup> Christofle manufactured electroplated daguerreotype plates starting in 1851, and as a testament to their quality, several examples of their plates bear images by Southworth and Hawes.<sup>13</sup> Despite the success of Christofle, electroplating never threatened the dominance of the Sheffield process in the manufacture of daguerreotype plates. "Galvanizing," however, remained popular with quality-conscious daguerreotypists through the end of the daguerreian era.

Modern daguerreotypists rely on professional electroplaters to apply silver to carefully selected and polished copper sheets. Electroplating silver onto copper has become the least expensive, most reliable way to arrive at a

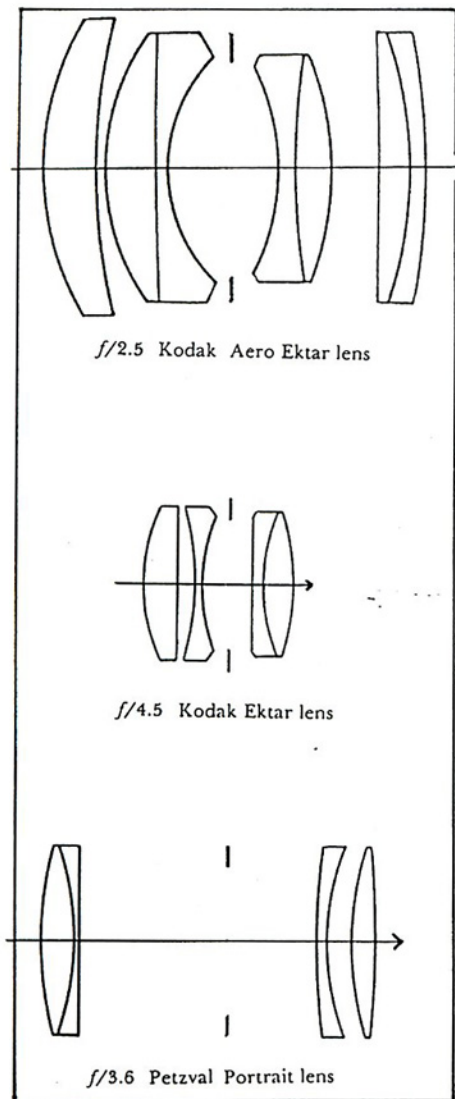


Fig. 5: Diagrams adapted from Kingslake's *History of the Photographic Lens*, scaled to show the relative sizes of the three lenses.

durable, mirrorlike silver surface on which to make daguerreotypes. Under close examination, well crafted modern plates are every bit as good as those produced in the 19th century by Gaudin, Anthony, Scovill, and Christoffe. A few modern workers have taken to "galvanizing" their plates in their own electroplating baths in pursuit of the most consistent surface possible. While I have not been able to substantiate tonal differences between plates that have been galvanized and those not galvanized, I will state that galvanized plates are a dream to buff. They "grab" the velvet rather than race off of it, and take a polish quickly and cleanly. In a process so fraught with subjective assessments, this quality alone justifies adoption of the technique.

The modern daguerreotypist, overseeing the manufacture of plates for his or her own consumption, undoubtedly pays far more attention to the quality of the individual plate than did the 19th century professional operator. Historical examples illustrate that the industrial standard for surface quality in daguerreotype plate manufacture was high indeed. If the operator of 1853 spent as much time as contemporary artists do in the preparation of equivalent silver surfaces, I doubt there would be much of a daguerreian history to research. In our age, making daguerreotypes without the plates of various manufacturers supplied by the Scovill Manufacturing Company and E. Anthony is like working in a darkroom bereft of precoated products by Kodak, Ilford, Agfa, et. al. Every daguerreotypist I have spoken with has identified plate-making as the single greatest challenge in mastering the process.

### The Lens

The first lenses used in photography were uncomplicated, made of one or two thin elements of simple glasses. These lenses had served well until that time for camera obscuras and telescopes. Daguerreotypy placed two critical demands on these lenses: "achromatism," or correction of chromatic aberration, so that the nearly ultraviolet light to which the photosensitive plate is primarily sensitive focuses on the same plane as does light to which the eye is most sensitive; and image sharpness across the full field of the picture. The original Chevalier



Fig. 6: "Alan Brown," by K. Nelson, 1980. Made with a sixth-plate Petzval-type lens by C.C. Harrison, ca. 1860. (The field of the sixth-plate lens could not cover the 4x5 inch [roughly half-plate] format of this daguerreotype, hence the strong vignetting. A lens designed to cover a half-plate format would not exhibit this tendency.) (Collection of Alan Brown, Victor, New York)



achromat supplied with the Giroux camera of 1839 satisfied these requirements fairly well, but did so at an aperture of  $f/15$ , not exactly conducive to short exposures with Daguerre's original slow process. Scarcely a year after the publication of the daguerreotype process, the Austrian firm of Voigtlander began manufacturer of the four element,  $f/3.6$  Petzval Portrait lens (fig. 5, bottom), which provided an achromatized, flat, but narrow, field at a wide aperture. A working aperture of  $f/3.6$  meant that exposure times could be reduced dramatically from those required by the  $f/15$  Chevalier achromat.

The Petzval lens was the first to be scientifically designed to meet purely photographic needs.<sup>14</sup> From then on, the science of lens design kept pace with increasingly specialized photographic requirements, and the result is today's bewildering array of modern and historical objects lumped together under the common name of "camera lenses." Modern daguerreotypists can still learn much from the remarkable lenses that first put image to silver in the early years of the process, but in fact, the whole history of photographic objectives is a playground we can choose from and experiment with. Following are a few examples:

Sensitized daguerreotype plates respond almost exclusively to light in the ultraviolet, violet, and blue regions of the spectrum, and rapidly lose sensitivity as the color of light changes towards green. Most camera lenses seem to pass light at the UV/violet end of the spectrum fairly well, and so will work for making daguerreotypes, but there are lenses that significantly curtail UV transmission.

One such UV absorbing lens is the  $f/2.5$  Kodak Aero Ektar, patented in 1941 as a fast, sharp lens for aerial photography (fig. 5, top). I bought one thinking it would be the answer to my prayers for a fast, sharp daguerreotype lens, but despite its wide  $f/2.5$  aperture, it failed to shorten exposure times as much as I had expected. When stopped down to  $f/4.5$ , daguerreotypes made with it required longer exposures than those made with my much smaller, optically simpler,  $f/4.5$  Kodak Ektar (fig. 5, middle). I

later discovered that the Aero Ektar was one of the first lenses to incorporate elements made from a new lanthanum crown glass developed by Kodak in the late 1930s. According to Dr. Rudolph Kingslake, early lanthanum glasses appeared yellowish because of unremovable traces of cerium in the melts, and lenses made with these glasses would filter out UV light very effectively (which is an advantage in aerial photography). It was not until about 1947 that lanthanum crowns could be made without the cerium and its characteristic UV-filtering yellow tint.<sup>15</sup> My 1943-vintage Aero Ektar was apparently yellow enough to significantly affect its performance relative to lenses that did not make use of the early lanthanum glass, like the  $f/4.5$  Ektar.

The very modern Zeiss UV-Sonnar is a lens designed to pass as much UV radiation as possible to the film through elements ground from quartz crystal. If any lens would be right for the daguerreotype, it ought to be this one. Grant Romer of Rochester, New York, used a 6x6 cm Hasselblad camera with a plate-holding back to test the performance of the UV-Sonnar. While the camera performed well for making daguerreotypes, Grant could detect no special performance from the lens. Surprisingly, he found it no better or worse than any other good lens he had used.<sup>16</sup>

The daguerreotypes I have made with older Petzval-type lenses suggest that the process may be fairly "technology proof" in the lens department. While not as sharp across the full field as daguerreotypes I have made with the  $f/4.5$  Kodak Ektar, pictures made with Petzvals have a smoothness and a fullness of tone (pardon the vague terminology) that I have not otherwise seen in my plates (fig. 6). Dr. Kingslake suggests that the simple, low index glasses used in the manufacture of early photographic lenses is the key: crowns were made from selected lumps of window glass, flints were made from lead-crystal tableware glass, and when thin elements of each were put together, they produced reasonably achromatic lenses of good clarity, with almost no filtration of essential near-UV and violet light.

## The Chemicals

To make a daguerreotype, a perfectly clean and polished plate of silver is exposed to the mere vapor of iodine to make it light sensitive by the formation of silver iodide, followed by a similar exposure to the vapor of bromine to "accelerate," or increase the sensitivity of the plate. The resulting surface of light sensitive silver halides is then put in a camera and exposed to an image formed by a lens. Following exposure, the image is brought forth on the silver with the vapor of heated mercury. The plate is bathed in a fixer to remove the sensitive parts, then immersed in a solution that deposits gold over its surface to make it brighter and more durable, and finally rinsed in pure water and dried. This is, of course, a dramatic oversimplification, with the emphasis on "dramatic." Every step in the process, from brushing rouge into the velvet on the buffs to blowing the last water from the finished plate, is *beautiful*.

François Arago, Daguerre's champion in the Académie des Sciences, compared a finished daguerreotype's surface to the delicacy of a butterfly's wing, but the comparison can easily be extended to describe the pure, luminous colors shown by silver that is progressively exposed to the vapors of iodine and bromine. While sensitizing my first plate, I was at once amazed at how beautiful the colors were, and how *dull* the descriptions of them had been in the daguerreian manuals I was working from. Lines like "Coating over dry iodine to an orange color, then over the accelerator, to a light rose..."<sup>17</sup> or "Coat to a deep yellow over iodine, to a cherry red over..."<sup>18</sup> failed utterly in the presence of the colors themselves, or so it seemed, until I tried to describe those colors in my own words. Much of the daguerreotype process is similarly colorful, delicate, and defying of description.

The two elements most commonly used to sensitize silver to light were still recent discoveries when Daguerre was working to refine his process in the late 1830s. Iodine was first extracted from the ashes of burnt seaweed in 1811 by B. Courtois, a French saltpetre manufacturer. The English chemist Sir Humphrey Davy noted the light-sensitivity of silver iodide in 1814, and it was tried by Niépce and Daguerre

on several occasions before Daguerre's eventual success with it in 1835.<sup>19</sup> Bromine was not identified until 1826 (the year Niépce made his photograph from the window at Gras), when A.J. Balard isolated the blood-red fluid from the bitterns of evaporated Mediterranean Sea water. Neither element is found free in nature, and both combine readily with chlorine and fluorine, the other common elements in the halogen class. By 1849, fluorine, chlorine, bromine, and iodine had all been tried to varying acclaim as sensitizing agents and/or accelerators in the daguerreotype process.<sup>20</sup>

Modern daguerreotypists have consistently used the simplest of bromine compounds, such as "bromide of lime" or "bromine water," as accelerators to increase the sensitivity of their plates. This selection can be attributed to several factors: fluorine and chlorine, the two other halogens that could be employed, are both gaseous in their natural state, and so are more difficult to handle consistently; the results reported in historical literature are mixed as to the real benefits of fluorine and chlorine for general work; and the same historical literature praises the effects of simple bromine accelerators highly.<sup>21</sup>

Many of the accelerator recipes detailed in manuals such as Humphrey's *American Hand Book of the Daguerreotype* involve exotic chemicals and complex operations that would tax the facilities and safe operating ability of any modern daguerreian hobbyist. These accelerators were available to the 19th century worker, professional and tyro alike, as ready-made compounds sold by commercial photographic suppliers. Edward Anthony listed fifteen prepared accelerating compounds in his 1854 *Catalogue of Photographic Apparatus and Material, Manufactured, Imported and Sold*. Iodine, bromine, chlorine and fluorine were all represented, either singly or by combination, in forms that required only an adjustment of strength to be ready for use. Those, indeed, were the days!

The iodine and bromine used by daguerreotypists today is extremely pure, probably much more so than the best available in the mid-19th century. Nineteenth century daguerreotypists were also prey to unscrupulous chemical manu-

facturers and suppliers. Instances were reported where iodine was cut with plumbago, an ore of lead having no photographic value, and of "American" bromine being sold as that of German manufacture, the latter perceived to be of higher purity.<sup>22</sup>

The "pure" bromine, iodine, chlorine, or fluorine of the 1840s and 1850s probably contained appreciable amounts of each other that could not be removed without great expense. Whether or not these "contaminants" affected the tone and sensitivity of plates prepared according to published formulas, we cannot know, except by inference from continued experimentation and comparison. At best, and perhaps as it should be, the modern daguerreotype is remarkably similar to its 19th century forbear in image tone and contrast, but should not be looked upon as a definitive model.

The final step in the daguerreotype process involves treating the plate in a solution of gold chloride and sodium thiosulfate, called "gilding." Gilding, along with bromine accelerators and Petzval lenses, were the three amendments to Daguerre's constitution that fundamentally refined the daguerreotype process in the early 1840s. This treatment, however, has brought more modern workers to tears than any other step in the process.

Many of the 19th century daguerreotype manuals include passages similar to: "It is not unfrequent that the [plate] surface assumes a dark, cloudy appearance [during gilding]. This is generally the best sign that the gilding will bring out the impression with the greatest degree of distinctness. Soon, the clouds gradually begin to disappear, and, 'like a thing of life' stands forth the image, clothed with all the brilliancy and clearness that the combined efforts of nature and art can produce."<sup>23</sup> Because gold is precious, only the finest plates are submitted to the "gilding" operation. Danger lurks: "...often by trying to do too well, the operator, if he persists in heating certain parts of the plate, may find...the blacks are covered by a film, or even the coating of silver may suddenly exfoliate, when small particles are detached from it; the impression is then entirely spoiled..."<sup>24</sup>

When I first started gilding daguerreotypes, gold chloride was comparatively inexpensive. I

used the gilding solution at full strength, and my plates clouded over and cleared as described above. I lost a few good images to exfoliation when things went badly. When I began diluting the gilding solution in the name of conserving gold, I found I could not expect the plate to cloud over and then clear...it would just steadily cloud over, necessitating the early removal of the plate from the gilding bath. I also found that I could not expect as much from the gilding operation in terms of brightening the image.

How is one to know whether the plate is being clouded by a film preparatory to the silver exfoliating, or whether the clouding is "the best sign the gilding will bring out the impression with the greatest degree of distinctness?" Personal experience has shown me that the phenomena are unsettlingly similar. I believe that most contemporary daguerreians respond to this question by *under-gilding* plates, myself included. We immerse our plates in gilding solutions considerably diluted from those recommended in the 19th century manuals (ostensibly to conserve gold), and remove the plates as soon as they show a sign of change. By not allowing the gilding reaction to run its course, or by using dilute gilding solutions (thus risking permanent clouding of our plates in the final step of the process), we are not taking full advantage of the capacity of the gilding technique to brighten our images.

## The Future

In 1977, Grant Romer compiled a history of the daguerreotype in the post-daguerreian era.<sup>25</sup> His work illuminates the small but persistent interest in making daguerreotypes that is found throughout the history of post-daguerreian photography. There have even been brief periods that could be called "revivals," when a critical mass of a few daguerreotypists would discover one another and share their passion for the process, thereby leaving richer evidence for historians in the form of correspondence, images, and notices. We are in one such revival period now, and Romer's assessment that "Interest in making daguerreotypes is still on the increase, particularly in countries that have strong photographic history activities in other

respects...<sup>26</sup> is as accurate today as it was in 1977.

We now have thirteen years of perspective on Romer's landmark history, and find that the practice of making daguerreotypes is more closely allied with both the study of photographic history and collecting than ever before. This alliance has wrought profound change in the philosophy and tools of daguerreotypy since the current revival started gathering momentum in the early 1970s. The sesquicentennial of photography in 1989 further invigorated interest and innovation in the process. Many serious artists are pushing the technical standard of modern daguerreotypy to that of the finest 19th century work, and are exploring subjects and aesthetics that are entirely new in daguerreian art. The age in which daguerreotypists are considered achronisms is over. The daguerreotype is not showing that it is so resistant to change, but that it can come of age for any age.

<sup>14</sup>"The 'Daguerreotype,'" *The Knickerbocker*, *New York Monthly Magazine*, vol. XIV (December 1839), p. 560, quoted in Richard Rudisill, *Mirror Image: The Influence of the Daguerreotype on American Society* (Albuquerque: University of New Mexico Press, 1971), pp. 51-52.

<sup>15</sup>M. Susan Barger, *The Daguerreotype: Image Structure, Optical Properties, and a Scientific Interpretation of Daguerreotypy* (Ph.D. dissertation, Pennsylvania State University, 1982), pp. 98-108.

<sup>16</sup>James M. Reilly, *Care and Identification of 19th-Century Photographic Prints* (Rochester, New York: Eastman Kodak Company, 1986), p. 38.

<sup>17</sup>M. Susan Barger, "Cleaning Daguerreotypes," *Studies in Conservation*, vol. 31 (1986), p. 16.

<sup>18</sup>*Ibid.*, p. 17.

<sup>19</sup>Available from Lab Safety Supply, P.O. Box 1368, Janesville, Wisconsin 53547-1368, and elsewhere.

<sup>20</sup>S.D. Humphrey, in *The Daguerreian Journal*, vol. IV (1852), p. 288, cited in Beaumont Newhall, *The Daguerreotype in America*, 3rd Revised Edition (New York: Dover Publications, 1976), p. 126.

<sup>21</sup>In 14 years of casual daguerreotypy, I have not yet gone through half of my original one-pound bottle of bromine, and by my best estimate, a couple of ounces of mercury.

<sup>22</sup>N. Hudson Moore, *Old Pewter, Brass, Copper and Sheffield Plate* (New York: Frederick A. Stokes Co., 1905), pp. 175-176, 187.

<sup>23</sup>Ernst Von Meyer, *A History of Chemistry From Earliest Times to the Present Day* (London: Macmillan and Co., 1891), p. 502.

<sup>24</sup>See S.D. Humphrey and M. Finley, *A System of Photography, Containing an Explicit Detail of the Whole Process of Daguerreotype* (Canandaigua, New York: Humphrey and Finley, 1849), pp. 70-72; S.D. Humphrey, *American Hand Book of the Daguerreotype*, 5th Edition (New York: S.D. Humphrey, 1958), pp. 167-169; and H.H. Snelling, *A Dictionary of the Photographic Art* (New York: H.H. Snelling, 1854), pp. 76-77; as examples.

<sup>25</sup>Beaumont Newhall, *The Daguerreotype in America*, 3rd Revised Edition (New York: Dover Publications, 1976), p. 121.

<sup>26</sup>Robert Sobieszek and Odette M. Appel, *The Spirit of Fact: The Daguerreotypes of Southworth & Hawes, 1843-1862* (Boston: David R. Godine, 1976), plates 3, 33, 54, 56, 61, 75, 86, 104b.

<sup>27</sup>Rudolph Kingslake, *A History of the Photographic Lens* (San Diego: Academic Press, 1989), pp. 23-27, 35-37.

<sup>28</sup>Interview with Rudolph Kingslake, June 27, 1990.

<sup>29</sup>Interview with Grant Romer, June 18, 1990.

<sup>30</sup>S.D. Humphrey, *American Hand Book of the Daguerreotype*, 5th Edition (New York: S.D. Humphrey, 1858; reprint edition, New York: Arno Press, 1973), p. 27.

<sup>31</sup>A. Bisbee, *History and Practice of Daguerreotyping* (Dayton, Ohio: Claffin & Co., 1853), p. 41.

<sup>32</sup>Helmut and Alison Gernsheim, *L.J.M. Daguerre: The History of the Diorama and the Daguerreotype*, 2nd Revised Edition (New York: Dover Publications, 1968), p. 69.

<sup>33</sup>S.D. Humphrey and M. Finley, *A System of Photography, Containing an Explicit Detail of the Whole Process of Daguerreotype* (Canandaigua, New York: Humphrey and Finley, 1849), pp. 44-48.

<sup>34</sup>H.H. Snelling, *The History and Practice of the Art of Photography* (New York: G.B. Putnam, 1849; reprint edition, Hastings-on-Hudson, New York: Morgan & Morgan, 1970), pp. 68-69.

<sup>35</sup>Humphrey, *American Hand Book of the Daguerreotype*, pp. 73, 84.

<sup>36</sup>*Ibid.*, pp. 47-48.

<sup>37</sup>Robert Hunt, *Photography: A Treatise on the Chemical Changes Produced Solar Radiation, and the Production of Pictures from Nature* (New York: S.D. Humphrey, 1852), p. 249.

<sup>38</sup>Grant Romer, "The Daguerreotype in America and England after 1860," *History of Photography*, vol. 1, no. 3 (July 1977), pp. 201-212.

<sup>39</sup>*Ibid.*, p. 211.