 Greta Glaser, "Platinum Enlargements," in *Platinum and Palladium Photographs: Technical History, Connoisseurship, and Preservation*, ed. Constance McCabe (Washington, D.C.: American Institute for Conservation of Historic and Artistic Works, 2017), 192–203.

Platinum Enlargements

Greta Glaser

Figure 1. Edward Curtis, *The Vanishing Race*, 1904. Enlarged platinum print, 40.6 × 50.8 cm. University of Pennsylvania Museum Archives.

Modern accounts of platinum photographic technology suggest that platinum prints are made strictly by contact printing and that creating a large print requires a large negative (fig. 1). Late nineteenth-century literature indicates, however, that photographers were capable of and dedicated to making enlarged platinum prints using both solar and electric light sources (fig. 2).[1] Specially made cameras could be modified for enlarging, reducing, and projecting lanterns slides.[2] In fact, advertisements of the same period suggest that the practice of enlarging by both contact and projection was common soon after the introduction of the platinum process (fig. 3).

Photographers who made enlarged platinum prints include Thomas Eakins (1844–1916), F. Holland Day (1864–1933), Heinrich Kühn (1866–1944), Edward Curtis (1868–1952), Clarence H. White (1871–1925), Paul Strand (1890–1976), Irving Penn (1917–2009), and Richard Benson (b. 1943). Kühn, for example, was no stranger to enlarging. He had been making photomicrographs while a medical student prior to 1890, when his interests turned solely to photography. Understanding different photographers' working methods and close examination of their prints may reveal clues as to how the prints were produced and are essential for determining whether platinum enlargements were made by contact or projection.[3] This overview of the equipment, materials, chemistry, and working methods is intended to provide a greater understanding and appreciation of these rare photographs.

Figure 2. Rockwood Solar Printing Company advertisement for solar and electric printing. From *Philadelphia Photographer* 20, no. 230 (February 1883): 3.

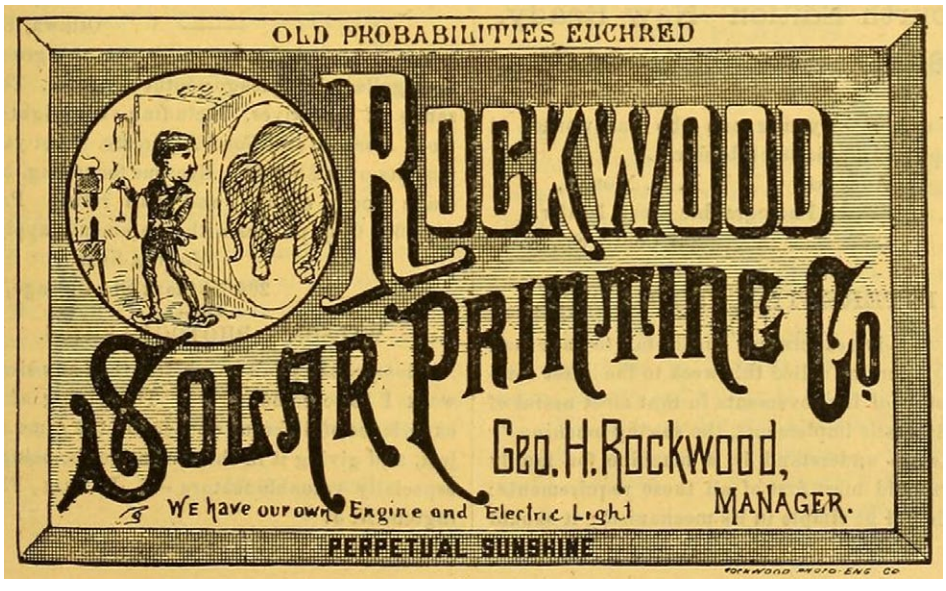
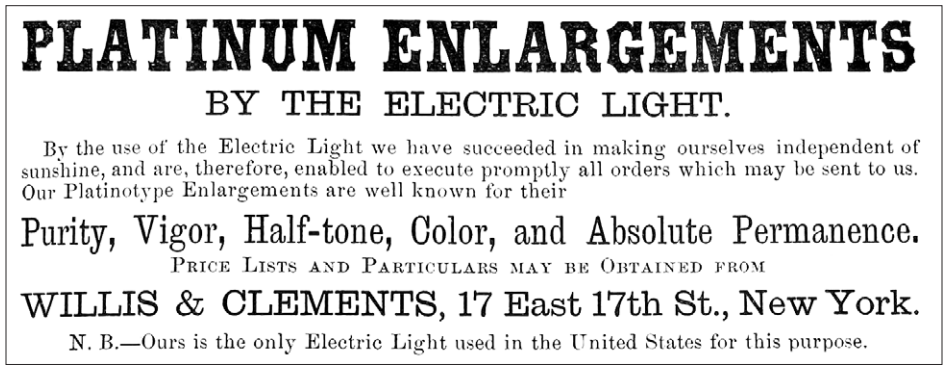


Figure 3. Willis & Clements advertisement for "Platinum Enlargements by the Electric Light." From *Philadelphia Photographer* 17, no. 203 (1880): 57.



 Greta Glaser, "Platinum Enlargements," in *Platinum and Palladium Photographs: Technical History, Connoisseurship, and Preservation*, ed. Constance McCabe (Washington, D.C.: American Institute for Conservation of Historic and Artistic Works, 2017), 192–203.

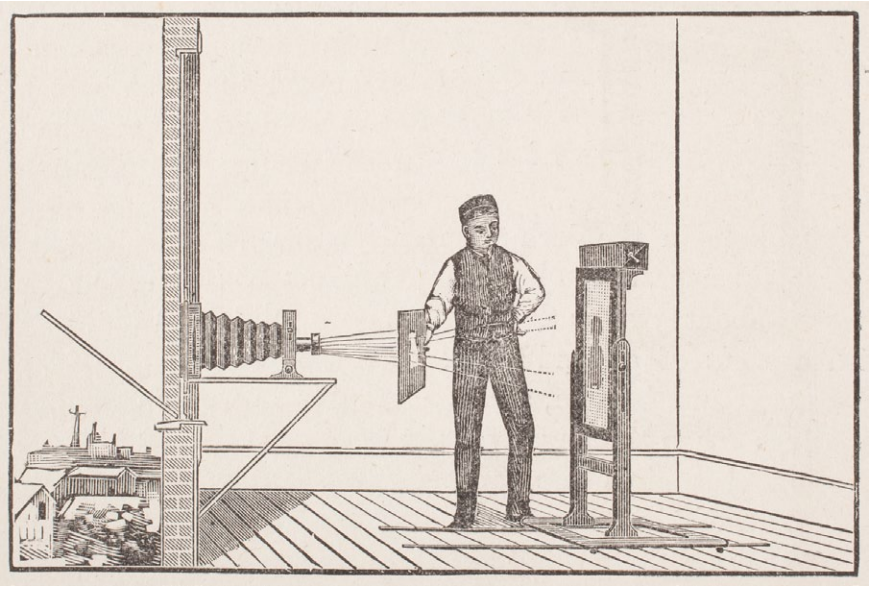


Figure 4. Illustration of an enlarging apparatus and the operator vignetting a portrait. From William Henry Burbank, *Photographic Printing Methods: A Practical Guide to the Professional and Amateur Worker* (New York: Scovill & Adams, 1889), 112.

Photographic enlargements can be printed using one of three common methods:

1. An enlarged copy negative is a second-generation negative made using a large-format camera to photograph an existing positive image, such as a print or daguerreotype, to be contact-printed in the desired larger format (copy print).
2. An enlarged duplicate negative is made by exposing the original negative onto a plate or film to create an interpositive transparency.[4] The interpositive may be made by contact-printing the original negative to produce a same-size positive, from which an enlarged duplicate negative is made by projection. Alternatively, the original negative may be projected to produce an enlarged interpositive from which a duplicate negative is made by contact. The enlarged duplicate negative is then printed to make a same-size print. Both the copy negative and the duplicate negative made from the interpositive can be larger or smaller than the original negative, accordingly.
3. Direct enlargements are made by projecting light through the original negative and an optical system onto sensitized photographic paper.

A Condensed History of Enlarging by Projection

Platinum enlargements were possible in the late nineteenth century because optical and photographic technologies converged at a point that made them economically viable and widely popular. Long before the invention of photography, eighteenth- and early nineteenth-century scientists working with projecting microscopes sought a way to permanently capture what they saw. A projecting microscope works by placing it in a window of a darkened room, while a mirror on the exterior of the window directs sunlight through a lens (fig. 4). The image is then projected onto paper, where it was usually traced with a pen or pencil. Permanently recording such images using light was not practical until 1839, when Sir John Herschel (1792–1871) found a way to halt the action of light on silver halides using sodium thiosulfate to "fix" the image. Herschel described his photographic enlarging system that employed a projecting solar microscope to fellow scientist Henry Fox Talbot (1800–1877),[5] who in turn also found the solar microscope to be a useful instrument. Talbot claimed he could use this instrument to make paper prints up to 17 times larger than the original object with only a 15 minute exposure.[6] Early solar enlargers or solar cameras, like solar microscopes, relied on consistent, intense sunlight and required exposure times as long as 2 or 3 hours to create salted paper and albumen prints from collodion negatives.[7]

Enlarging Lenses and Condensers

The platinum process, like all printing-out processes, requires a considerable amount of ultraviolet (UV) energy to act upon the light-sensitive material to form an image. Most enlarging systems require several glass components that significantly reduce the amount of ultraviolet energy reaching the projected image. The salted paper and albumen processes are therefore impractical to print by direct enlargement due to their long exposure times. In comparison, securing an image by projection using William Willis Jr.'s (1841–1923) developing-out platinum process was approximately 3 times faster.[8] Developed-out silver bromide papers, introduced in the 1880s, effectively superseded the use of the printed-out salted paper and albumen processes, but platinum enlargements continued to be made until World War I.

The lens is among the most important components of an enlarging system because the quality of the glass and

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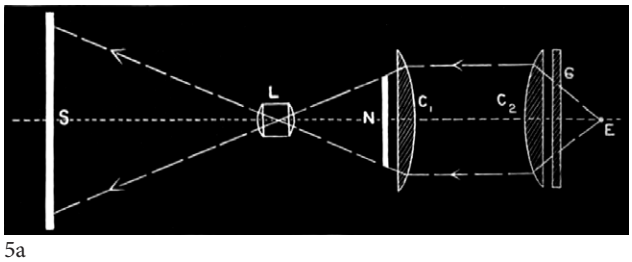
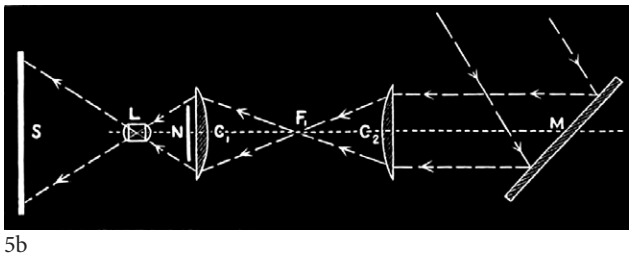
lens design determine the strength of the projected image and therefore the print. Concurrent improvements in the late nineteenth century in lens design and an increase in the number of lens manufacturers greatly aided the advancement of projection enlargement. For enlarging, a lens with a flat field that can be used with a large aperture is most desirable; therefore the preferred enlarging lens in the early twentieth century was the universal anastigmat. Introduced in 1890, this lens corrected for astigmatism and optical aberrations and can be used with a large field of view.[9] Consequently distortions from lens aberrations found in large-format prints could be evidence of creation by projection enlargement prior to the introduction of the universal anastigmat.

Condensing lenses were often part of enlarging systems because they allowed the photographer to maximize the efficiency of the light traveling through the enlarging components. A condenser concentrates light, which is useful when the light source is not directed at the enlarging lens. While the simplest enlarging systems have no condenser lens, some were built with two or even three in sequence (fig. 5).[10] Each additional piece of glass absorbs UV energy, so some photographers may have chosen to limit the number of condensers or dispense with them altogether to reduce exposure times.



5a



5b

Figure 5. Diagrams of enlarging systems. From William de Wiveleslie Abney and Lyonel Clark, *The Platinotype: Its Preparation and Manipulation*, 2nd ed. (New York: Scovill & Adams, 1898), 144, 146. C= condenser, L = lens, M = mirror, N = negative, S = sensitized paper; E = incoming light, F_1 = focal length of condenser ([C_1]).

5a. Diagram illustrating the positioning of the enlarging apparatus to project the image onto the sensitized paper.

5b. Diagram illustrating the use of a mirror to reflect light toward the condenser.

Light Sources

Sunlight is the most powerful source of light on Earth. However, its strength depends on the weather and season. Cloud cover can fluctuate throughout the day, and the angle of the sunlight constantly changes direction as the Earth rotates. The strength of sunlight outside of the equatorial zones varies seasonally due to the Earth's tilted axis and rotation around the sun. Alternatives to solar light in the nineteenth century were limited, expensive, and often dangerous. These included magnesium ribbons, the oxyhydrogen lamp (also called the limelight or Drummond light), and electric lamps such as the carbon arc lamp.

Before long-distance transmission of electricity was standard, the use of electric-powered lights was an expensive endeavor requiring elaborate mechanisms and steam engines to generate power.[11] Limelight was a practical alternative for nineteenth-century photographers before electricity was in general supply. It relies on a chemical reaction that produces both candoluminescence and incandescence in which an oxyhydrogen flame is used to heat a cylinder of calcium oxide or quicklime.[12] Limelight was popularly used with magic lanterns, and some saw its application with the solar camera almost as soon as it was invented.[13] Its flame and combustible ether fuel supply, however, which were kept in close proximity to each other, posed significant hazards.

The advent of electric utilities by the early twentieth century enabled the use of two types of electric lights for projection printing: the carbon arc lamp and the high-pressure mercury-vapor lamp. Projection by carbon arc light was advertised in the 1880s as providing great utility for large photographic firms, especially in areas with frequent cloud cover. High-pressure mercury-vapor lamps, introduced by Peter Cooper Hewitt in 1901, provided another practical alternative to limelight.[14]

Alfred Clements (1846–?), Willis's partner in the United States–based firm Willis & Clements, was the first to conceive of the idea of using electric lamps to make platinum prints by projection. He offered enlarging services at the firm's New York studio before moving the operation to Philadelphia.[15] The following account is from the *Photographic Times*:

> Having met Professor Chandler, of the School of Mines, Columbia College, and learned from him that he had a lantern in which he used electric light in his lectures for the purpose of projections upon the screen, Mr. Clements was given permission to make experiments with this lantern in the college where he

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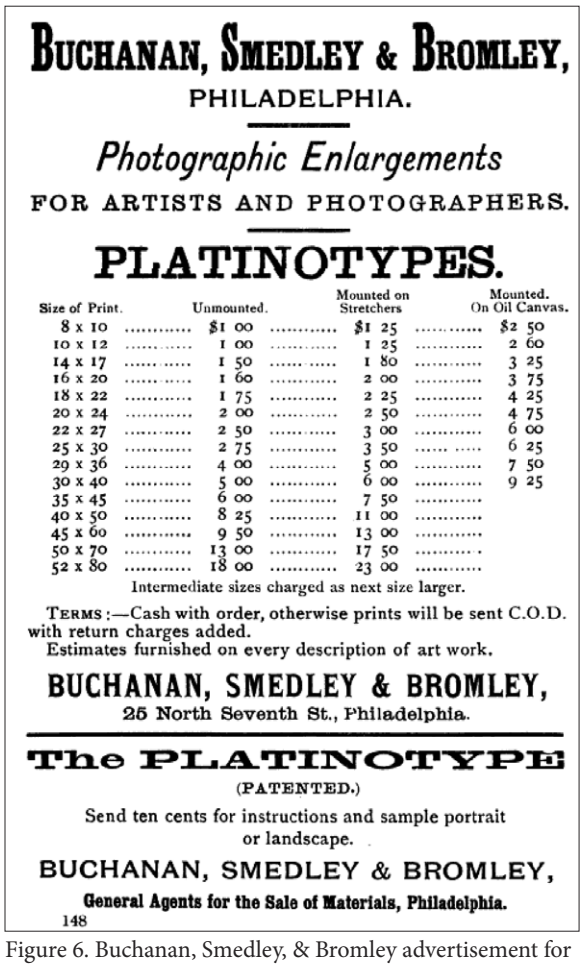

BUCHANAN, SMEDLEY & BROMLEY,

PHILADELPHIA.

Photographic Enlargements

FOR ARTISTS AND PHOTOGRAPHERS.

PLATINOTYPES.

Size of Print.	Unmounted.	Mounted on Stretchers	Mounted. On Oil Canvas.
8 x 10	$1 00	$1 25	$2 50
10 x 12	1 00	1 25	2 60
14 x 17	1 50	1 80	3 25
16 x 20	1 60	2 00	3 75
18 x 22	1 75	2 25	4 25
20 x 24	2 00	2 50	4 75
22 x 27	2 50	3 00	6 00
25 x 30	2 75	3 50	6 25
29 x 36	4 00	5 00	7 50
30 x 40	5 00	6 00	9 25
35 x 45	6 00	7 50	
40 x 50	8 25	11 00	
45 x 60	9 50	13 00	
50 x 70	13 00	17 50	
52 x 80	18 00	23 00	

Intermediate sizes charged as next size larger.

TERMS:—Cash with order, otherwise prints will be sent C.O.D. with return charges added.
Estimates furnished on every description of art work.

BUCHANAN, SMEDLEY & BROMLEY,
25 North Seventh St., Philadelphia.

The PLATINOTYPE
(PATENTED.)

Send ten cents for instructions and sample portrait or landscape.

BUCHANAN, SMEDLEY & BROMLEY,
General Agents for the Sale of Materials, Philadelphia.

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Figure 6. Buchanan, Smedley, & Bromley advertisement for platinum enlargements in sizes up to 52 × 80 inches. From *Photographic Mosaics: An Annual Record of Photographic Processes, 1885* (New York: Edward L. Wilson, 1885), 148.

demonstrated the practicability of the light for this his purpose.

He afterward went to the Technological Institute of Hoboken, where the opportunity of testing the sensitiveness of Platinotype paper by a more powerful light was given him, and here he found the possibility of printing by this method entirely practicable, and he gave an order to the Institute for a lantern, the condensing lenses being made for it after Professor Morton's formula. The firm now fitted up a place on 17th Street, New York, launched into the business of electric light printing in platinum, and although their apparatus was crude, by careful application to the mechanical part of their labor and a liberal outlay of money they met with much success. For a long time they were the only firm in the world to use electric light. Now everyone in the copying business uses it, as it is an admirable substitute for sunlight and one that is always available.[16]

Clements's experiments proved to be successful for the business. An account of a 1911 tour of the Platinotype Company facilities at Penge, a suburb of London, describes the enlarging department as

> recently installed for making platinum prints from customers' negatives as also of enlargements. Printing is done entirely by mercury-vapour lamps. . . . In this department was also seen a large apparatus by means of which enlargements on the paper are made directly from the negative. The illuminant is a powerful arc lamp, which, in conjunction with an objective of aperture F 3.5, allows of an enlargement being made with an exposure of about three hours.[17]

Another account of a visit by the Croydon Camera Club to the Platinotype Company later that same year describes the lamps in more detail: "Here mercury lamps entirely supplant fickle day-light, and the blaze of light that came from one battery in operation of twenty-four 2 feet tubes amply demonstrated the power of the illuminant. It was stated that the mercury light gave platinotype print indistinguishable from those obtained by daylight, and was in this respect far superior to the arc lamp."[18]

Negatives

Making a platinum print by projection was efficient only when one or a few enlargements were required, because the weaker light needed longer exposure times than when contact-printing. If only one enlarged platinum print was desired, it may have been more economical to print a direct enlargement from a negative produced expressly for direct enlargement rather than to create an enlarged negative. When several prints were ordered, the usual method was undertaken: an interpositive transparency was made from the original negative, and from that an enlarged duplicate negative was made. For example, a commercial enterprise that printed and sold pictures of art or architecture, such as Frederick Hollyer (1838–1933), could have used multiple copy or duplicate negatives of varying sizes to mass-produce prints, exposing by projection or contact using electric light for product consistency and economy.[19]

To create a negative to be used specifically for enlarging by projection, it was important to properly time the exposure within the camera and carefully develop the negative to achieve the ideal image density. Period literature describes the best qualities of negatives for enlarging as delicate, transparent, smooth-surfaced, and unvarnished to reduce distortions that may be enhanced once

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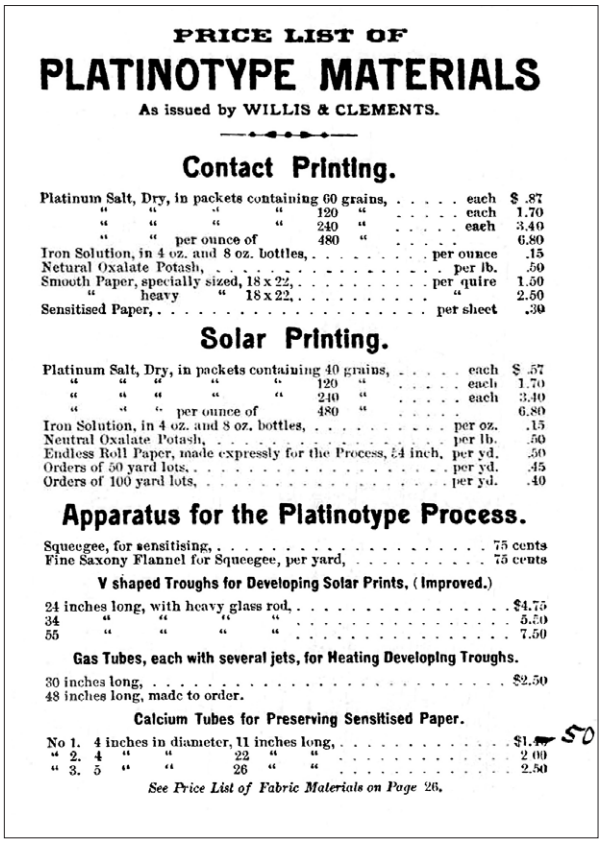

PRICE LIST OF

PLATINOTYPE MATERIALS

As issued by WILLIS & CLEMENTS.

Contact Printing.

Platinum Salt, Dry, in packets containing 60 grains,	each	$ .87
" " " " 120 "	each	1.70
" " " " 240 "	each	3.40
" " per ounce of 480 "		6.80
Iron Solution, in 4 oz. and 8 oz. bottles,	per ounce	.15
Netural Oxalate Potash,	per lb.	.50
Smooth Paper, specially sized, 18 x 22,	per quire	1.50
" heavy " 18 x 22,	"	2.50
Sensitised Paper,	per sheet	.30

Solar Printing.

Platinum Salt, Dry, in packets containing 40 grains,	each	$ .57
" " " " 120 "	each	1.70
" " " " 240 "	each	3.40
" " per ounce of 480 "		6.80
Iron Solution, in 4 oz. and 8 oz. bottles,	per oz.	.15
Neutral Oxalate Potash,	per lb.	.50
Endless Roll Paper, made expressly for the Process, 24 inch,	per yd.	.50
Orders of 50 yard lots,	per yd.	.45
Orders of 100 yard lots,	per yd.	.40

Apparatus for the Platinotype Process.

Squeegee, for sensitising,	75 cents
Fine Saxony Flannel for Squeegee, per yard,	75 cents

V shaped Troughs for Developing Solar Prints. (Improved.)

24 inches long, with heavy glass rod,	$4.75
34 " " " "	5.50
55 " " " "	7.50

Gas Tubes, each with several jets, for Heating Developing Troughs.

30 inches long,	$2.50
48 inches long, made to order.	

Calcium Tubes for Preserving Sensitised Paper.

No 1. 4 inches in diameter, 11 inches long,	$1.50
" 2. 4 " " 22 " "	2.00
" 3. 5 " " 26 " "	2.50

See Price List of Fabric Materials on Page 26.

Figure 7. Platinotype Company price list for solar platinum and solar iron sold by the Platinotype Company. From Willis & Clements, *The Platinotype* (Philadelphia: Clements Printing House, 1885), 25.

projected.[20] The image material in the selected negative should be "thin" (low in density) and the shadows only dense enough to barely distinguish them from the clear glass base.[21] The clarity of the glass support of collodion negatives provided advantages over paper and even gelatin negatives, which have significantly higher density in the shadows (base plus fog). The enhanced light transmission during projection allowed for shorter exposures.[22] Even after the introduction of gelatin glass negatives, collodion negatives continued to be in common use for many graphic arts applications well into the twentieth century, and they may have still been popular for making platinum enlargements due to their fine silver-image grain and capacity for producing high-resolution enlargements.

Crayon Portraits

An example of a print that would have been more economical to produce from a single negative by projection is the crayon portrait, which was popular from the 1850s to the early twentieth century and was generally made as a one-of-a kind enlargement. Advertisements for crayon portraits in platinum and the materials to create them are frequently seen in the period literature (figs. 6, 7). The underlying photographic image in a crayon portrait can be similar in appearance whether produced by a platinum or by a silver process. The neutral black image tone common in both processes provides a background image akin to underdrawing common in watercolor paintings and pastel drawings. One case of a platinum crayon portrait is a portrait thought to be of Juana Briones de Miranda in the Point Reyes National Seashore Archive (fig. 8).[23] Signs of lens distortions or flaws in the original negative that may otherwise be apparent around a print's perimeter often may not be visible in the photographic print when embellishments such as vignetting and hand-applied media are present. Without these signs, and without x-ray fluorescence analysis (XRF), it is difficult to distinguish a platinum crayon portrait from one made in silver, though any enlargement made before 1873 would be silver.

Paper and Processing Chemistry

A wide range of commercial platinum papers was available by the end of the nineteenth century, including some that were designed for enlargement. Manufacturers of paper raw stock, such as Steinbach and Rives, advertised papers

Figure 8. Photographer unknown, [*portrait of a woman believed to be Juana Briones de Miranda*], image c. 1850s. Later crayon portrait (enlarged platinum), 45.7 × 55.9 cm. Courtesy National Park Service, Point Reyes National Seashore Museum, PORE 9806.

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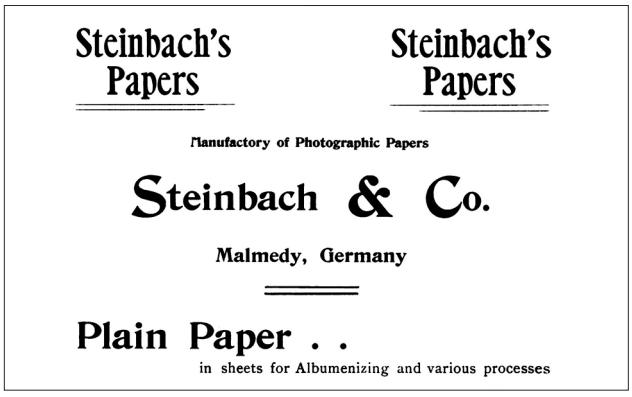

Figure 9. Steinbach & Company advertisement for plain papers. From *The International Annual of Anthony's Photographic Bulletin,* vol. 7, *1895* (New York: E. & H. T. Anthony, 1895), 34.

that could be coated by photographers for platinum printing (fig. 9), while the Platinotype Company and others provided presensitized sheets cut to various sizes. Willis & Clements conveniently sold all the necessary chemicals and supplies for making platinum enlargements, including unsized papers and specially formulated components for sensitizing the paper. The company marketed premixed iron solutions as "red label" for contact-printing and "black label" for solar-enlarging (see fig. 7).[24] Unfortunately, the specific components of these iron solutions were not divulged.

Professional and amateur photographers often shared instructions for preparing sensitizer for platinum enlargements, and these are found throughout period journals and handbooks.[25] In general, to make a sensitizer for a conventional platinum print by contact, the ratio of potassium tetrachloroplatinate (K_2PtCl_4) to ferric oxalate ($Fe_2(C_2O_4)_3 \cdot 6H_2O$) was approximately 1:1 in water, a ratio that corresponds to 1 platinum atom for every 2 iron atoms. To make papers more sensitive to light for exposure by projection, the sensitizer required a greater ratio of iron to platinum. By increasing the amount of ferric oxalate the sensitizer should, in theory, be more sensitive to light. Sensitivity to light is diminished in enlarging systems that transmit less light than in contact-printing.

The ratio of platinum to iron could also be adjusted to account for differences in the negative density. Decreasing the concentration of platinum will, in theory, decrease the internal filter effect by allowing more UV light to reach the iron, thus increasing photochemical sensitivity but at the same time resulting in diminished maximum density.[26] Henry Kimball suggested, "Sometimes it is better when printing from dense negatives to use less platinum in the sensitizer—1.6 grams to the ounce of iron instead of 2.6—so also is the opposite correct when printing from thin negatives—3.2 grams will be better than 2.6 grams."[27] The photographer and chemist Charles Needham suggested using as much as 3.8 grams of platinum to 1 ounce of iron solution for enlarging purposes.[28] The fastest process would have been the first "cold-bath" method, introduced in 1887, in which the paper was sensitized with ferric oxalate and the platinum salt was introduced in the developer.[29]

Distinguishing Direct Enlargements from Prints Made with Enlarged Negatives: Case Studies

Thorough investigation into the working techniques and technologies available to photographers is essential to understanding a print's fabrication process. During the study reported here, solar enlargements and contact prints made with enlarged negatives were closely examined to determine what visual evidence may be found in a print to distinguish various types of enlargements. Known samples of platinum enlargements by various artists working in the late nineteenth and early twentieth centuries were compared.

Edward Curtis

One prolific photographer whose working methods provided insight into this study is Edward Curtis. Curtis made multiple platinum prints of the same image in several different sizes. An example is the iconic *The Vanishing Race* from his Native American series, prints of which are in the University of Pennsylvania Museum Archives, the National Anthropological Archives, the Library of Congress, and the New York Public Library (NYPL) (see fig. 1). Curtis's meticulous cataloging system can be used to track how his prints evolved over a brief period of time.

For example, Curtis's numbering system changed from a unique number ("× 984") to later include a dash and two digits representing the date of the negative ("378–04") (fig. 10). The handwriting in each image appears to be identical, but the retouched inscription in the enlargements is several times larger than the unretouched inscription. The inscription "378-04" in the University of Pennsylvania Museum Archives (see fig. 10d) print is sharp and clear, suggesting it was written on an enlarged copy negative from which the larger prints were made by contact-printing.[30] Similar details may be compared in other prints of the same image to decipher a photographer's working method.

Clues to recognizing prints made from enlarged negatives may also include the presence of features in the source print, such as greatly enhanced paper texture

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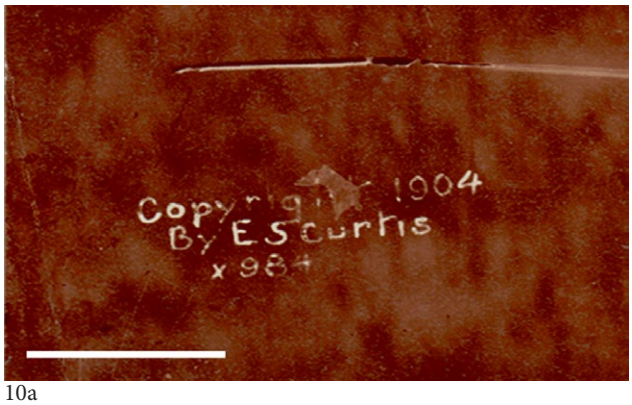
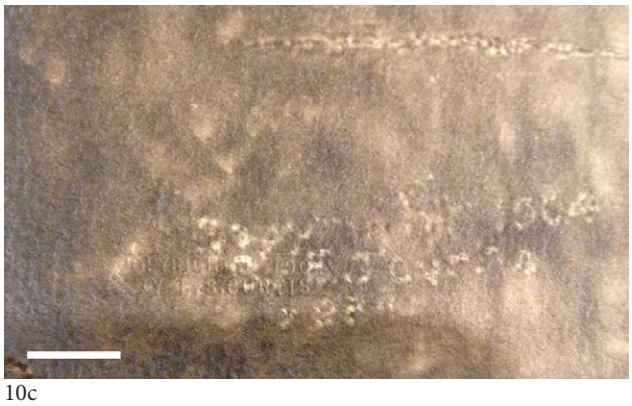
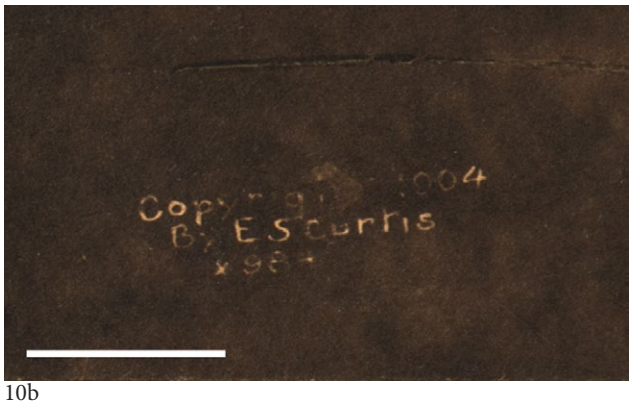


10a



10c



10b

10d

Figure 10. Details of *The Vanishing Race* (fig. 1).

10a. Gelatin silver developed-out print, 15.2 × 20.3 cm. National Anthropological Archives. An inscription reads, "Copyright E S Curtis 1904 × 984." Scale bar = 1 cm.

10b. Platinum print, 15.2 × 20.3 cm. Library of Congress. The inscription is the same as in the National Anthropological Archives print (see 10a). There is additional retouching in the scratch above the inscription. Scale bar = 1 cm.

10c. Enlarged platinum print, 40.6 × 50.8 cm. New York Public Library. The inscription "Copyright E S Curtis 1904 × 984" has been retouched in the negative and is barely visible. Scale bar = 1 cm.

10d. Enlarged platinum print, 40.6 × 50.8 cm. University of Pennsylvania Museum Archives. The earlier inscription is barely visible, and a newer inscription reads "378-04." Scale bar = 1 cm.

captured by the copy negative or damage or retouching that may indicate that an enlarged duplicate or copy negative of a smaller negative or print was used in the process. The enhanced paper texture and the scratch above the inscription observed in the Library of Congress print (see fig. 10b) is just one example.[31]

Paul Strand

Paul Strand employed interpositive transparencies to produce enlarged negatives for printing in platinum. The Philadelphia Museum of Art houses seventy-one of his 4¼ × 3¼ inch glass interpositives (which he called "lantern slides") and several of his enlarged platinum prints. Strand manipulated the images on these small glass positives by retouching, then cropping them with paper masks in preparation for printing on a larger scale (up to 13 × 9 inches). For example, to enhance *St. Patrick's Cathedral*, Strand secured a sheet of frosted glass to the interpositive plate to soften the final image and he shaded areas on the frosted glass with a pencil to adjust contrast, notably in the stairs along the bottom and in the upper corners.[32] He then projected his lantern slides onto 11 × 14 inch glass-plate negatives, from which he made his contact prints.

Thomas Eakins

Thomas Eakins produced his platinum enlargements by projection. The untrimmed margins in several of Eakins's photographs preserve important evidence, which Lee Ann Daffner used to identify Eakins's prints as direct enlargements.[33] The presence of white "reverse shadows" that radiate from individual pinholes along the margins, where straight pins were used to hold the sensitized paper, provide evidence that these prints were made by projection.[34] Though the focus is somewhat soft, a feature not uncommon for contact prints of that era, these prints appear otherwise indistinguishable from platinum prints made by contact. Furthermore, the edges of the images do not appear to "fall off," indicating the illumination across the

Greta Glaser, "Platinum Enlargements," in *Platinum and Palladium Photographs: Technical History, Connoisseurship, and Preservation*, ed. Constance McCabe (Washington, D.C.: American Institute for Conservation of Historic and Artistic Works, 2017), 192–203.

Figure 11. Photographer and subject unknown. Platinum enlargement (7×), 10.1 × 6.4 cm, made by projection with electric light from a 35 mm safety film negative in the National Gallery of Art, Photograph Conservation Department Study Collection.

entire image was even.[35] Evidence such as reverse shadows is rare in enlarged platinum prints, so one must seek other visual indications to differentiate direct enlargements from contact prints made with enlarged negatives.

Printing Modern Enlargements

To better understand how platinum enlargements were originally made, the author retraced the steps to produce both solar and electric light sources. Many nineteenth- and early twentieth-century light sources are difficult to duplicate and are considered dangerous, so safety precautions took precedence over comprehensive historic research.[36] This hands-on experience provided insight and appreciation for a process where technical challenges can be surmounted only with experience.

The first attempt to create a platinum enlargement by projection utilized an ultraviolet light-emitting diode (LED) flashlight.[37] A 7× enlarged platinum image was successfully produced with an approximately 6 hour exposure (fig. 11).[38] To attempt enlarging using sunlight, the historic photographic process specialists France Scully and Doug Munson joined the challenge to produce solar enlargements, sharing their specialized equipment and knowledge.

Munson created a set of light valve technology (LVT) negatives for contact-printing and solar-enlarging (fig. 12).[39] Under the guidance of Scully at the Scully & Osterman Studio, Rochester, New York, several attempts were

12a

12b

Figure 12. Photographer and subject unknown. Two negatives printed on light valve technology (LVT) film for comparing solar-enlarging and contact-printing. Original gelatin dry-plate negative courtesy of The Metropolitan Museum of Art, Photograph Conservation Study Collection.

12a. Negative adhered to glass, 16.5 × 10.1 cm.

12b. Enlarged negative, 21.6 × 17.8 cm. The enlargement ratio of the original to the enlarged negative is 6.6:1. This enlarged negative is intended for contact-printing.

13

Figure 13. Solar platinum enlargement made from the negative shown in figure 12a, 22.9 × 19 cm, made using LVT negative with a 2 hour exposure.

Greta Glaser, "Platinum Enlargements," in *Platinum and Palladium Photographs: Technical History, Connoisseurship, and Preservation*, ed. Constance McCabe (Washington, D.C.: American Institute for Conservation of Historic and Artistic Works, 2017), 192–203.

made to produce a solar enlargement.[40] The first attempt with the solar enlarger yielded a faint print after a 2 hour exposure through the LVT negative (fig. 13). A lower-density collodion negative was also employed with the same exposure time (fig. 14). Although this second print achieved greater tonal range, its details are blurred due to the constant adjustment of the mirror over the long exposure. It is likely that nineteenth-century photographers did not employ this intensive method of enlargement for processes that required long exposures.

While no completely successful solar enlargements were produced during the study, the experience demonstrated that to successfully print a direct platinum enlargement requires no small amount of skill, knowledge, and patience.

Conclusions

The technology that allowed nineteenth-century photographers to successfully produce platinum enlargements was already in use to create projected images before the platinum process was perfected. These photographers were steadfastly determined to produce enlarged platinum prints, and with all the necessary tools finally at their disposal, their success was achieved through experimentation and ingenuity. They traversed multiple avenues to manipulate their images to fit their artistic visions, and their superb enlarged platinum prints testify to their remarkable mastery of their craft.

Recent attempts to create modern platinum enlargements revealed that the challenges of making platinum enlargements by both solar and electric light are formidable, that experience trumps the quality of any equipment, and that the practice of platinum enlargement is a labor requiring patience and skill. And while much was discovered regarding the characteristics of these prints, it was ultimately determined that expertly printed platinum enlargements made by projection are often indistinguishable from ones made by contact from enlarged negatives.

Understanding the skill and persistence necessary to achieve successful platinum enlargements contributes to our appreciation and admiration of them. Platinum enlargements, whether made by projection or with enlarged negatives, are extraordinary feats of creativity and technical proficiency. Platinum enlargements mark a significant period in photographic history in which the artistic and technological achievements were harmoniously synchronized. Many platinum enlargements in our collections are waiting to be discovered by careful examination and appreciated for the skill it took to create them.

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14a

14b

Figure 14. Photographer and subject unknown. Glass-plate negative and corresponding platinum enlargement.

14a. Collodion glass-plate negative, 12.7 × 10.2 cm. Courtesy of Scully & Osterman Studio.

14b. Solar platinum enlargement, 22.9 × 19 cm, made using glass-plate negative shown in figure 14a with a 2 hour exposure.

40 Greta Glaser, "Platinum Enlargements," in *Platinum and Palladium Photographs: Technical History, Connoisseurship, and Preservation*, ed. Constance McCabe (Washington, D.C.: American Institute for Conservation of Historic and Artistic Works, 2017), 192–203.

Notes

1. Burbank 1889, 109–31.

2. Scovill & Adams Company advertisement, *American Annual of Photography and Photographic Times Almanac,* vol. 10, *1896* (New York: Scovill & Adams, 1896), cxc.

3. On Kühn, see Mahler 2012, 117; Andreas Gruber, "The Platinum Print Technology of the Austrian Pictorialist Heinrich Kühn," in this volume. See also Lee Ann Daffner, "Art and Enlargement: The Platinum Prints of Thomas Eakins"; Vasilios Zatse and Constance McCabe, "Irving Penn's Platinum-Palladium Prints"; and Tatiana Cole, "The Platinum Renaissance: Oral Histories of Platinum-Palladium Printers and Artists," in this volume.

4. For Kühn's use of paper negatives, see Gruber, "Platinum Print Technology of Kühn," in this volume.

5. Ostroff 1984, 7.

6. Talbot 1839, 27.

7. For more reading, see Whitman 2005.

8. [Tennant] 1899, 334. See also Mike Ware, "The Technical History and Chemistry of Platinum and Palladium Printing," in this volume.

9. Beck and Andrews 1903, 155–56, 211.

10. Abney and Clark 1898, 142; "Solar Printing" 1880, 50.

11. "Solar Printing" 1880, 49–50.

12. Lauginie 2015, 22.

13. Drawings for solar cameras used with nonsolar light are found in Monckhoven 1863, 285–300, and are re-created in "Solar Printing" 1880, 50.

14. M. Whelan and R. De Lair, "The Electric Light," Edison Tech Center, www.edisontechcenter.org.

15. Willis 1880, 232–33.

16. [Woodbury] 1895, 218.

17. "Visit to the Works" 1911, 16.

18. "Croydon Camera Club" 1911, 884.

19. Hollyer 1902. By 1897 Alfred Clements had also assumed the business title "The London Art Publishers" in the United States, selling reproductions of famous artworks, including those by Frederick Hollyer. See London Art Publishers advertisement for photographic art reproductions, *Harper's Magazine* 97 (1898): 17.

20. Kimball 1894, 502; "Negatives for Enlarging" 1892, 40; Willis and Clements 1885, 15; Pringle 1886, 588; Tissandier 1876, 151; Immke 1881, 130.

21. "Negatives for Enlarging" 1892, 40. It should be noted that, in general, contrast is enhanced when printing by projection because of light-scattering effects, first described by André Callier in 1909. Consequently, negatives of lower contrast are better for projection printing. See Callier 1909.

22. "Solar Printing" 1880, 50; Tissandier 1876, 151.

23. This crayon portrait was identified by XRF as platinum by Gawain Weaver Art Conservation, San Francisco, August 6, 2013. The spectrum indicated the presence of platinum, iron, and lead.

24. Willis and Clements 1885, 5, 14.

25. In the following discussion, measurements in the literature have been converted to modern equivalents.

26. Mike Ware, personal communication, September 14, 2015.

27. Kimball 1894.

28. Needham 1884, 605.

29. Clements 1893. The 1887 cold-bath process was replaced in 1892 with the cold-development method. See also Ware, "Technical History and Chemistry of Platinum and Palladium Printing," and Sarah S. Wagner, "Manufactured Platinum and *Faux Platinum* Papers, 1880s–1920s," in this volume.

30. In an interview, Imogen Cunningham revealed that Curtis's studio manager made transparencies, then enlarged negatives for contact-printing. Hill and Cooper 1979, 298.

31. Flaws in the negative, such as craquelure, that appear unusually large relative to the image may also indicate that an enlarged negative was used to make a contact print. This phenomenon has been observed in platinum prints made by the Gerhard Sisters housed at the Library of Congress, among others.

32. For additional details, see Alisha Chipman and Matthew L. Clarke, "A Technical Study of Paul Strand's Platinum Prints," in this volume.

33. Lee Ann Daffner, "Art and Enlargement," in this volume.

34. Lee Ann Daffner, "The Platinum Print Enlargements of Thomas Eakins: Examination and Investigation," paper presented at "Work-in-Progress by Museum Research Fellows Colloquium," Metropolitan Museum of Art, New York, May 15, 1996. For more information, see Daffner, "Art and Enlargement," in this volume.

35. "Falling off" occurs when using a short-focus lens, such as many rapid rectilinears were, and can be adjusted by stopping down or using a lens with higher defining power such as an anastigmat. See Beck and Andrews 1903, 211; Dresser 1887, 130–33. On the contrary, some sources claim that enlargements have more even tonality because they correct for the falling off in the negative's margins. See Abney and Clark 1898, 142; "Negatives for Enlarging" 1892, 41.

36. Many nineteenth-century light sources are no longer in production, produce unsafe amounts of UV energy, or are potentially flammable, and were therefore not used in the modern experiments.

37. This project was undertaken in 2013 at the National Gallery of Art with the help of the Photograph Conservation Department. The flashlight was fitted to a Beseler 4 × 5 inch enlarger with a Berkey Omega Prolab quartz condensing lens, which was selected due to its excellent UV-transmitting qualities.

38. A 35 mm safety-film negative was projected onto a Crane & Company's 100% cotton paper (internally alum-rosin-starch-sized) that was sensitized with potassium tetrachloroplatinate and ferric oxalate. For details of the sensitizer formula and paper, see Matthew L. Clarke, "Characterization, Degradation, and Analysis of Platinum and Palladium Prints," in this volume.

39. The negatives were printed on light valve technology (LVT) film, and the smaller one (see fig. 12a) was adhered to 2 mm glass for use in the enlarger. For the process for making LVT film, see Chicago Albumen Works, Digital Services, Archival Film Output, www.albumenworks.com. The same sensitized paper as described above was used for the solar experiments. Papers were sensitized several days in advance at the National Gallery of Art prior to traveling to the Scully & Osterman Studio in Rochester, New York, where the trials took place in August 2014.

40. Scully & Osterman Studio's "active enlarger" is placed in a window on an exterior wall with a mirror that must be adjusted manually from inside the room to direct sunlight through the apparatus. The exposure time was limited by several factors, most notably that the enlarger is positioned on an east-facing wall and can capture only a few hours of sunlight per day. Period literature suggests that the enlarging apparatus should face north or south. See Pringle 1886, 586; Tissandier 1876, 149; Dresser 1887, 131.

Greta Glaser, "Platinum Enlargements," in *Platinum and Palladium Photographs: Technical History, Connoisseurship, and Preservation*, ed. Constance McCabe (Washington, D.C.: American Institute for Conservation of Historic and Artistic Works, 2017), 192–203.

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