The History of Photography
EDWARD WESTON. Waterfront, 1946. From a Kodachrome Transparency
The History of Photography
from 1839 to the Present Day

BY BEAUMONT NEWHALL

THE MUSEUM OF MODERN ART
Distributed by Simon and Schuster, New York
To Alfred Stieglitz, 1864–1946

whose search for truth through photography spanned half the camera's past
FOREWORD AND ACKNOWLEDGMENTS

For more than a century, the camera has been a vital means of communication and expression. The growth of this contribution to the visual arts is the subject of this book. It is a history of a medium, rather than a technique, and of the seeing of those who have not been content to use the camera merely as a tool.

Photography is so linked to science that technical explanations are inevitable in any discussion of the esthetics of the camera. Although technical matters are taken up in the following pages, no attempt has been made to retell the scientific development of the photographic process.

This book was begun as an illustrated catalog of the exhibition Photography 1839–1937, which I organized for the Museum of Modern Art in 1937. In 1938 the text and illustrations were reprinted, with minor revisions, as Photography: A Short Critical History. The present text, although based on this earlier research, has been entirely rewritten and a new selection of illustrations has been made. Two of the chapters first appeared in the Magazine of Art and Antiques.

I wish to extend grateful thanks to:

The John Simon Guggenheim Memorial Foundation, for the Fellowship grant which enabled me to spend a year of uninterrupted research, study and writing.

Nancy Newhall, my wife and colleague, for constant encouragement, stimulating suggestions, searching criticism, and for sharing with me the fruits of her research, which I have freely used in Chapters 5, 8 and 9.

Ferdinand Reyher, for helping me to sharpen my thinking and my writing.

C. E. Kenneth Mees, Vice-President in charge of research, Eastman Kodak Company, for showing me how the theory and practice of photographic processes could be more clearly and accurately described.

Harold White, for unpublished material gathered for a forthcoming biography of Fox Talbot.

Monroe Wheeler of the Museum of Modern Art, who asked me to write this book, for his patience and encouragement.

Sources for all quotations are given in the appendix; for permission to make use of copyrighted material I am indebted to the authors and publishers named there. I have used passages from some of my own writing first published by Art News, Arizona Highways, Minicam Photography, and the Journal of the Warburg and Courtauld Institutes.

My greatest debt is to the photographers who have allowed me to reproduce their work; their names are printed with their photographs. If photography has art potentials, it is because photographers have made it so; for them I have written this book.

BEAUMONT NEWHALL

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Camera pictures have been made ever since the Renaissance. Artists turned to mathematics and optics for assistance in solving perspective problems, and they found the phenomenon of the *camera obscura* (literally "dark room") a mechanical aid of the greatest value. Leonardo da Vinci described the principle: light entering a minute hole in the wall of a darkened room forms on the opposite wall an inverted image of whatever lies outside. The first published account — Leonardo’s description lay hidden in his private notes — appeared in Giovanni Battista della Porta’s book, *Natural Magic*, of 1553. In 1568 Daniele Barbaro showed that a more brilliant image could be produced by substituting a lens for the pinhole:

Close all the shutters and doors until no light enters the *camera* except through the lens, and opposite hold a sheet of paper, which you move forward and backward until the scene appears in the sharpest detail. There on the paper you will see the whole view as it really is, with its distances, its colors and shadow and motion, the clouds, the water twinkling, the birds flying. By holding the paper steady you can trace the whole perspective with a pen, shade it and delicately color it from nature.

The camera, at first actually a room big enough for a man to enter, gradually grew smaller. The windows of sedan chairs were covered and the camera could be taken into the countryside. In the seventeenth and eighteenth centuries a lens was fitted into one end of a two-foot box, and the other end covered with a sheet of frosted or ground glass. The image cast on the ground glass by the lens could be seen outside of the camera. A perfected model, resembling the modern reflex camera, had the ground glass flush with the top of the box, the image being thrown upon it by a mirror placed at an angle of 45°. It had the advantage that the image was not upside down, and the artist could trace it by laying thin paper over the glass. Cameras became standard equipment for artists. Count Francesco Algarotti, in his *Essay on Painting* (1764) devotes a chapter to the camera: "The best modern painters among the Italians have availed themselves greatly of this contrivance; nor is it possible they should have otherwise represented things so much to life."

But the ancients had already observed that light not only forms images,
but changes the nature of many substances. The chlorophyll of vegetation becomes green on exposure to it; colored fabrics fade. Among the substances radically altered by light are the salts of silver: the combining element is liberated, leaving pure metallic silver which, because unpolished, is dark in tone. The light sensitivity of these salts was first scientifically established by the German physicist Johann Heinrich Schulze in 1727.

He filled a glass bottle with a mixture of chalk, silver, and nitric acid which, after he had thoroughly shaken it, combined to form whitish silver salts. When he put the bottle in bright sunlight, the mixture turned to a deep purple color. As exposure to the heat of a fire produced no such change, Schulze deduced that the reaction had been caused by the sun's light rather than by its heat. To prove his deduction, he pasted stencils of opaque paper on the flask. After exposure to light the stencil was removed, and images of the figures or writing which had been cut out of the paper were clearly visible on the surface of the mixture within the flask, traced by the dark color of metallic silver.

All unconsciously, Schulze had indicated a way to trap the elusive image of the camera. What we know as photography is but the combined application of optical and chemical phenomena long known to man.

The incentive to work out a practical technique was stimulated by the unprecedented demand for pictures from the rising middle class of the late eighteenth century. Reproductions in quantity were in order: lithography was invented and wood engraving revived, so that pictures could be almost endlessly duplicated. The middle class wanted cheap portraits; mechanical devices to eliminate the need for lengthy artistic training were put in its hands, so that every man could become something of an artist. The silhouette required merely the ability to trace a cast shadow; the physionotrace, invented by Gilles Louis Chrétien in 1786, asked no more of the beginner, with the advantage that a miniature engraved copper plate was produced, from which duplicates could be printed. The sitter's profile was traced on a sheet of glass with a stylus connected by levers to an engraving tool which recorded in reduced scale its every movement on a copper plate. The instrument was immensely popular; six hundred physionotrace portraits were exhibited at the 1797 Paris Salon alone.

Still another mechanical substitute for artistic skill was the camera lucida, invented by the Englishman William Hyde Wollaston in 1806. Drawing paper was laid flat. Over it a glass prism was suspended at eye level by a brass rod. Looking through the prism the operator saw at the same time both the subject and the drawing paper; his pencil was guided by the virtual image.
camera lucida, which resembled the camera only in name and function, could easily be carried about and was widely used by travelers. With it Basil Hall documented his American travels; in the preface to *Forty Etchings Made with the Camera Lucida in North America in 1827 and 1828* (Edinburgh, 1829) he praised the instrument which freed the amateur “from the triple misery of Perspective, Proportion and Form,” and concluded that although Wollaston, its inventor, had not discovered the “Royal Road to Drawing,” he had “at least succeeded in Macadamising the way already known.”

But to many amateurs “Macadamising” was not enough. Even the camera lucida demanded a modicum of skill in drawing.

In all history the experimental amateur has not been the one to accept either his shortcomings or the difficulties which block the professional. The fever for reality was running high. The physical aid of camera obscura and camera lucida had drawn men so near to an exact copying of nature and the satisfaction of the current craving for reality that they could not abide the intrusion of the pencil of man to close the gap. Only the pencil of nature would do. The same idea burned in many at once, and the race for discovery was on: to make light itself fix the image in the camera without having to draw it by hand.

Before the camera lucida was developed, Thomas Wedgwood, son of the British potter, had already attempted to make permanent prints “by the agency of light.” He bathed paper or leather in silver nitrate solution; a paint-
ing or drawing made on glass was placed over the paper, and the whole exposed to light. Where the glass was clear, light penetrated to the silver salts on the paper, turning them dark. The leaf of a tree pressed against light-sensitive paper left, on exposure to light, a record of its form in white on a dark ground; semi-transparent material passed light in proportion to its transparency, with the consequence that middle tones could be recorded.

Wedgwood was dismayed that his sun prints were not permanent. He found no way to desensitize the prepared paper. When the drawing or object was removed, light darkened the white areas. Only by keeping his results in darkness could they be prevented from turning dark; he looked at them furtively by the weak light of a candle. He attempted to record the camera’s image, but his silver nitrate paper was not light sensitive enough, and attempts to use the more sensitive silver chloride were not successful. Ill health forced him to abandon further experiments, and all that remains of his work is a short account written in collaboration with his friend, Humphrey Davy, for the *Journal of the Royal Institution*, 1802.

Joseph-Nicéphore Niépce of Chalon-sur-Saône, France, was more successful. Although no authenticated example of his camera work remains today, his letters and eyewitness accounts leave no doubt that, between 1816 and 1829, he often succeeded in permanently fixing the camera’s image.

Nicéphore Niépce and his brother Claude were ardent inventors. They had patented a hot-air engine; when lithography was introduced, Nicéphore turned his attention to it. He had no artistic skill, and first relied on others for the drawings which he reproduced. Soon he conceived the possibility of making them by means of light. On April 1, 1816 he wrote to his brother Claude in Paris:

The experiments I have thus far made lead me to believe that my process will succeed as far as the principal effect is concerned, but I must succeed in fixing the colors; that is what occupies me at the moment, and it is the most difficult.

A few days later he described his camera as “a kind of artificial eye, simply a little box, each side six inches square, which will be fitted with a tube that can be lengthened carrying a lenticular glass.”

He broke the lens and had to make a new camera, smaller in size — about 1½ inches on each side — because the only other lens he had was from his solar microscope.

I placed the apparatus in the room where I work, facing the bird house and the open casement. I made the experiment according to the process which you know [he
wrote his brother on May 5, 1816] and I saw on the white paper all that part of the
bird house seen from the window and a faint image of the casement which was less
illuminated than the exterior objects. This is but an imperfect trial . . . The poss-
sibility of painting in this way seems to me almost demonstrated . . . That which
you have foreseen has happened. The background of the picture is black, and the
objects white, that is, lighter than the background.

This is an accurate description of a negative. The copies of natural objects
and paintings upon glass which Wedgwood made by contact printing showed
this same reversal of tone. Had Niépce only thought of making prints from
these negatives he could have again inverted the tones so that they corre-
sponded to the order of lights and shades in nature. But he wanted to secure
pictures directly in the camera.

He began to search for a substance which light would bleach instead of
darken. His experiments were fruitless until he found that a certain type of
bitumen or asphalt, normally soluble in lavender oil, became insoluble in
that chemical on exposure to light. At first, instead of trying to reproduce the
infinite shades of light which form the camera’s image, he attempted to fix
simply the black and white contrasts of an engraving. Isidore, Niépce's son, recounts how his father spread on a well-polished pewter plate bitumen of Judea dissolved in Dippel's oil. On this varnish he placed the engraving to be reproduced, which had been made transparent, and exposed the whole to the light . . . After a time he immersed the plate in a solvent which bit by bit brought out the image which until then had remained invisible; then he washed the plate and let it dry. After these different operations, for the purpose of etching it, he placed it in water more or less acidified.

My father sent this plate to [the engraver Augustin François] Lemaître, requesting him to contribute his talent in engraving the drawing still deeper. M. Lemaître acceded very courteously to my father's request. He pulled several proofs of this portrait of Cardinal d'Amboise . . .

The printed lines of the engraving had held back the light; the white paper had permitted it to pass through. Thus most of the bitumen was rendered insoluble, but that which lay directly under the lines remained soluble and could be removed by lavender oil. The bared metal was then etched to form a printing plate.

This process Niépce named heliography. It is a photoengraving technique. Now Niépce went further. He attempted to fix in a similar manner the camera's image. Using glass instead of metal, he was partially successful.

In January, 1826, Niépce received a letter from a stranger who said that he had been given Niépce's address by their mutual lens maker, Chevalier of Paris, and claimed he was working along similar lines. Jealous of his secret, Niépce replied warily. More than a year passed before the other, as cagey as Niépce, wrote again. This second note led Niépce to ask Lemaître: "Do you
know one of the inventors of the Diorama, M. Daguerre?” He received an immediate reply:

You ask me if I know M. Daguerre? A few years ago, without knowing him personally, I went to soirées where I met him. Last spring, having been commissioned by a publisher to engrave one of his paintings in the Luxembourg Gallery I went to show him the drawing I had made: that is how I made his acquaintance; I haven’t seen him since, except in going to see one of his paintings at the Diorama, and I have to submit to him at the end of the month a proof of my engraving, which is almost finished.

As to what I think of him: M. Daguerre, as a painter, has a fine talent for imitation, and an exquisite taste for the arrangement of his pictures. I believe he has an unusual understanding of stage machinery and lighting effects; the connoisseur, visiting his establishment, can easily convince himself of that. I know he has busied himself for a long time perfecting the camera obscura, but I do not know the object of his work.

Daguerre sent Niépce something noncommittal in the graphic line, which he called dessin fumée, and Niépce, in exchange, sent him a lightly etched heliographic plate which, he told Lemaître, “could in no way compromise the secret of my discovery.” Still they were getting closer in a veiled correspondence in which each hinted at that which the other did not have but needed. On June 4, 1827, Niépce made his first positive approach to Daguerre for active collaboration. Nothing came of it.

Then in England Claude Niépce fell ill, and his brother set off to visit him at the end of August. He was held up in Paris by passport difficulties and the advent of Charles X in Calais, which so jammed the stage coaches to the port that no seat was to be had. Niépce took occasion of the delay to meet Daguerre in person.

I have had many and very long interviews with M. Daguerre [he wrote his son on September 2–3, 1827]. He came to see us yesterday. His visit lasted for three hours . . . and the conversation on the subject which interests us is really endless . . . I have seen nothing here that impressed me more, that gave me more pleasure, than the Diorama. We were taken through it by M. Daguerre and could contemplate at our ease the magnificent pictures which are exhibited there . . . Nothing is superior to the two views painted by M. Daguerre; one of Edinburgh, taken by moonlight during a fire; the other of a Swiss village, taken at the end of a wide street, facing a mountain of tremendous height, covered with eternal snow. These representations are so real, even in their smallest detail, that one believes that he actually sees rural and primeval nature, with all the illusion with which the charm of color and the magic of chiaroscuro can endow it. The illusion is even so great that one attempts to
leave one's box in order to wander out into the open and climb to the summit of the mountain. I assure you there is not the least exaggeration on my part, the objects are, or seem to be, of natural size.

Daguerre, master of lighting effects, had pushed the representation of reality as far as it would go with the resources available. He wanted to go further. Small wonder that the creator of such illusionistic spectacles was interested in the idea of photography!

In England, Niépce met Francis Bauer, secretary of the Royal Society, who urged him to communicate his experiments to the Society. That learned body, however, refused to receive his communication because it was against its rules to discuss secret processes, and Niépce declined to reveal his technique. He gave Bauer samples of his work; three of them, bearing Bauer's endorsement, are now in the Royal Photographic Society in London. They are pewter plates made from engravings, but Bauer, in a letter to the *Literary Gazette*, February 27, 1839, stated that Niépce showed him in 1827 "his first successful experiments to fix the image of nature." A *View of Kew* by Niépce was shown at the International Inventions Exhibition in 1885; unfortunately, it is now lost.

This evidence indicates that Niépce made negatives in 1816 and direct positives before 1827 with the camera. He started to write an instruction manual *On Heliography; or, A Means of Automatically Fixing, by the Action of Light, the Image Formed in the Camera Obscura*. It was left undone.

He came back to France in 1829 determined to concentrate on what he called "view points" (*points de vue*) with the "sole object to copy nature with the greatest fidelity." He reopened correspondence with Daguerre. The showman advised him to postpone his book: "As regards your intention of publishing your method, there should be found some way of getting a large profit out of it before publication, apart from the honor the invention will do you." Lemaître criticized one of Niépce's "view points" for its contradictory shadows cast by the sun during the excessively long exposure time. Niépce replied:

Unfortunately I can't avoid it . . . A camera as perfect as M. Daguerre's is needed, otherwise I shall be condemned to come more or less close to the goal without ever reaching it . . . I am, therefore, hastening to reply to his gracious offer to be of service by proposing that he cooperate with me in perfecting my heliographic process.

After nearly three years of polite distrust and trying each other out and leading each other on, Niépce and Daguerre joined articles of partnership, signed at Chalon-sur-Saône on December 4, 1829, to last ten years.

Only four had run their course when, in 1833, Niépce died.
In 1837 Daguerre made a brilliant, detailed picture of a corner of his studio, using a modification of Niépce's invention which he considered sufficiently his own to name the *daguerréotype*. He persuaded Isidore Niépce, who had taken his father's place as Daguerre's partner, to agree to a revision in the contract. The process was to be made public jointly with heliography "in order that the name of M. J. Nicéphore Niépce may figure always, as it should, in this discovery." The associates planned to market the process by subscription, but the public would have none of it. They were skeptical of Daguerre's claim that with his invention "anyone can take the most detailed views in a few minutes." They could not believe that the daguerreotype was "a chemical and physical process which gives Nature the ability to reproduce herself."

Daguerre secretly demonstrated his invention to François Arago, director of the Paris Observatory. The famous scientist, himself an investigator of light, saw the potentialities of the daguerreotype, lectured on it to the Academy of Sciences, January 7, 1839, and proposed that if, on further investigation, the process was found practical and useful, he would recommend its purchase by the government. A few months later a bill was introduced into the Chamber of Deputies and the Chamber of Peers. After hearing reports by Arago for the Deputies and Joseph-Louis Gay-Lussac for the Peers, both chambers passed the appropriation: Daguerre was to be granted an annuity of 6000 francs and Isidore Niépce an annuity of 4000 francs, in return for which they would "place in the hands of the Ministry of the Interior a sealed package containing the history and most detailed and exact description of the invention mentioned." For his extra 2000 francs Daguerre was to divulge the processes of his diorama. Arago was directed to make public the technical details at a joint open meeting of the Academy of Science and the Academy of Fine Arts, August 19, 1839.

The public's reaction to these negotiations was extraordinary. They marvelled over the daguerreotypes shown at the Chamber of Deputies:

In one, representing the Pont Marie, all the minutest indentations and divisions of the ground, or the building, the goods lying on the wharf, even the small stones un-
under the water at the edge of the stream, and the different degrees of transparency given to the water, were all shown with the most incredible accuracy.

The Leipzig *Anzeiger* — for the news spread rapidly throughout Europe — went so far as to brand the process sacrilegious. Excitement ran high; on the day set for formal publication, all Paris was tense.

Daguerre was not at the meeting; he had excused himself because of a sore throat, and the process was described — but not demonstrated — by Arago.

An eye witness — Marc Antoine Gaudin — relates that

the Palace of the Institute was stormed by a swarm of the curious at the memorable sitting on August 19, 1839, where the process was at long last divulged. Although I came two hours beforehand, like many others I was barred from the hall. I was on the watch with the crowd for everything that happened outside. At one moment an excited man comes out; he is surrounded, he is questioned, and he answers with a know-it-all air, that bitumen of Judea and lavender oil is the secret. Questions are multiplied, but as he knows nothing more, we are reduced to talking about bitumen of Judea and lavender oil. Soon the crowd surrounds a newcomer, more startled than the last. He tells us with no further comment that it is iodine and mercury. Finally the sitting is over, the secret is divulged . . .

A few days later, opticians' shops were crowded with amateurs panting for daguerreotype apparatus, and everywhere cameras were trained on buildings. Everyone wanted to record the view from his window, and he was lucky who at first trial got a silhouette of roof tops against the sky. He went into ecstasies over chimneys, counted over and over roof tiles and chimney bricks, was astonished to see the very mortar between the bricks — in a word, the technique was so new that even the poorest proof gave him indescribable joy.

Daguerre wrote a seventy-nine-page booklet, *Histoire et description du*
procédé nommé le Daguerreotype. His instructions were so complete that anyone could have the apparatus built by an instrument maker and could anticipate some sort of success if he followed the directions carefully. Within five months twenty-nine different editions and translations of the manual had appeared; to list their places of publication is to plot the spread of the daguerreotype through the Western world: Barcelona, Berlin, Carlsruhe, Edinburgh, Genoa, Halle, Hamburg, London, Madrid, Naples, New York, Paris, Philadelphia, Quedlinburg, Saint Gall, Saint Petersburg, Stockholm, Stuttgart.

But Parisians complained that the brochure was written in too scientific a language; the process seemed excessively complicated. In answer to this criticism the government ordered Daguerre to make daguerreotypes publicly, so that the very simplicity of the process might become clear.

A special correspondent of the New York Star went to the demonstration
of September 17 at the Grand Hotel on the Quai d'Orsay. He reported that Daguerre
took a plate of copper plated with silver and rubbed the silver surface in a slight
manner with very fine pumice powder and sweet oil, using small balls of cotton
wool for this purpose. He thus completely dulled the surface, and I noticed that he
rubbed first with a circular motion, and then with straight lines from top to bottom.
He then washed the plate thus dulled in a liquid consisting of: distilled water, 16
parts; nitric acid, 1 part. He then gave a slight heat to the plate by passing it over
the flame of a lamp — the copper side being next to the flame and the silver sur-
face uppermost. He then washed it a second time in dilute nitric acid.
The plate was now ready for a coating of iodine. The apartment was darkened,
and the plate, fixed on a small board, was placed (with the silver part downwards)
over an opening the size of the intended picture, in the lid of a box at the bottom
of which the iodine was. Halfway down in the box was a slight wooden frame on
which a piece of muslin was strained, and through this muslin, as the iodine eva-
porated, the fumes rose, and were thus equally received upon the silvered surface,
there forming a coating of iodide of silver, having the yellow appearance of brass.
A camera obscura was now brought up. Its focus had previously been adjusted
by trying the effect of the picture on a bit of ground glass. The plate prepared as
above was placed in the camera. The view intended to be taken was the Tuileries,
the Quay and the Seine in front of the window where the camera obscura was
placed. It was there to remain until the action of the sun's rays on its surface was
sufficient. This occupies a period of from five to forty minutes, according to the
time of the year and state of the weather, and as the director (for I cannot call him
the operator) cannot see by the plate how the process goes on, experience alone can
tell him how to judge as to the advancement which the action of the light has made.
In this instance the day was dull, and the plate remained fifteen minutes in the cam-
era obscura. When it was taken out it appeared exactly the same as when it was put
in, and the people looked very blank, I do assure you, at what looked like a failure;
but indeed one could scarcely tell whether or not it had been marked, for the process
requires that no light fall on it before finishing operations.
M. Daguerre took the plate and held it with the silver part downwards, and thus
held it for half a minute, while three persons peered upon it and said, "Nothing has
been traced upon it."
He fixed it then, at an angle of 45°, in a box at the bottom of which was an earthen
pan holding two pounds of mercury. Under the pan was a lamp which heated the
mercury to 62° Centigrade or 117° Fahrenheit, and as the mercury grew hot its glob-
ules arising, combined with the prepared surface of the metal, brought out the pic-
ture. In front of the box is a glass spyhole, through which the process is watched, and
the moment it was completed the plate was taken out and washed with distilled
water saturated with common salt or with the hyposulphite of soda, heated a degree below the boiling point. This finished it, and the picture, thus literally executed by the sun, was handed about.

I never saw anything more perfect. When examined by the naked eye every object appeared minutely engraved, but when viewed through a magnifying glass the difference of grain in the separate flags of the trottoir was visible, and the texture of everything, if I may use the phrase, was easily distinguishable.

The Star’s reporter was amazed that there was no trace of an image on the plate until it had been “brought out” by the mercury vapor. This development of the hidden or latent image enabled Daguerre to reduce the exposure time, and to succeed where earlier experimenters had failed. It is a principle followed ever since in most photographic processes. But still the exposures were minutes long. During those minutes vehicles and pedestrians moved
about; they did not stay still in one place long enough for the plate to record their images. In only one of Daguerre’s pictures does a man appear: by chance a pedestrian on the boulevard had stopped to have his shoes shined, and had held still during most of the exposure.

The daguerreotype had another disadvantage. Each picture was unique. It could be duplicated only by making a copy of it with a camera or by hand. Many engravings and lithographs after daguerreotypes were published; between 1840 and 1844 a hundred and fourteen travel views were issued in Paris as the series *Excursions Daguerriennes*. Daguerreotypes taken in Europe, Africa and America for the publisher, N. P. Lerebours, were painstakingly traced and transferred to copper plates by the aquatint process. Figures and traffic, imaginatively drawn in the Romantic style, were added in an attempt to please the public who abhorred the depopulated aspect of the first daguerreotypes.

Although albums of engravings after daguerreotypes were popular, the public was disappointed that the daguerreotype did not reach the heights anticipated by the first announcement. "It has excited some surprise," we read in the London *Athenaeum* for October, 1839, "that, after the eager and natural

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Daguerreotype camera and equipment, about 1843. Plate holders, box for holding plates, coating box, camera with double Chevalier lens dated 1843, mercury bath with thermometer and alcohol lamp. Collection Albert Gilles, Paris
curiosity of the public concerning the discovery of M. Daguerre while it yet remained a secret, so little interest should now be taken in the subject.” One reason was that, in spite of the apparently generous action of the French Government in offering the daguerreotype free to “all the world,” the inventor applied for and received a patent in England. Another, and more important reason, was that the process needed radical improvements if it was to fulfill the public’s demand for portraits.

Samuel F. B. Morse, who had met Daguerre in Paris and was so impressed by his daguerreotypes that he persuaded the National Academy of Design to elect him an honorary member, tried to take portraits shortly after Daguerre’s instructions arrived in New York on September 20, 1839. His wife and daughter sat “from ten to twenty minutes,” he recollected, “out of doors, on the roof of a building, in the full sunlight, and with the eyes closed.” This trial of patience took place, according to Morse, in September or October. He stated that his associate, John William Draper, was taking portraits “at about the same time.” Alexander S. Wolcott and John Johnson claimed to have taken “profile miniatures” in New York in October, using a camera of their own invention, in which a concave mirror was substituted for a lens. The results were at first indeed miniatures, for the plates were but three-eighths of an inch
square. A few months later they were taking them 2 x 2½ inches. To increase
the illumination, sunbeams were reflected into the room by mirrors. Sitting
was an ordeal; one victim recollected that he sat
for eight minutes, with the strong sunlight shining on his face and tears trickling
down his cheeks while . . . the operator promenaded the room with watch in hand,
calling out the time every five seconds, till the fountains of his eyes were dry.

In Philadelphia, Robert Cornelius took a self portrait in his back yard, which
is said to antedate the New York experiments. But one hesitates, in the ab-
seence of more complete documentation, to assign to any one of these pioneers
the honor of priority. Despite their efforts, portraitists could not hope for
popular support so long as they demanded the heroism of immobility beneath
blinding light for minutes on end. Radical improvements in technique were
needed. Daguerre himself, who predicted the eventual use of his technique
for portraiture, did little to perfect his invention. He took up again the scene
painter's brush and painted an illusionary apse for the church at Bry-sur-
Marne. He died in that village in 1851.

By the end of 1840 substantial technical advances had been made.
First, a double lens, which passed sixteen times more light than the simple meniscus fitted to the original daguerreotype cameras, had been designed by Josef Petzval and constructed in Vienna by Peter Friedrich Voigtländer. The design at once became so popular in France that imitations were made and marketed as “German lenses,” while in America unscrupulous dealers even engraved the name Voigtländer on “tubes” of domestic manufacture.

Second, the light sensitivity of the plate was increased by adding to the iodized surface another halide. The thought had occurred to many and had been tried by many, but it is clear that the first to publish a practical method was John Frederick Goddard, lecturer on optics and natural philosophy at the Adelaide Gallery, London: after the silvered plate had been fumed with iodine, the operation was repeated with bromine. The use of such an accelerator, or in the vernacular of the daguerreotypists, quickstuff, in combination with the Petzval lens, made it entirely possible to take portraits regularly at exposures of less than a minute.

Third, the tones of the daguerreotype were softened and enriched by gilding the plate, the invention of Hippolyte-Louis Fizeau. After the plate had been
bathed with hypo it was heated, and a solution containing gold chloride was flowed over it, which toned the image deep purplish brown. This operation had the added advantage that the delicate surface of the daguerreotype—compared by Arago to a butterfly's wing—was rendered less fragile.

As soon as these improvements had been made, portrait galleries were opened everywhere and the world rushed to them.

All kinds of people sat before the camera; thanks to the relative cheapness of production, financial distinctions mattered little. Celebrated men and distinguished ladies as well as peasants and workmen who otherwise would be forgotten, have left their features on the silvered plate which Oliver Wendell Holmes called "the mirror with a memory." The best daguerreotype portraits are straightforward and penetrating, due partly to the complete absence of retouching, which, except for delicate tinting, the fragile surface did not allow. But perhaps of more importance is the apparent handicap of the long exposure time. It was hard work to be daguerreotyped; you had to cooperate with the operator, forcing yourself not only to sit still for at least half
a minute, but also to assume a natural expression. If you moved, the picture was ruined; if you could not put yourself at ease in spite of the discomfort, the result was so forced that it was a failure.

A chapter of the illustrated book on Paris, *La Grande Ville* (1842), describes a daguerreotypist’s studio which was so popular that people waited their turn for an hour. One sitter
who is naturally ugly, and finding herself still uglier in the doleful expression of the daguerreotype, insists that it is a failure, and goes out without taking it. After her there comes a man with a tic, who constantly twitches the corner of his mouth, and in spite of it wants to be daguerreotyped; then another who blinks his eyes rapidly, then an old lady who everlastingly shakes her head. All these people cannot understand that they will never have a portrait by this process.

Of all countries, America adopted the daguerreotype with most enthusiasm, and it lived longer here than elsewhere. Yankee ingenuity brought mechanical improvements. The tedious task of buffing the plates to a high polish was done by machinery. John Adams Whipple of Boston installed a steam engine in his gallery to run the buffing wheels, heat the mercury, fan the clients waiting their turn, and revolve a gilded sunburst on his sign outside the gallery. At the Great Exhibition in the London Crystal Palace, 1851, Americans won three of the five medals awarded for daguerreotypes.

The United States department is of a very superior character. In the arrangement of the groups, and in the general tone of the pictures, there will be found an artistic excellence which we do not meet with in many others. This has been attributed to peculiar atmospheric conditions, but we believe it to be due to a great extent also to superior manipulation.

Among the exhibits were eight daguerreotypes of Cincinnati, taken by Charles Fontayne and William S. Porter in 1848. They were framed end to end to form a panorama, showing the river front crowded with steamboats, and the city climbing the heights above. Similar views were frequently made of other cities. The daguerreotype image is normally laterally reversed; the picture appears as in a mirror. In portraiture this reversal was not noticed; indeed the sitter found the likeness identical to his own vision of himself, which he knew only from a looking glass. But the reversal was troublesome in views; landscapes did not appear natural, signboards read backwards. To overcome this defect, daguerreotypists commonly fitted a prism over the lens when working out of doors, despite the fact that exposure was thus increased twofold.

There were seventy-one galleries in New York City in 1850, employing in all one hundred and twenty-seven operators. Each American city and most of the larger towns boasted of several daguerrean galleries apiece, many of which were magnificently fitted out. In Luther Holman Hale’s Boston gallery, the pianoforte, the music box, the singing of birds; the elegant drapery; the beautiful pictures; the expensive gallery of portraits; the struggling sunbeam peering
John Quincy Adams, President of the United States. Daguerreotype from the gallery of Southworth & Hawes, Boston. The Metropolitan Museum of Art, New York
through doors of stained glass; statuary, engravings; all, all seem to impress the visitor with the ideal of palace-like magnificence, and serve to soothe the troubled spirit, and calm the anxious brow, preparatory to the obtaining of a good picture.

Daguerreotypists vied with one another for the privilege of making portraits of the famous. One of the largest collections was formed by Mathew B. Brady,* a leather-case maker who had begun to take daguerreotypes in 1844. He planned a *Gallery of Illustrious Americans*, and in 1850 published the

* His first name is spelled in this fashion on his gravestone. He always signed his letters “M. B. Brady.” No one ever knew what the “B” stood for.
first instalment: twelve lithographs by François d’Avignon, eleven of which were copies of daguerreotypes. The publication was a failure: not even the price of materials was recovered. But Brady continued to add to his collection; his name became a household word; again and again wood engravings in the illustrated magazines of the fifties and engraved frontispieces in biographies bear the credit: “From a Daguerreotype by Brady.”

In Boston Albert Sands Southworth and Josiah Johnson Hawes produced portraits far removed from the conventional stiff poses so favored by the majority of their colleagues. When Chief Justice Lemuel Shaw of the Massachusetts Supreme Court came to their gallery he happened to stand in a beam of sunlight which brought out his rugged features with uncompromising force; the daguerreotypists took him as he stood. They went to the home of John Quincy Adams and there daguerreotyped him with spontaneous informality, sitting by the fireplace, a bookstrewn table at his elbow. They even took a schoolroom full of girls. Hawes remained a photographer to his death in 1901, and although he gave up taking daguerreotypes commercially in the late fifties, turning to the production of the more popular paper prints, he never lost his love for the process, which he attempted to revive in the 1890’s. Because Southworth and Hawes took many plates at each sitting, a quantity of duplicates remained in the Hawes studio; the cream of this collection is now divided between the Metropolitan Museum of Art, New York, and the Boston Museum of Fine Arts. Their portraits, usually on whole plates (6½ x 8½ inches) were larger than the average. It was their boast that they never charged less than $5 for a picture.

This was well above the general price of $1 for a medium plate (2¾ x 3½ inches), complete with case. Competition forced prices lower and lower, until by slap-dash methods daguerreotypes were made at two for a quarter. In vain did the conscientious artists of the profession form protective societies, boycotting the “blue bosom boys” — so called because they were not craftsmen enough to record properly a white shirt front.

The daguerreotype was doomed. It did not lend itself to ready duplication. It was fragile and had to be kept under glass in a bulky case. It was hard to look at because of the metallic glare. And it was expensive. When the rival paper process was perfected so that the public could buy a dozen prints for less than the price of one daguerreotype, the beautiful silver picture became obsolete.
While Daguerre was perfecting Niépce's heliography in France, William Henry Fox Talbot, English scientist and mathematician of means, was busily conducting similar researches in England. Neither knew of the other's work until Arago's lecture to the Academy of Sciences in January, 1839, informed Talbot of the Frenchman's success and spurred him on to prior publication.

In his book, *The Pencil of Nature* (1844), Talbot tells us how he had the idea of what came to be called photography.

One of the first days of the month of October, 1833, I was amusing myself on the lovely shores of the Lake of Como in Italy, taking sketches with Wollaston's *camera lucida*, or rather, I should say, attempting to take them: but with the smallest possible amount of success . . . After various fruitless attempts I laid aside the instrument and came to the conclusion that its use required a previous knowledge of drawing which unfortunately I did not possess. I then thought of trying again a method which I had tried many years before. This method was, to take a *camera obscura* and to throw the image of the objects on a piece of paper in its focus—fairy pictures, creations of a moment, and destined as rapidly to fade away. It was during these thoughts that the idea occurred to me—how charming it would be if it were possible to cause these natural images to imprint themselves durably, and remain fixed upon the paper!

As soon as he returned to England, Talbot began to experiment with making paper light sensitive. He bathed paper with a weak solution of common salt (sodium chloride) and then, after it had dried, with a strong solution of silver nitrate. The two chemicals reacted to form silver chloride, an insoluble and light sensitive salt, in the fibers of the paper. He pressed a leaf, a feather, a piece of lace against this prepared paper under glass. Light darkened the paper wherever it had not been protected by the object in contact with its surface. Talbot then washed the paper either with a strong solution of common salt or with potassium iodide. Because silver salts formed with an excess of chloride are less light sensitive than those formed with silver in excess, treatment with salt solution reduced the sensitivity of the unaltered silver salts to such a degree that the prints could be examined in daylight. The silver
iodide formed by treatment with potassium iodide darkens only slowly in daylight.

He now began to use this material to record the image of the camera obscura. His first camera was, he said, made "out of a large box, the image being thrown upon one end of it by a good object glass fixed in the opposite end." An hour’s exposure on a summer afternoon left only the image of the highlights on the paper. But with smaller cameras he had better success, obtaining "very perfect, but extremely small, pictures; such . . . as might be supposed to be the work of some Lilliputian artist." One of these, signed and dated 1835, is still preserved; it is a tiny negative hardly an inch square. He had a collection of box cameras — "little mouse traps" his wife called them — with which, on a sunny day, he would surround his country house, Lacock Abbey, near Bath. "After the lapse of half an hour I gathered them all up, and brought them within doors to open them. When opened, there was found in each a miniature picture of the objects before which it had been placed."

In his researches, Talbot came upon the description of Wedgwood’s work, but he later claimed that he was completely unaware of what Daguerre was doing, and Arago’s lecture on the daguerreotype to the French Academy of Science took him completely by surprise. "I was placed," he recollected, "in a very unusual dilemma (scarcely paralleled in the annals of science,) for I was threatened with the loss of all my labours, in case M. Daguerre’s process proved to be identical with mine."
To establish priority he rushed samples of his work to The Royal Institution in London where, on the evening of January 25, 1839, Michael Faraday showed them to the members. They consisted of flowers and leaves; a pattern of laces; figures taken from painted glass; a view of Venice copied from an engraving; some images formed by the Solar Microscope [and] various pictures representing the architecture of my house in the country . . . made with the Camera Obscura in the summer of 1835 . . .

Sir John Herschel at once became interested in the work of his friend Talbot. In a letter to him dated February 28, 1839, he used the word *photographed*, and took occasion to explain in a footnote why he considered it more appropriate than *photogenic*. This has led to the conclusion that Herschel coined the noun *photography*, which was immediately absorbed by every Western language.
The photogenic drawings were reversed. They showed the shadows light and the lights dark. Talbot noted that “if the picture so obtained is first preserved so as to bear sunshine, it may be afterwards itself employed as an object to be copied; and by means of this second process the lights and shadows are brought back to their original disposition.” The original, reversed, picture Herschel named the negative. Its re-reversed copy he named the positive.

Thus Talbot had the advantage over Daguerre: from a single negative he could print any number of positives. This discovery of the negative-positive concept was epochal; all modern photographic techniques are based upon it.

However in point of excellence the photogenic drawing was eclipsed by the daguerreotype. Talbot’s warmest supporters had to admit it: Herschel told Arago that “compared to the masterful daguerreotype, Talbot produces nothing but mistiness.” Furthermore Talbot’s method of preserving the pictures was not reliable: much of his earliest work has faded so badly that the images are no longer recognizable. Herschel proposed that the unused silver chloride be removed with the chemical then known as the hyposulphite of soda (now described as sodium thiosulphate), which he had found in 1819 to be a solvent of silver salts. Talbot adopted the suggestion and, with Herschel’s consent, described this use of hypo in a letter to J. B. Biot, which was published in the Comptes rendus of the Academy of Sciences. From this description Daguerre may have learned of its value.

A second improvement increased the light sensitivity of the paper by alternately bathing it in silver nitrate and potassium bromide. In May, 1840, the...
TALBOT: Photogenic drawing, made by exposing lace in contact with sensitive paper. Collection Miss M. T. Talbot

Graphic Society showed in London a series of Talbot’s photographs which, to judge from the account of them in the Literary Gazette, were far superior to his earlier work. They were mostly camera pictures.

Various views of Lacock Abbey . . .: of trees; of old walls and buildings, with implements of husbandry; of carriages; of tables covered with breakfast things; of busts and statues; and, in short, of every matter from a botanical specimen to a fine landscape, from an ancient record to an ancient abbey . . . given with a fidelity that is altogether wonderful.

In the fall of 1840 Talbot invented a modification of his process so radical that he gave it a new name, the calotype, but which, at the suggestion of friends, he later called the talbotype. Previously he had allowed his sensitive paper
to remain exposed to light in the camera until the image became visible. Now he found, as had Daguerre, that it was possible to give a much shorter exposure and yet secure a brilliant image. When the paper was removed from the camera no image could be seen, but by development the latent image appeared as if by magic.

He bathed the paper first in silver nitrate and then in potassium iodide. The relatively stable silver iodide which was formed became, he found, highly light sensitive when bathed in gallic acid and silver nitrate, a solution he named gallo-nitrate of silver. After exposure the paper was bathed in the same solution which gradually brought out the image. To fix these negatives Talbot used at first potassium bromide and later a hot solution of hypo.

This technique was restricted to the making of negatives. Talbot printed them with his silver chloride paper, or by the improved technique of the toxicologist Alfred S. Taylor, who added ammonia to the silver nitrate sensitizing bath until a precipitate was thrown down which was then dissolved by adding nitric acid. Warmer and more pleasing tones could thus be secured.

Late in the spring of 1844 Talbot began the publication of a handsome quarto, The Pencil of Nature. On the title page he put a Latin verse from Virgil’s Georgics: “It is a joyous thing to be the first to cross a mountain.”
was a show book, an account of the history of the invention, a demonstration of its accomplishments in the form of twenty-four actual photographs, and predictions of its use. He wanted to put on record "some of the early beginnings of a new art, before the period, which we trust is approaching, of its being brought to maturity by the aid of British talent." The photographs were mostly of architecture, still-life arrangements, or works of art. Accompanying each was a page or two of text explaining the significance of the picture and occasionally offering predictions not realized for decades.

The most interesting plates show scenes of daily life around Lacock Abbey. Talbot said:

We have sufficient authority in the Dutch School of art for taking as subjects of representation scenes of daily and familiar occurrence. A painter's eye will often be ar-
rested where ordinary people see nothing remarkable. A casual gleam of sunshine, or a shadow thrown across his path, a time-withered oak, or a moss-covered stone may awaken a train of thoughts and feelings, and picturesque imaginings.

The *Art Union*, reviewing the book, spoke particularly of Plate VI, *The Open Door*: “It is, of course, an effect of sunshine, and the microscopic execution sets at nought the work of human hands.”

Eleven years after his unsuccessful attempts to sketch Lake Como, Talbot could write:

there is, assuredly, a royal road to *Drawing*; and one of these days, when more
known and better explored, it will probably be much frequented. Already sundry amateurs have laid down the pencil and armed themselves with chemical solutions and with *cameræ obscuræ*. These amateurs especially, and they are not a few, who find the rules of *perspective* difficult to learn and to apply — and who, moreover, have the misfortune to be lazy — prefer to use a method which dispenses with all trouble.

The talbotype, however, was not free for all to use, for in 1841 Talbot had secured for it Her Majesty's Royal Letters Patent No. 8842. This action, so out of keeping with the open and unrestricted publication of his original process, was perhaps suggested to Talbot by the example of Daguerre, who
HILL & ADAMSON: James Glencairn Burns, about 1845. From calotype negative in collection F. C. Inglis, Edinburgh
had patented the daguerreotype in England. Talbot had received no recompense and but little recognition for his invention: Daguerre, on the other hand, had been rewarded with a life-long pension, was receiving income from the sale of licenses in England, and had won international fame. Talbot saw others making a commercial success with photography, and felt entitled to exact royalties from those using his invention.

He vigilantly controlled the patent, prosecuting those who infringed it. Amateurs and professionals felt hampered, and the Presidents of the Royal Academy and of the Photographic Society jointly appealed to Talbot to relax his grip. In a letter published in *The Times*, August 13, 1852, he relinquished all control of his invention except its use for taking portraits for profit.

The exception was significant, for portraiture was the most lucrative use of photography. Fortunes had been made: in one year Richard Beard, neither scientist nor artist, but a former coal merchant, realized £40,000 from the chain of daguerreotype portrait galleries which he owned and managed in cities throughout the British Isles. Up to 1851 by far the greater number of professional portraitists used the daguerreotype, which was more suited than the talbotype for the rapid production methods essential to commercial success, and which, by its shorter exposure time, was less of a tax on the sitter’s patience. But with the introduction of a new process both the daguerreotype and the talbotype were dropped almost at once. Like the talbotype, the new collodion process was negative-positive. The negatives were on glass instead of on paper, they were developed in pyrogallic acid instead of “gallo-nitrate of silver,” and the exposures were shorter. This technique seemed to Talbot identical in principle to his own, and he considered it an outright infringement of his patent. He sued a professional portraitist, Silvester Laroche, for working it without a license.

The case was taken into court in 1854. The defense attempted to show (1) that Talbot was not entitled to the patent which he held and (2), even if he was, the collodion process was so dissimilar and distinct from the talbotype that no infringement could be claimed. To support the first argument, evidence was submitted that Talbot had been preceded in the use of gallic acid by the Reverend Joseph Bancroft Reade. The intricacies of photo-chemistry perplexed the judge, who said to the jury, “It is already sufficiently difficult to understand the subject, particularly as you and I know nothing at all about it. . . . I am sorry to say the case kept me awake all last night.” He was able, however, to reduce the second charge to a technicality which he summed up in his charge to the jury:
Is pyrogallic acid, though it may differ in its shape, in its action with reagents, in its composition, is it or is it not a chemical equivalent with gallo-nitrate of silver? If it is, the defendant is guilty; if it is not, he is not guilty.

After an hour's deliberation the jury brought in a double verdict. They found the defendant, Laroche, not guilty. They also found that Talbot was the first and true inventor of the talbotype "within the meaning of the Patent Laws: that is, the first person who disclosed it to the public."

The artistic potentialities of Fox Talbot's process were first demonstrated by David Octavius Hill and Robert Adamson, who took hundreds of portraits in Edinburgh. Hill was a painter of local repute; he was secretary of the Scottish Academy of Painting, and had published a series of landscape lithographs as *The Land of Burns*. In 1843 he received a gigantic commission: to portray, on one canvas, all four hundred and fifty delegates to the convention at which the Free Church of Scotland was founded. To secure likenesses of each one of these Scottish worthies was a Herculean task. Hill had dabbled with photography, and the thought occurred to him to use photographs as preliminary studies. He secured, on Sir David Brewster's recommendation, the assistance of Robert Adamson, a young chemist and photographer who, Brewster had said, "was doing some of the very finest things in portrait and landscape."

The two collaborated until 1848, when Adamson died at the age of twenty-seven. They did not limit their work to making memoranda for Hill's "Disruption" picture: all kinds of sitters found their way to the out-door studio on Calton Hill, or were photographed among the baroque monuments of the Greyfriars Cemetery. The part which Adamson played appears to have been more than that of technician, for on his death Hill ceased to make photographs until he again found a collaborator, and these later pictures do not compare with the work he did with Adamson.

They posed their sitters outdoors, usually singly. The strong shadows cast by the direct sunlight were softened by reflecting light into them with a concave mirror; the exposures were minutes long. They saw their subjects broadly, and composed in simple masses of light and shade, as if they had an intuitive respect for the medium. For the calotype process, unlike the daguerreotype, could not record delicate and fine detail. The fibers of the paper on which the negative was made were themselves reproduced in the positive print. Although the finest paper was used, and although Talbot, in an improvement to his patent, described waxing the paper negative to improve its transparency, detail was inevitably destroyed.
The influence of painting is strong in the work of these pioneer Scotch photographers. Hugh Miller, the geologist, had compared their portraits with Raeburn's, and some of their genre studies of ladies clothed in glistening gowns of rich silk remind one of Dutch seventeenth-century paintings. But we remember Hill and Adamson for the dignity and depth of their perception, and for their awareness of individual character — qualities seldom equalled by later photographers during the century that has elapsed since they worked together. A collection of their calotypes received Honorable Mention at the Great Exhibition of 1851 in the London Crystal Palace; during the next decade they were widely shown. Then they were almost forgotten until in 1890 J. Craig Annan made modern prints from the old negatives which delighted connoisseurs. James McNeill Whistler, among other artists, praised them; they were recognized as incunabula of portrait photography. Hill's paintings, however, have long since been forgotten. He did not complete the great canvas which had led him into photographic work until 1866, four years before his death.

An attempt was made to popularize the talbotype in the United States. Frederick Langenheim and his brother William purchased the American rights from Talbot — he had taken out a United States patent — and tried to sell licenses. They pointed out in a broadside addressed to daguerreotypists that paper portraits and views were "devoid of all metallic glare," and could be multiplied "to an unlimited extent with very little expense and labor." Their appeal met with no response. "A thousand of these circulars have been distributed all over the union," they wrote Talbot, "but, horribile dictu, up to this date, Novbr 18 [1849] not a single license has been sold." They failed, partly because their results could not be compared with the brilliant and precisely defined daguerreotypes which delighted the American public, and partly because American photographers rebelled at paying a license fee to anybody.

In France, however, the process flourished. Although Talbot, through an agent named Moses Poole, had taken out a French patent for the calotype in 1841, he does not appear to have restricted its use in that country. Louis Désiré Blanquart-Evrard, who worked out many improvements, was accused by his very countrymen of having appropriated Talbot's invention without even the courtesy of a credit. He coated paper with egg-white or milk-whey to make a smooth surface which would record with more detail the camera's image. Although first proposed as a negative material, this albumen paper came to be the universal method of making prints throughout the century.
After exposure to sun beneath a negative, the image was toned to a pleasing brown by the same gold chloride formula which daguerreotypists used, and then fixed, washed, and dried.

Blanquart-Evrard was dissatisfied with this printing method, because the printing time was too great to permit mass production. By using for positives a slight modification of Talbot's calotype negative paper a much shorter exposure, measured in seconds instead of minutes, could be given. The latent image was developed, and the disagreeable color of the image was changed to a rich slate tone by acidifying the hypo fixing bath.

This innovation enabled Blanquart-Evrard to produce photographs in bulk. In the summer of 1851 he published the first number of the Album photographique, a portfolio of single prints of architectural and landscape subjects in the style of Romantic lithographs. His friend Thomas Sutton wrote in 1857 that

the proofs are permanent, they have not faded. They are also beautifully artistic: vigorous, without being glazed, and superb in color, particularly in the lights. A vast number of copies of this Album were sold, and it became necessary for him in 1852 to enlarge his printing establishment. A huge building, resembling a manufactory, was then erected in the grounds of a chateau, belonging to a friend, situated three miles from Lille. Blanquart-Evrard being a man of fortune, handed over the concern to his friend, who had been connected with chemical and dyeing operations, and who speedily mastered the details of Photographic Printing. A staff of thirty or forty assistants, mostly girls, were then instructed, each in a particular branch of the process, and operations commenced on a large scale. About a hundred thousand prints have been issued from that establishment.

An important use for these mass-produced prints was for the illustration of books. The first production of the establishment was a handsome folio volume Egypte, Nubie, Palestine et Syrie, with a hundred and twenty-five prints from paper negatives taken by Maxime Du Camp on a trip to the Middle East with Gustave Flaubert from 1849 to 1851. Blanquart-Evrard's prints have stood the test of time; those that have come down to us have retained their brilliance and clarity. Strangely enough, his technique never became popular, and it was decades before a developing-out paper was again adopted.

Henry Le Secq, whose negatives Blanquart-Evrard printed, specialized in architectural views; he had been appointed photographer to the Historical Monuments Commission, the government bureau charged with the preservation and restoration of cathedrals. So sympathetic and informative were his photographs that one critic went so far as to say that the sculptured portal of
LE SEQQ: Old architecture at Chartres, France, 1852. Calotype negative, dated 1852, collection V. Barthélémy, Paris; print courtesy Edward Steichen
Rheims Cathedral could be studied better in them than on the spot, where the eye is overwhelmed by the great scale and wealth of detail. Some of Le Secq’s 11 x 14 inch paper negatives, signed and dated 1852, still yield brilliant prints. His contemporary Charles Nègre made even larger negatives: his photographs of Chartres Cathedral measure 20 x 29 inches.

These French calotypists were by no means satisfied with the uncontrolled image of the camera. To record detail in shadows as well as highlights of buildings, Blanquart-Evrard instructed them to choose a day when the bright sun is momentarily obscured by clouds, and to make half the exposure when the sun is shining, and half when its light is diffused. In his Intervention de l’art dans la photographie, 1863, he suggests a method of limiting the marvellous but unintelligent work of the camera to the formation of a complete but slightly intense image and giving the photographer a means of continuing or modifying its action at will — in a word, of substituting his action for that of the camera by using chemical means.

Although Talbot’s technique proved to be the first successful way of mak-
ing paper photographs, his was not the only method. No sooner had he described photogenic drawing than others broke into public print with ingenious alternative techniques in which the light sensitivity of other metals—iron, platinum, potassium—were employed. In May, 1839, the editor of the Magazine of Science noted that the "periodicals still teem with fresh experiments and receipts relative to this art."

The most luckless pioneer was Hippolyte Bayard, who exhibited thirty photographs in Paris on June 24, 1839. His method was original: silver chloride paper was held to the light until it had turned dark. It was then plunged into potassium iodide solution and exposed in the camera. The light now bleached the paper, in proportion to its strength, and he thus obtained direct positives, each unique.

But in the spectacular publication of the daguerreotype the work of Bayard was completely overlooked. He commented on his misfortune in a photograph, dated 1840. He showed himself half naked, propped up against a wall as if dead. On the back of the print he wrote:

The body you see is that of Monsieur Bayard . . . The Academy, the King, and all who have seen his pictures admired them, just as you do. Admiration brought him prestige, but not a sou. The Government which gave M. Daguerre too much, said it could do nothing for M. Bayard at all, and the wretch drowned himself.

Bayard: Self portrait as a drowned man. Direct positive on paper, signed and dated 1840. Société Française de Photographie, Paris
The demand for cheap portraits became so great in the fifties that the daguerreotypists and calotypists could hardly keep up with it. In a price war operators offered the public daguerreotypes at 50¢, at 25¢ and finally at 12½¢ — made “two at a pop” with a double lens camera. In picture factories division of labor was said to have speeded up the work to a production of “300, 500 and even 1000 daily.” The sitter bought a ticket and was posed by an operator who never left the camera. A plate, already prepared by the polisher and the coater, was brought to him, and he passed it on exposed, in its protective shield, to the mercuralizer who developed it, to the gilder who enriched it, and to the artist who tinted it: fifteen minutes later the customer exchanged his ticket for the finished likeness. Such hastily made portraits were seldom satisfactory; many were left behind by disappointed customers; but new prospects streamed up the stairs to the skylight and the cash rolled in.

Then the perfection of new techniques brought prices even lower and quantities even higher. The collodion process, invented by Frederick Scott Archer in England in 1851, almost at once replaced the calotype. Three times, in three guises, it threatened the daguerreotype, and finally triumphed.

Like the calotype, the process was primarily a method of making negatives. Collodion, discovered in 1847 as a means of protecting wounds, is a mixture of guncotton in alcohol and ether; flowed on a surface it dries to form a tough, skin-like film. Archer first used it to save glass plates. The imperfection of the talbotype because of its lack of transparency had early suggested the replacement of paper as a negative support by glass. To attach the silver salts to glass various substances had been tried, even the gluey slime exuded by snails, until partial success came with the use of egg white. These albumen plates — invented by Niepce de Saint-Victor in 1847 — gave excellent negatives, of a brilliance and fineness of detail far surpassing the talbotype. Their drawback was a loss of sensitivity so great that they were practical only for landscape work. And to photographers used to light-weight sheets of inexpensive paper, glass plates were heavy and dear. Archer described in The Chemist for March, 1851, his original and highly ingenious technique. Glass was coated with collodion in which potassium iodide was dissolved. It was then dipped in
silver nitrate, and exposed while wet. After development in pyrogallic acid, the film of collodion bearing the negative image was stripped from the plate, rolled up with paper around a glass rod, and carried home to be fixed and washed. “Thus one piece of glass,” he wrote, “will be sufficient to make any number of drawings upon, the above operations being repeated for each picture.”

As finally perfected, a separate piece of glass was used for each negative. The seven following steps were carried out:

1. A piece of glass was placed in a vise and thoroughly cleaned and polished.
2. Holding the cleaned glass by one corner, enough of the viscous collodion (to which an iodide and often a bromide had been added) was skillfully flowed over the surface to form a smooth, even coating.
3. In the subdued orange light of the darkroom the coated plate, while still tacky, was excited, or made light sensitive, by soaking it for about five minutes in a bath of silver nitrate. When it had become creamy-yellow it was taken out, drained and put, still wet, into a light-tight plate holder, or shield.
4. “Place the cap on the lens [the beginner was directed by John Towler in his handbook, The Silver Sunbeam]; let the eye of the sitter be directed to a given point; withdraw the ground-glass slide; insert the plate-holder; raise or remove its slide; attention! One, two, three, four, five, six! (slowly and deliberately pronounced in as many seconds, either aloud or in spirit). Cover the lens. Down with the slide gently but with firmness. Withdraw the plate-holder and yourself into the darkroom, and shut the door.”
5. The plate was removed from its holder and over its surface a solution of pyrogallic acid or ferrous sulphate was poured. In a few seconds the image began to appear, increasing rapidly in brilliancy. When it was judged to be fully developed, the plate was rinsed in clean water.
6. Hypo or potassium cyanide in solution was now poured over the developed plate to dissolve the remaining unaltered silver salts. The plate was then well washed under running water.
7. Over a gentle flame the fixed plate, held between thumb and forefinger, was rapidly moved until dry; while still warm it was varnished.

The process required experience and skill of hand; a mistake in any one operation spelled failure. The photographer was chained to his darkroom, for all these operations had to be done rapidly, before the collodion dried or else excess silver nitrate would crystallize out and spoil the image. Because the plate had to be kept continually moist the process came to be called “wet plate.”
Wood engravings from contemporary manuals showing steps of the wet-plate process
Although invented for making negatives, Archer described the application of his technique to the production of positives. A wet-plate negative could be viewed as a positive simply by placing it against a piece of dark material or by painting the back black. The highlights were represented by the grayish-white tone of the developed collodion emulsion; the shadows, being more or less transparent, revealed the black background. Like the daguerreotype, each such picture was unique; the very glass plate exposed in the camera was itself the final product. Thus Archer’s modification lacked the power of duplication, but it had the advantage of speed; the sitter could take the finished picture with him almost immediately.

These glass positives, because of their similarity to the daguerreotype, both in appearance and in manner of production, were especially popular in America. Scott Archer’s invention, which he had published without restrictions of any kind, was patented by James Ambrose Cutting of Boston in 1854. Marcus A. Root, a Philadelphian writing master turned daguerreotypist, named the pictures ambrotypes. Like the daguerreotypes, which they imitated, they were commonly enclosed in leather or composition cases.

The familiar tintype is a modification, the support for the light-sensitive collodion emulsion being, instead of glass, thin metal plates japanned black or chocolate color. The manufacture of such plates was begun in 1856 by Peter Neff, Jr., who named the process melainotype, and by Victor M. Griswold, who chose the name ferrotype. The more popular word tintype was introduced later.

Because the surface of the tintype was not fragile they could be sent through the mail, carried in the pocket, and mounted in albums. They were processed while the customer waited. They were cheap, not only because the materials were cheap, but also because, using a multi-lens camera, several images could
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be secured with one operation. After processing, the plate was cut into single pictures with tin snips.

Tintyping was usually casual; when the results have charm it is due to the lack of sophistication and to the naïve directness characteristic of folk art. Records of outings, mementos of friendships, stiffly posed portraits of country folk against painted backgrounds are common: views are few. The process lingered in the backwaters of photography as the direct yet weak descendant of the daguerreotype.

Despite the competition of direct imitation, neither the tintype nor the ambrotype dealt the death blow to the daguerreotype. That was left to a third application of the collodion technique, the carte-de-visite photograph, patented in France by Adolphe-Eugène Disdéri in 1854. The name refers to its similarity to a common visiting card in size, for it was a paper print pasted
on a mount measuring $4 \times 2\frac{1}{2}$ inches. To take these small portraits, Disdéri first made a wet-plate negative with a special camera that had several lenses and a plate-holder which moved. Eight or a dozen poses could be taken on one negative. A single print from this negative could then be cut up into eight or more separate portraits. Unskilled labor was used for this work; the production of the cameraman and printer was thus increased eightfold or more.

Disdéri, a brilliant showman, made this system of mass production portraiture world famous. Napoleon III halted a column of troops he was leading out of Paris on their way to Italy in front of Disdéri's studio while he had his portrait taken. So great was the publicity that all Paris, it seems, wanted portraits. Disdéri's studio became, in the eyes of a German visitor, "really the Temple of Photography — a place unique in its luxury and elegance. Daily he sells three to four thousand francs' worth of portraits." At twenty francs
a dozen, this sum represents a daily production of eighteen to twenty-four hundred photographs!

The “photomania” jumped to England (seventy thousand pictures of the Prince Consort were sold the week after his death) and to America (a thousand prints a day were made of Major Robert Anderson, the hero of Fort Sumter). “The year eighteen sixty-one is memorable for a revolution in pictures,” wrote the editor of the American Journal of Photography. “The card photograph has swept everything before it; and it is the style to endure.” To accommodate card photographs of relatives, friends and celebrities, elaborately bound albums were sold. The cards, of uniform size, were readily slipped into cut-out openings; the family album became a fixture in the Victorian home.

The card photograph was stylized to a formula. The figure was almost invariably taken at full length. To the American daguerreotypists the first carte-de-visite imported from France seemed comical. Abraham Bogardus, a veteran New York daguerreotypist, recollected that “it was a little thing; a man standing by a fluted column, full length, the head about twice the size of a pin. I laughed at that, little thinking I should at a day not far distant be making them at the rate of a thousand a day.” The fluted column, the book-strewn table and the velvet drape became indispensable pieces of studio furniture.
Little effort was made to bring out the character of the sitter by subtleties of lighting, by choice of attitude or expression: the posing was done too quickly to permit such individual attention.

In the face of this intense competition, portraits larger in size and less standardized in pose, lighting and concept were made by the collodion process. Paris took the lead. A school of portraitists developed a bold and vigorous style well suited to interpreting those highly individualistic personalities who made Paris the center of the artistic and literary world.

The more prominent portraitists had for the most part been Young Romantics of the Latin Quarter, living the *Vie de Bohème* as second-rate painters, caricaturists and writers. Nadar, whose real name was Gaspard-Félix Tournachon, contributed sketches and articles to comic magazines and founded a new one. He planned a vast series of caricatures, the *Panthéon-Nadar*, of
everybody prominent in Paris; and to gather documents for the thousands of sketches to be included, he turned to photography. In 1853 he opened a photographic studio in Paris with his brother Adrian. At first he made daguerreotypes, but he quickly took up the collodion process, using large plates to record the famous people who flocked to his studio, which had become a favorite meeting place. His portrait style was simple and straightforward: he took his friends usually three-quarter length standing under a high skylight against a plain background. The posing was subdued: the faces are seen with a directness and a penetration due partly to the fact that he knew most of the sitters intimately, but more to the power of his vision.

All the artistic, dramatic, political galaxy – in a word the intelligentsia – of
NADAR: Théophile Gautier, about 1853. Collection Georges Sirot, Paris
ETIENNE CARJAT: Charles Baudelaire. Woodburytype from Galerie Contemporaine, 1870. Eastman Historical Photographic Collection, Rochester, N.Y.
Nadar: Sarah Bernhardt, 1859. Negative in collection Mme Paul Nadar, Paris; print courtesy Daniel Masclet
our time has passed through his studio. The series of portraits that he exhibits is the Panthéon — serious this time — of our generation. Daumier meditates on his epic Robert Macaire — M. Guizot stands, his hand in his waistcoat, as severe and cold as if he were waiting for silence in the court before launching into a thundering rebuttal — Corot smiles as someone asks him why doesn’t he finish his landscapes. These photographs are broadly seen . . . The photographer has the right to be called an artist.

He was a ceaseless worker. While still taking portraits, he continued to illustrate books. He was an experimenter. He took the first pictures by electric light; and, in 1856, the first photographs from a balloon. Aeronautics became an obsession: he built the largest balloon the world had seen, the Giant. On its second ascension the balloon was carried to Germany; the descent was made near Hannover. At the last moment control of the balloon was lost, and the luckless passengers were banged and dragged some twenty-five miles over open country before they finally came to rest. In 1870 Nadar was one of those who organized the balloon service by which the inhabitants of besieged Paris were able to maintain contact with the world.

His aeronautical ventures proved to be a financial failure, and he took up photography again, this time to make money. In the meanwhile competition had become enormous. “The appearance of Disdéri and the carte-de-visite,” he wrote in his autobiographical Quand j’étais photographe, “spelled disaster. Either you had to succumb — that is to say, follow the trend — or resign.” And he went on to tell of his friend Gustave Le Gray who had taken up photography because of his “preoccupation with art” and who, rather than change his studio into a factory, abandoned the camera and spent the rest of his life in Egypt as an art professor.

Nadar, who lived on into the twentieth century, never again achieved the brilliance of his earlier work. The business was taken over by his son Paul in 1880, who used the bold signature of his father as a trade mark for the somewhat routine products of his studio.

Disdéri, whose fortune had once been the talk of Paris, died penniless, blind and deaf, in a public hospital in Nice. He was a victim of his own invention. The system which he popularized was so easy to imitate that all over the world cartes-de-visite were being made by the million, by photographers who were hardly more than technicians.
PIERRE PETIT: Eugène Delacroix, about 1857. Collection V. Barthélemy, Paris
BRADY: Walt Whitman. Negative the National Archives, Washington, D.C.; print courtesy Ansel Adams
In 1861 an English critic, in an article "On Art-Photography," wrote: "Hitherto photography has been principally content with representing Truth. Can its sphere not be enlarged? And may it not aspire to delineate Beauty, too?" He encouraged photographers to produce pictures "whose aim is not merely to amuse, but to instruct, purify and ennoble."

 Allegories had been attempted. In 1843 John Edwin Mayall of Philadelphia made ten daguerreotypes to illustrate the Lord's Prayer; they were acclaimed by the British art press when he showed them a few years later in his London studio. In 1848 he produced six plates based on Thomas Campbell's poem *The Soldier's Dream*. At the Great Exhibition of 1851 in the London Crystal Palace other American daguerreotypists exhibited allegorical pictures: Martin M. Lawrence, for example, showed a 13 x 17 inch plate of three models facing left, front and right, which he titled *Past, Present, and Future*, inspired by Edwin Greene Malbone's miniature painting, *The Hours*.

 These pictures relied for their effect upon the choice, costuming and posing of models; they were records of *tableaux vivants*. In lighting and technique they were identical to routine portrait daguerreotypes.

 With the perfection of the collodion process an increasing number of amateurs were attracted to photography, and they brought with them a broader viewpoint on artistic matters than the average professional possessed. In 1853, the Photographic Society of London (now the Royal Photographic Society of Great Britain) was founded; its first president, Sir Charles Eastlake, was himself an amateur; although the membership was divided between those who practised photography as an avocation and as a profession, the amateurs were more often heard. At one of the first meetings Sir William Newton, miniature painter to the court, addressed the members "Upon Photography in an Artistic View." He suggested that the photographic image could be altered to produce results "in accordance with the acknowledged principles of Fine Art," and recommended that negatives be taken slightly out of focus and that the deficiencies of the process be overcome by hand work on the negative.

 These concepts were not new. In 1843 daguerreotypists were instructed to
use a relatively large lens opening when taking a portrait of a person with
wrinkled features to "obtain one of those soft and rather vague likenesses
which painters call 'flou.'" Daguerreotypes were commonly tinted with trans-
parent watercolors applied over a varnish of isinglass, and D. O. Hill had even
painted in a complete waterfall on a paper negative. But in general, the optical
image was unaltered. Sir William's suggestion led to a spirited controversy,
creating a split in photographic esthetics which still persists. Should the cam-
era's natural image be respected? Or should it be considered as a starting point
for the creation of a picture by manipulating the image and retouching nega-
tive and print?

These questions were particularly pertinent in the 1850's. Collodion emul-
sion was relatively insensitive to red light and oversensitive to blue. As a re-
result when an exposure had been given that was long enough to record the
landscape, the blue sky above was recorded on the negative as a solid tone;
the print consequently appeared with a white, cloudless, sky. To remedy this
shortcoming two negatives were often taken — one a short exposure to record
the sky, the other longer, to record the landscape. The two negatives were
masked; part of the print was made from one, and part from the other.
“Combination printing,” as it came to be called, was applied in 1857 to allegorical compositions by Oscar G. Rejlander, a Swede working in Wolverhampton, England. His first work, printed from thirty separate negatives, was *The Two Paths of Life*, which was described as an allegory representing a venerable sage introducing two young men into life—the one, calm and placid, turns towards Religion, Charity and Industry, and the other virtues, while the other rushes madly from his guide into the pleasures of the world, typified by various figures, representing Gambling, Wine, Licentiousness and other vices, ending in Suicide, Insanity and Death. The center of the picture, in front, between the two parties, is a splendid figure symbolizing Repentance, with the emblem of Hope.

The large print—it measured 31 x 16 inches—was shown in 1857 at the Manchester Art Treasures Exhibition, where it was purchased by Queen Victoria, herself an amateur photographer.

Unlike the allegorical daguerreotypes, this “magnificent picture, decidedly the finest photograph of its class ever produced”—to quote the critic further, was not a record of a *tableau vivant*, although the models were actually members of a troupe of strolling players. The negatives were made at separate
times, and the same model is often shown in several different poses. Rejlander considered the picture an example of the camera's usefulness to artists, and said that he could think of no other subject which would enable him better to portray "various draped figures as well as exhibit the beautiful lines of the human form."

Henry Peach Robinson made an equally famous picture, *Fading Away*, a year later with five negatives. The photograph showed a dying girl attended by grief-stricken parents. On the mat was printed:

Must, then, that peerless form
Which love and admiration cannot view
Without a beating heart; those azure veins,
Which steal like streams along a field of snow,
That lovely outline, which is fair
As breathing marble, perish? — Shelley

Robinson stated that the principal model "had three years practice in expression for photography before a satisfactory picture was taken." Contemporaries
were shocked by the subject; it was felt to be poor taste to represent so painful a scene. Though the criticism seems ridiculous, we should not ignore it as Victorian sentimentality. Far more painful subjects were painted in those days. But the very fact that it was a photograph implied that it was a truthful representation, and so the scene was viewed literally. Its artificiality did not escape criticism. “Look steadily at it a minute,” the Literary Gazette told its readers, “and all reality will ‘fade away’ as the make-up forces itself more and more on the attention.” Such criticism, which was widespread, was discouraging. Rejlander wrote Robinson in 1859:

I am tired of Photography for the public, particularly composite photos, for there can be no gain and there is no honor but cavil and misrepresentation. The next Exhibition must, then, only contain Ivied Ruins and landscapes forever besides portraits — and then stop.

But Robinson produced quantities of art-photographs; he published one every year. His influence was even more strongly felt through his prolific writing. His Pictorial Effect in Photography, 1869, went through edition after edition, and was translated into French and German. The book, a handy manual for the production of art-photographs, was based on Burnet’s Treatise on Painting, a long outmoded resumé of academic rules of composition. Robinson illustrated his text with reduced photographs of his own work and with crude woodcuts of paintings, particularly those of David Wilkie, whose “pyramidal” structures he analyzed for his readers. “As the science of photography has its formulae,” he wrote, “so has the art of picture-making, in whatever material, its rules.” This regimentation of photographic esthetics and confusion of media caused damage still felt.

Not only did Robinson popularize the emulation of paintings, but he encouraged artificiality. At the very time when painters were moving their easels outdoors, Robinson was building nature under the skylight: shrubbery was mounted on a rolling platform; a brook was improvised from the darkroom drain; clouds were painted on backdrops. He told the beginner that:

Any “dodge, trick, and conjuration” of any kind is open to the photographer’s use. . . . It is his imperative duty to avoid the mean, the bare and the ugly, and to aim to elevate his subject, to avoid awkward forms, and to correct the unpicturesque. . . . A great deal can be done and very beautiful pictures made, by a mixture of the real and the artificial in a picture.

The professional artist’s approach was brought to photography by the French sculptor Antony Samuel Adam-Salomon. He posed his models under
the high side light which has ever since been called “Rembrandt lighting.” He swathed them with velvet drapery to make the effect more painterly. And he mounted his prints on blue cards printed with the legend “composed and photographed by the sculptor Adam-Salomon.” Alphonse de Lamartine, who had called photography “a plagiarism of nature,” confessed that

after admiring the portraits caught in a burst of sunlight by Adam-Salomon, the emotional sculptor who has given up painting, we no longer claim that photography is a trade — it is an art, it is more than an art, it is a solar phenomenon, where the artist collaborates with the sun.

When some prints of Adam-Salomon’s were shown at the Photographic Society in Edinburgh, an argument broke out: was the effect due to retouching? It was settled only by a microscopic examination of the prints: Adam-Salomon had indeed retouched them.

Retouching had become controversial ever since Franz Hanfstaengl of Munich showed at the 1855 Exposition Universelle in Paris a retouched negative with a print made from it before and after retouching. It was, Nadar recollected, the beginning of a new era in photography. So difficult was it to be-
ADAM-SALOMON: Portrait, about 1867. Collection V. Barthélémy, Paris
lieve that modifications had been made to the negative rather than to the print that one of Hanfstaengl’s prints was even tested by the somewhat extreme method of bleaching out the silver image entirely with potassium cyanide; no trace of India ink was found.

Not all the work of these self-styled artist-photographers was artificial, sentimental and pretentious. Robinson produced charming genre scenes, such as the simple study of two little girls reading a book, used as a frontispiece to *Pictorial Effect*. Rejlander pioneered in instantaneous photography with a series of photographs showing the most fleeting facial expression for Charles Darwin’s *Expression of the Emotions* (1872).

There was a curious duality apparent in the writings and work of artist-photographers. Robinson on one page wrote that beautiful photographs could be made “by the mixture of the real and the artificial,” and on another page praised “this perfect truth, this absolute rendering of light and shade and form . . . beyond the reach of the painter and sculptor.” C. Jabez Hughes, while praising Rejlander’s and Robinson’s work, strongly rebelled against combination printing.

When an artist conceives a brilliant thought, and hastens to put it on canvas, how he sighs that he is obliged to work piecemeal — that he cannot, with one sweep
of his brush, realise the thought in his mind. It is the proud boast of photography that it can do this.

This ambivalence is characteristic of the work of Julia Margaret Cameron; her dynamic portraits are among the most noble and impressive yet produced by means of the camera; her genre pictures, on the other hand, drip with sentimentality and lie within the stylistic idiom of the Pre-Raphaelite painters.

At Freshwater Bay, in the Isle of Wight, Mrs. Cameron, whose husband was a British civil servant, entertained illustrious friends: Tennyson, Herschel, Carlyle, Darwin, Browning, Longfellow. She took up photography when she
CAMERON: Thomas Carlyle. Carbon print, 1867. The Museum of Modern Art
was fifty: a portrait titled *Annie, My First Success* is dated 1864. She trained her camera on her friends; by the sheer force of her personality she seems to have intimidated them into co-operation. In her autobiographical *Annals of My Glass House* she describes the intensity she brought to portraiture.

When I have had such men before my camera my whole soul has endeavored to do its duty towards them in recording faithfully the greatness of the inner as well as the features of the outer man. The photograph thus taken has been almost the embodiment of a prayer.

She blundered her way through technique, resorting to any means to get desired effects. It did not matter if the subject moved — she wanted that spirit which defines a personality, not accidental details. She used badly made lenses to destroy detail, and appears to have been the first to have them specially built to give poor definition.

By accident or design, Mrs. Cameron gave her photographs that breadth and simplicity which was characteristic of early calotypes. Her compositions, undoubtedly inspired by her friendship with the painter George Frederic Watts, are for the most part costume pieces. She admired the work of Rejlander and invited him to Freshwater Bay "to help her with his great experience." Tennyson tells of the tedious hours of posing for the *Mad Monk*; her children are to be seen in such pictures as *Venus Chiding Cupid and Removing his Wings*. Without the challenge of interpreting great personalities, her work tended to become lost in sentiment and to echo painting.

More and more laymen found photography a stimulating avocation. Writers seem to have been especially attracted: Charles Dodgson ("Lewis Carroll"), Charles Kingsley, Samuel Butler, Oliver Wendell Holmes were all amateurs. The French poet Auguste Vacquerie accompanied Victor Hugo to Jersey and, with Charles and François Hugo, produced in 1852 an album documenting the poet's life in exile. An eerie romanticism pervades these pictures; details seem selected for their symbolism: the gnarled logs of the breakwater, Hugo's resting place under the flowering vines on the conservatory, Vacquerie dozing on a grassy bank. A series of hands alone — Hugo's and his wife's — appear, a novel idea in photography.

Perhaps the excellence of the work of these amateurs is due to the very difficulties which must have intimidated all but the more intrepid. They rebelled against the handicaps, against sensitizing their own plates on the spot, against lugging about the heavy equipment for immediate development, and against the caustic silver nitrate which blackened their fingers and ate into
their clothes. Lady Eastlake seems to have written from personal experience in 1857:

Every sanguine little couple who set up a glass-house at the commencement of summer, call their friends about them, and toil alternately in broiling light and stifling gloom, have said before long, in their hearts, “Photography, thy name is disappointment!” But the photographic back is fitted to the burden.

Yet, when a less messy process was invented, many looked back on the good old days. They missed the intimate sense of material and the craftsmanship of the obsolete process. As late as 1906 R. Child Bayley wrote:

The very smell of the ether has a fascination. The wet plate photographer cleans his glass and dirts his fingers, coats his plate, sensitizes it, develops it and dries or smashes it as he may think fit, and all within an hour. . . . There is no such feeling of “alone I did it” to be obtained by the user of the dry plate of commerce.

Lewis Carroll would have nothing to do with the new process. He considered it unfit for “artistic effect,” and sent his negative to be printed by H. P. Robinson.
In the winter of 1855 Roger Fenton sailed from England on the ship *Hecla* for the theatre of the Crimean War as an accredited war photographer. He was backed by Agnew Brothers, picture dealers of Manchester, who knew his accomplished architectural, landscape and portrait photographs. He had studied painting with Paul Delaroche, and as the first secretary of the Photographic Society he was a friend of Rejlander, Robinson and the other artist-photographers.

Documentation of battle was a new application of photography. Daguerreotypes had been taken during the Mexican War showing officers and men, but there is no evidence that they were taken during combat. Fenton was the first to photograph under fire and to show the very battlefields.

He took with him a wagon, fitted out as a darkroom, for he was using the wet collodion process. Five cameras, seven hundred glass plates, chemicals, rations, harnesses and tools made up his equipment. At Gibraltar he bought four horses.

The "Photographic Van" was unloaded at Balaklava in March, 1855. In a month he was at the front. Once a piece of the van roof was torn off by enemy shell fire, but he was more bothered by demands to take portraits. "If I refuse to take them, I get no facilities for conveying my van from one locality to another," he complained. The heat was excessive. "When my van door is closed before the plate is prepared, perspiration is running down my face, and dropping like tears. . . . The developing water is so hot I can hardly bear my hands in it." He returned from the Crimea in July with over three hundred negatives. Exhibitions were held in London and in Paris; wood engravings of the more interesting scenes were printed in the *Illustrated London News*. The subjects were landscapes and portraits — battlefields and fortifications, officers and men. There were no scenes of action: to record them was then beyond the power of the camera. "The photographer who follows in the wake of modern armies must be content with conditions of repose and with the still life which remains when the fighting is over," the London *Times* wrote of Fenton's work. To a public used to the conventional fantasies of romantic
battle painters, these photographs seemed dull, yet they recognized in them the virtue of the camera as a faithful witness. "Whatever he represents from the field must be real," the Times admitted, "and the private soldier has just as good a likeness as the general."

War has ever been an ungrateful subject for the photographer. The battlefields of the Crimea appear deserted; officers and men stand in bored groups. Even those scenes taken under direct shellfire show nothing of the menace which the photographer felt. But to the soldiers in their unshapely battle-dress and to the generals in their smart uniforms, these photographs must have carried an authentic stamp which no other kind of picture could convey.

When war broke out in America between the States in 1861, the photographic fraternity took the news lightly. "A battle scene is a fine subject for an
artist — painter, historian or photographer,” declared the editor of the *American Journal of Photography.* “We hope to see a photograph of the next battle. . . . There will be little danger in the active duties, for the photographer must be beyond the smell of gunpowder or his chemicals will not work.”

How greatly the dangers and difficulties of combat photography had been underestimated was soon found out by Brady, the former daguerreotypist. He already had shown his interest in history in the publication of his *Gallery of Illustrious Americans.* This sense of photographic documentation impelled him to undertake the recording of the Civil War; his close friendship with influential government leaders enabled him to secure the necessary authorization to wander where he chose; and from his assistant Alexander Gardner he had acquired technical skill in using wet plates.

He hurried to the front with his assistants, where his photographic buggy became a familiar sight to the soldiers, who called it the “What-is-it?” wagon, and spoke of Brady as “That grand picture maker.” It must have required no little zeal and intrepidity to remain crouched for minutes on end in the darkness of that fragile darkroom, going through the delicate manipulations of preparing and processing the glass plates while the din of battle shook the ground. Unarmed, knowing that the wagon itself was a suspicious-looking target, the photographers were exposed to the hazards of war. They risked their lives to save their plates. Brady was almost killed at Bull Run. Lost for three days, he finally turned up in Washington, haggard and hungry, still in his long linen duster, from which protruded a sword given him by a Zouave. He purchased new equipment, rounded up his assistants, and rushed back to the battlefields.

Brady and his men photographed every phase of the war which their technique could encompass: battlefields, ruins, officers, men, artillery, corpses, ships, railroads. He ordered two negatives of the same subject made whenever possible. There were seven thousand when peace was declared. “The views,” said his catalog, “were taken on the spot, during the progress of hostilities, and represent ‘grim-visaged war’ exactly as it appeared.”

His expenses, even more numerous, put him in debt, and he lost control of the negatives. One set was purchased by the War Department on payment of the storage bill; these are now preserved in the National Archives. Another set was seized, in default of payment, by E. and H. T. Anthony and Company, the stockhouse which had supplied him with material; these negatives are now in the Library of Congress.

Brady himself appears to have been the first to photograph the Civil War,
BRADY: City Point, Richmond, Va., 1865. The National Archives, Washington, D.C.
for the editor of *Humphrey's Journal of Photography* remarked in the issue of September 15, 1861, that Brady was planning to return to the front and was amazed that other photographers had not followed his example.

Alexander Gardner left Brady’s employment to become official photographer to the Army of the Potomac. His *Photographic Sketch Book of the War*, a hundred actual photographic prints mounted in two folio volumes, includes some of the finest photographs of the conflict. The names of the makers of the negatives and prints are meticulously recorded: Timothy H. O'Sullivan, George N. Barnard, Wood & Gibson, and others.

Perhaps the most poignant of these Civil War photographs are the inhumanly objective records of ruins — architecture and men. The bleak and ravaged fields, shattered houses, stiff and gruesome corpses, the pathetically homely pictures of camp life, overreach in their intensity mere records. They
may be compared to another great documentation of the war — Winslow Homer's drawings in *Harper's Weekly*. But while we admire Homer's sketch of a sharpshooter in a tree, we do not necessarily believe in his existence. The sharpshooter may actually have been there, or he may have been a figment of Homer's imagination, or a mixture of the two. We have no way of telling beyond the assurance given to us by the credit line which the editors felt necessary, "Drawn from life by our special artist."

But Gardner's dead sharpshooter, his long rifle gleaming by his side, is not imagined. This man lived; this is the spot where he fell; this is how he looked in death. There lies the great psychological difference between photography and the other graphic arts; this is the quality which photography can impart more strongly than any other picture making. As Oliver Wendell Holmes put it:

The very things which an artist would leave out, or render imperfectly, the photograph takes infinite care with, and so renders its illusions perfect. What is the picture of a drum without the marks on its head where the beating of the sticks has darkened the parchment?

The camera records what is focused upon the ground glass. If we had been
there, we would have seen it so. We could have touched it, counted the pebbles, noted the wrinkles, no more, no less. We have been shown again and again that this is pure illusion. Subjects can be misrepresented, distorted, faked. We now know it, and even delight in it occasionally, but the knowledge still cannot shake our implicit faith in the truth of a photographic record. A picture book called *Paris under the Commune* is subtitled "By a Faithful Witness, Photography."

The fundamental belief in the authenticity of photographs explains why photographs of people no longer living and of vanished architecture are so melancholy. Neither words nor yet the most detailed painting can evoke a moment of vanished time so powerfully and so completely as a good photograph.

Old Paris, medieval Paris, lives for us in the brilliant photographs of the condemned areas which Charles Marville recorded for the government before Napoleon III had the great boulevards cut through the city. Marville's camera was not an impersonal lens, for documentary photography is a personal matter. It is not enough to set up the camera and record unthinkingly that which lies before it; choice of stance, choice of time of day, choice of details to emphasize or to subdue are subjective matters. Marville's pictures of streets and houses, worn by human use but emptied of people, have the melancholy beauty of a vanished past.

In America, in the unsettled days which followed the cessation of hostilities, many war photographers followed the building of the transcontinental railroad and joined the semi-military survey parties of the army engineers. Combat photography had not only toughened them for the rigors of frontier travel but had also trained them to handle the difficult wet collodion technique under unfavorable conditions.

Alexander Gardner drove his photographic buggy into the Kansas wheatfields in 1867 when the Eastern Division of the Union Pacific Railroad was being thrown across the plains at the rate of two miles or more a day. He made a hundred and fifty views of the country and of the construction gangs at work. For this record he used a stereoscopic, twin-lens camera.

The paired prints of the stereograph give a startling illusion of relief when viewed through the apparatus called the stereoscope. In many ways stereoscopic photography is the ideal technique for the historian, for the power of the camera to convince is greatly intensified by the three-dimensional effect. Oliver Wendell Holmes, who was not only an enthusiastic collector of stereoscopic views but who also devised the skeleton-type viewer which joined the brass-clasped photograph album in the Victorian parlor, found the twin pic-
tures of inexhaustible interest. He revelled in the wealth of detail which they contained, and found their illusion of nature identical to nature herself. Of Brady's Civil War stereographs he wrote:

It is so nearly like visiting the battlefields to look over these views that all the emotions excited by the actual sight of the stained and sordid scene, strewed with rags and wrecks, came back to us, and we buried them in the recesses of our cabinet as we would have buried the mutilated remains of the dead they too vividly represented.

The stereograph creates its dramatic effect because it reproduces binocular vision. Normally we see the world with both of our eyes. The image of each eye is slightly different: the fusion of the two in our mind is our most important method of depth perception. Charles Wheatstone maintained in 1838 that if two perspective drawings were made, reproducing exactly the image created in each eye, and were looked at by each eye simultaneously yet independently, depth perception would be re-created.

Attempts were made to draw pairs of pictures by hand so exactly that they could be fused into a three-dimensional unity, but the process was so exacting and so laborious it was not practical. It meant that the artist had to calculate the true perspective from viewpoints separated only by the distance between the eyes — about 2 1/2 inches. But the camera gave exact perspective automatically; it was simply necessary to make one exposure, move the camera laterally 2 1/2 inches, and make a second exposure. In 1841, Wheatstone had stereo pairs made for him by both the calotype and the daguerreotype. But neither technique was well adapted to the purpose. To view each picture separately, they were held close to the eyes and looked at through two low-powered magnifiers. The calotype would not stand this magnification; the metallic glare of the daguerreotype made the images difficult to see.

Glass transparencies and paper prints were much more suitable. They could be handled easily, the instruments to view them were not cumbersome, and they could be produced in mass. During the fifties, sixties and seventies they were produced by the million. Cameras were designed with twin lenses, so that both photographs could be taken simultaneously. The negatives were small and thus easier to prepare than the "extra whole plate" (8 x 10 inches) which became a standard size for single views. Because the lenses were of short focal length, exposures could be more quickly made with the result that action photographs could, to a limited extent, be taken.

The focal length of a lens is a fixed characteristic which determines the
point at which a sharp image will be formed of an extremely distant object. Imagine the light ray from a distant point as a lever, which is pivoted where it passes through the lens, and which continues until it forms an image. When the point at one end of the lever moves, its image at the other end moves; the
shorter the arm of the lever behind the lens (a distance determined by the focal length), the less the image moves. Consequently, by the use of a short focal length lens the motion of the image of a moving object can be reduced on the plate to a degree so negligible that during the brief time the lens is open no appreciable blur will be produced.

The stereographs which exist are mainly records of events and places. We can see how Broadway looked when it was unpaved and choked with horse cars and carriages. We can travel, as Oliver Wendell Holmes invited the readers of the Atlantic Monthly, over the world. We can visit the Holy Land; we can see European museums and historical buildings; the aspect of foreign cities. And we can go West into the American frontier country with the pioneers.

In addition to Gardner's documentation of the Eastern Division of the Union Pacific Railroad, another war photographer — Captain A. J. Russell — covered the Western Division with large single photographs as well as with stereographs. Many of his vivid views of the hurriedly constructed roadbed were published by the explorer scientist Ferdinand Vandiveer Hayden in Sun Pictures from the Rocky Mountains (1870). A Mormon photographer, Charles R. Savage, was on hand to record the driving of the last spike at Promontory Point, Utah, when the two lines finally met in 1869.

Photographers accompanied the government expeditions sent out to explore the territories. In A Canyon Voyage, F. S. Dellenbaugh described the photographic outfit as the terror of Major John Wesley Powell's exploration of the Grand Canyon in 1871:

The camera in its strong box was a heavy load to carry up the rocks, but it was nothing to the chemical and plate-holder box, which in turn was a featherweight compared to the imitation hand organ which served for a darkroom. This dark box was the special sorrow of the expedition, as it had to be dragged up the heights from 500 to 3000 feet.

Men would travel miles over back-breaking terrain and come back empty handed. Two of the photographers, who had made a side trip to the Kanab Canyon,

did not get a single negative. The silver bath had got out of order, and the horse bearing the camera fell off a cliff and landed on top of the camera, which had been tied on the outside of the pack, with a result that need not be described.

John K. Hillers, who had joined the party as an oarsman, learned the hard technique of expeditionary photography in the field and, when both pro-
fessionals quit, took over and for six years made spectacular 11 x 14 inch views of the canyon and hundreds of stereographs of vanishing Indian tribes.

T. H. O'Sullivan, one of the most daring of the war photographers, joined Clarence King's Geological Exploration of the Fortieth Parallel in 1867. Seventeen civilians and twenty cavalry troops left San Francisco for the Great Salt Lake via the Sierra Nevada. Two mules and a packer were assigned to O'Sullivan. At Nevada City he photographed hundreds of feet down in the Comstock Lode mines by magnesium flare—dangerous and unpredictable anywhere, almost suicidal in mines where inflammable gas might be lurking. A side trip took him into the desert a hundred miles south of Carson Sink where, with the luxury of an ambulance drawn by four mules, he photographed the shifting sand dunes five hundred feet high.

In 1870 he was in Panama, photographing for Commander Thomas Oliver Selfridge's Darien Expedition. A self portrait made shows him lean, tough, mustached, standing beside his huge camera in a native village.

The following year, when he joined First Lt. George Montague Wheeler in the Engineer Corps' Geographical Surveys West of the 100th Meridian, O'Sullivan was probably the most experienced expeditionary photographer in the country. He was to find high adventure and magnificent material for
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his camera in the Southwest. The expedition's first sortie was an ascent of the Colorado River. In camp thirty-five miles below the present site of Hoover Dam, O'Sullivan made one of his finest views. In the foreground his boat, Picture, is drawn up to the bank, with the omnipresent black dark tent inside it. The waters of the Colorado appear deceptively smooth, due to the length of exposure. Behind rise the dark and menacing profiles of Black Canyon. As the party passed through the area now submerged by Lake Mead the going became increasingly tough. "... The boat party entered the jaws of the Grand Canyon, not knowing what was before them," Wheeler wrote. "Up to this time the rapids, though often very swift, had not been accompanied by heavy falls, and the estimate for the time to reach the mouth of the Diamond Creek [the rendezvous with the ground party] was based on our experience up to that time, which supposed due allowance for increasing difficulties." Wheeler's papers were lost in an upset; at Camp 28, Starvation Camp, rations
were so low that Wheeler guarded them personally, complaining to his diary that there were not enough to make even a decent pillow. After a month's trip the exhausted travelers reached Diamond Creek.

Some of O'Sullivan's most interesting photographs were made on the Survey's 1873 exploration of the area now known as the Canyon de Chelly National Monument in Arizona. The awe-inspiring scale of the Canyon is wonderfully sensed. One view was taken by brilliant, raking sunlight, which picks out every stratum of the Canyon wall. Two tiny figures pose on the famous White House ruin "in a niche 50 feet from the present Cañon bed," as the caption reads. Two other explorers stand among the lower ruins; one holds the rope by which the cliff was scaled.

Most photographers took several cameras into the field, partly as insurance
against accidents and partly in order to make different sized negatives. Enlarging was infrequent and impractical. If large prints were required, large negatives had to be made, and as the expanse of western scenery demanded big pictures, field photographers were obliged to take big cameras. The limit was reached by William Henry Jackson who packed a 20 x 24 inch camera on a trip to the Rocky Mountains and the Southwest with Hayden’s survey of 1875.

The technique was still the same old messy wet-plate process. The two-foot square glass plates could not be handled in a portable dark box: “for darkroom had a canvas tent lined with orange calico about six feet square at base with center pole,” Jackson wrote in his diary. Nor could he use the conventional silver bath, a glass-lined box open at one end. “Used a flat wooden tray for bath.”

Working with the oversize camera was exacting. His first exposure, of Lake San Cristobal, Colorado, cost him three days’ work. Three times he climbed the mountain. On the first day the wind blew too strongly; on the second day the silver bath leaked; on the third day, “Everything worked lovely and secured a fine negative on first attempt.”

Hillers: John Wesley Powell, first to navigate the Grand Canyon of the Colorado, with Taú-Gu, Great Chief of the Pai-Utes. Stereograph, about 1872. The Museum of Modern Art
o'SULLIVAN: Canyon de Chelly, Arizona, 1873. The Museum of Modern Art
Jackson recorded twelve of these huge negatives in the official government catalog: "These are the largest plates ever used in field-photography in this country. They convey an impression of the real grandeur and the magnitude of mountain scenery that the smaller views cannot possibly impart."

Jackson was the last of the frontier photographers. He died in 1942 at the age of ninety-nine, a grand old man whose full life he described in his autobiography, *Time Exposure*. He joined Hayden’s survey in 1870; in 1872 he made the first photographs of the Yellowstone area which Congress, largely on the evidence of these very pictures, set aside as our first National Park.

Reading Jackson’s detailed journals and other accounts of field photography in the mid-nineteenth century, we find that much of the cameraman’s work was preparatory, prospecting for views. Perhaps this is the key to the excellence of these photographs. Perhaps the very despairs of the photographer worked, in the long run, for him. Casual, promiscuous snap-shooting was impossible. Every exposure was an effort; every piece of glass carried by pack mule, boat or human brawn was precious. If a negative was a failure, the silver image was washed off and the glass used again. Only successes survived to be brought back for printing during the between-season layover.

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JACKSON: First photograph of Old Faithful, 1872. Eastman Historical Photographic Collection, Rochester, N.Y.
In the earliest photographs action was not recorded. The almost universal praise of Daguerre’s first work was tempered with the criticism that in depicting motion he was less successful than in recording architecture. Indeed one critic went so far as to state that moving objects “can never be delineated without the aid of memory.”

The prediction was soon proved false. Fox Talbot in 1851 photographed by a sudden electric flash a page of the London Times fastened to a rapidly revolving wheel; although he used albumen plates the illumination was sufficiently intense to give a well exposed picture. This was Talbot’s last photographic experiment. He turned his attention to a photo-mechanical reproduction technique which he patented as photoglyphic engraving in 1852 and 1858. When he died in 1877 he was translating from the Assyrian, and the best obituary of the great inventor appeared in the Transactions of the Society of Biblical Archaeology.

Outdoors, under normal illumination, “instantaneous” photographs were occasionally taken in the fifties, but they were exceptional. In A Manual of Photographic Manipulation (1858) Lake Price said:

If there is one direction more than another in which we may look for greater artistic excellence and interest to be imparted to the photographic picture . . . it will be by the process being so much accelerated by optical and chemical improvements, that any dimension and class of picture may be taken instantaneously; nor need we despair of witnessing this result, when we see what progress a few past years have brought to this art.

The first photographs in which action was stopped with more or less regular assurance were stereoscopic views of city streets, peopled with minute figures of pedestrians. Oliver Wendell Holmes, in an essay on how man walks, in the Atlantic Monthly, 1863, tells of basing his theory on

a new source, accessible only within the last few years and never, so far as we know, employed for its elucidation, namely the instantaneous photograph . . . We have selected a number of instantaneous stereoscopic views of the streets and public
places of Paris and New York, each of them showing numerous walking figures, among which some may be found in every stage of the complex act we are studying.

The article was illustrated with wood engravings drawn by Felix O. C. Darley directly from photographs. The Autocrat of the Breakfast Table found the attitudes in these pictures startlingly different from the conventions which had been used for centuries: he called attention to the length of stride and to the almost vertical position of the sole of the foot in one of the figures. Of another he remarked that the leg is suspended in mid-air: "No artist would have dared to draw a walking figure in attitudes like some of these."

Perhaps it was not so much dare as do, for the eye alone cannot detect attitudes which exist for mere fractions of a second. This inadequacy of human vision was even more convincingly demonstrated a decade later, when Muybridge showed the world that nobody had accurately observed how a horse gallops.

Governor Leland Stanford of California had made a bet. In the gallop, he declared, all four feet of a horse were off the ground at once. To prove it, he proposed to have instantaneous photographs taken of his horses. There was recommended to him as a photographer capable of this exacting commission Eadweard Muybridge, whose large photographs of Yosemite Valley, signed
"Helios — The Flying Studio," were world famous. He had come to America from England in 1852, photographed the Pacific Coast for the government, and was one of the first to photograph in Alaska. He had taken the strange name Eadweard Muybridge in the belief that it was the Anglo-Saxon original of his real name, Edward James Muggeridge.

The assignment was difficult because Muybridge had at first only wet plates. His first attempt in 1873 was almost successful. In 1874 he was accused of murdering his wife's lover; although he was acquitted, he had to leave the country, and not until 1877 was he able to continue his experiments. He decided that his only hope was to secure silhouettes, by photographing the horses against a slanting board fence covered with rock salt to reflect as much sun as possible. Opposite this dazzling reflector he ranged a number of cameras fitted with shutters, actuated by electricity, which would admit light to the plate for $1/5000$ second. Strings attached to electric switches were stretched across the track; the horse, galloping past, broke the strings one after the other, the shutters were released, and a series of negatives were made. In 1878 drawings of the results were published in American, English and French scientific magazines. Vague as the silhouettes were, they clearly showed that Leland Stanford was indeed correct: the feet were all off the ground during the gallop.
But, to the surprise of the world, they were in mid-air only when the feet were bunched together. None of the horses which Muybridge photographed ever assumed the hobbyhorse attitude so traditional in painting, front legs stretched forward and hind legs backward. The photographs looked absurdly awkward. To prove that they were true, Muybridge put them on the outside of a large disk, only the upper part of which could be seen at a single view.

Setting this disk in rapid rotation, so that picture after picture comes into view but a moment, we are able to see the horse galloping as in nature, stride succeeding stride, every circumstance of the motion, even to the waving of the tail and mane, being truthfully, and therefore naturally, recorded.

In 1880, using a similar technique with a device he named the zoopraxiscope, Muybridge projected his pictures on a screen, anticipating motion-picture photography.

Jules-Etienne Marey, a French physiologist who had been specializing in the problems of locomotion, wrote Muybridge for details, and soon began to use his technique with modifications. Instead of a series of cameras, Marey used one, and recorded on a single plate successive phases of action. He clothed men in black, painted white lines along their arms and legs, and had them move against a black background while several exposures were made on the
MUYBRIDGE: Jumping horse, taken in Philadelphia between 1883 and 1885. The Museum of Modern Art
same plate. The result was a linear graph of the motion of arms and legs. He later devised a camera with a moving plate, so that each exposure was a separate picture.

The American painter Thomas Eakins wrote Muybridge in 1879, suggesting an improvement by superimposing scales of measurement over the image during printing. He owned a set of the 1878 photographs from which he made lantern slides, presumably for teaching. And he devised a camera which was an improvement over Muybridge’s. It is not unlikely that Eakins instigated the invitation extended to Muybridge by the Trustees of the University of Pennsylvania to continue his work under their auspices in Philadelphia. During his two years’ residence in Philadelphia (1883–85) Muybridge perfected his equipment: the shutters were controlled by a master electric switch driven by clockwork, so that exposures could be made at any desired interval; three batteries of twelve cameras were used, to photograph from side, front and rear; and, most important of all, the newly perfected dry plate made it possible for him to secure well detailed images at short exposure times.

The results of Muybridge’s labors were published in 1887 in the form of over seven hundred large photogravure plates which fill eleven volumes. In addition to horses, animals of all kinds were borrowed from the Philadelphia zoo for photographing. But the most significant work was with the human figure. Hundreds of nude models were photographed in all manner of activity—walking, running, laying bricks, climbing stairs, fencing, jumping. Muybridge even photographed one girl pouring water on another, and a mother spanking a child! His specific intention was to create an atlas for the use of artists, a dictionary of human and animal forms in action.

There were those who rejected the evidence so painstakingly gathered. Joseph Pennell told the members of the London Camera Club that

if you photograph an object in motion, all feeling of motion is lost, and the object at once stands still. A most curious example of this occurred to a painter just after the first appearance in America of Mr. Muybridge’s photographs of horses in action. This painter wished to show a drag coming along the road at a rapid trot. He drew and redrew, and photographed and rephotographed the horses until he had gotten their action apparently approximately right. Their legs had been studied and painted in the most marvellous manner. He then put on the drag. He drew every spoke in the wheels, and the whole affair looked as if it had been instantaneously petrified or arrested. There was no action in it. He then blurred the spokes, giving the drag the appearance of motion. The result was that it seemed to be on the point of running right over the horses, which were standing still.
There is little doubt that Pennell was referring to *The Fairman Rogers Four-in-Hand* which Eakins painted in 1879, for it corresponds exactly to the description. The case of the "frozen" wheel continued to bother photographers themselves. W. de W. Abney preferred the "fuzzy mass of wool-like matter radiating from the center," as drawn by John Leech, the *Punch* artist. He concluded that instantaneous photographs were untrue and artistically incorrect; the strange positions often assumed in them by men and animals
could, he said, only be seen by the eye if the scene were illuminated by a flash of lighting, and he counseled photographers to represent only those phases of action which approach that of rest. H. P. Robinson stated that “it is the mission of the artistic photographer to represent what he sees and no more.” P. H. Emerson, artist-photographer and opponent of Robinson, found “nothing more inartistic than some positions of a galloping horse, such as are never seen by the eye, but yet exist in reality, and have been recorded by Mr. Muybridge.”

In these later experiments, Muybridge used the new gelatin dry plates. The universal demand for a more convenient technique than the wet-plate process led to many experiments. The first thought was to add a hygroscopic substance, such as honey, sugar, glycerine or even beer to the collodion in an
effort to delay its drying and thus to postpone the crystallization of the excess silver nitrate on the surface. Then, in 1864, B. J. Sayce and W. B. Bolton showed how the silver bath could be eliminated by making an emulsion of collodion, a bromide and silver nitrate which was then applied to glass plates and allowed to dry. Such plates could be used at any time; they could be manufactured, and the photographer needed no longer to be his own plate maker. The Liverpool Dry Plate and Photographic Printing Company began to put these collodio-bromide dry plates on the market in 1867. But the convenience of being able to dispense with the wet-plate paraphernalia was gained at the expense of a pronounced loss of sensitivity. Exposures were long, averaging, according to the manufacturer's own directions, three times that of wet plates.

In 1871 the British Journal of Photography published a letter from a physician, Richard Leach Maddox, describing an emulsion made of gelatin, which the editor pronounced to be "the driest of the dry processes." Maddox soaked gelatin in water, added cadmium bromide in solution and then silver nitrate. This emulsion was flowed on glass and allowed to dry. Maddox realized that his process was still in the experimental stage, and urged other amateurs to continue where he had been forced, by the pressure of professional work, to stop. He later stated that he had been led to the use of gelatin not because he found the wet collodion process troublesome to manipulate, but because he could not stand the smell of ether in the hot garden glass house where he was doing his photomicrographic work.

Over two years went by before Dr. Maddox's odorless process was refined to a workable technique. The first improvement was to wash the emulsion in its jelly state to remove the excess silver salts, which tended to crystallize on the surface. Then in 1878 Charles Bennett allowed the emulsion to ripen by subjecting it to high temperature after washing. With these plates he made successful negatives at snapshot speeds (1/25 second) which amazed the photographic world when they were shown at the South London Photographic Society. The editor of the British Journal of Photography wrote in 1879 that the year would "be looked back to in the future as one of the most noteworthy epochs in the history of photography."

In every camera club there was talk of gelatin:

Onward still, and onward still it runs its sticky way,
And Gelatine you're bound to use if you mean to make things pay.
Collodion — slow old fogey! — your palmy days have been,
You must give place in future to the plates of Gelatine.

Manufacturers now began to make gelatin plates, and problems which had
long plagued the photographer suddenly were solved. He was freed from the need of a darkroom at his elbow, for the plates could be processed at any time after exposure. He could give them to others to develop, and the industry of photo-finishing was born. Even more: the speed of the new process made the tripod no longer indispensable; the camera could be held in the hand.

A bewildering array of hand cameras appeared on the market in the 1880's. Many held several plates in a magazine, so that the photographer could take a dozen or more exposures without reloading. Some were disguised as paper parcels, luggage, watches, books; others were concealed in hats and behind neckties. Because with these cameras exposures could be made surreptitiously, they were called "detective cameras."

The most famous detective camera was the Kodak, manufactured by George Eastman, a dry-plate maker in Rochester, New York. Introduced in 1888, it was named the Kodak, a word coined by Eastman to be short and pronounceable in any language. The first Kodak was a box, $3\frac{1}{4} \times 3\frac{3}{4} \times 6\frac{1}{2}$ inches, loaded at the factory with a roll of paper coated with gelatino-bromide emulsion. After the user had taken one hundred exposures, each 21\frac{1}{2} inches in diameter, he sent the entire camera to the factory, where the negative was developed, its emulsion transferred from the paper to glass, dried and printed. For $10 the camera was reloaded and returned to the owner. You press the button, we do the rest brought the taking of photographs to the million. George Eastman had done more than invent a camera; he invented a system and worked out machinery for producing standardized material in quantities sufficient to back up the system. In 1889 he substituted transparent film for the paper, eliminating stripping, and amateurs could, if they wished, process their own Kodak exposures.

Photography now became a popular pastime, and the ranks of amateur organizations swelled. The new techniques were not looked upon favorably by all. In 1891 one amateur wrote:

In common, doubtless with many others, I have been led to deeply deplore the rage for employing hand, or so-called Detective Cameras, which has swept over the country as a flood during the past year. Every would-be photographer has possessed himself of one of the fascinating little boxes, in some one of their many forms; and older and more experienced devotees of the art (who ought to know better) have in too many instances sacrificed picture making to facilities for procuring a rapid succession of snapshots afforded by their use.

Most of the thousands upon thousands of photographs taken with Kodaks
and detective cameras were undoubtedly as insignificant as the critic feared. Yet there were exceptions. With a Fallowfield “Facile” camera disguised as a suitcase, Paul Martin made a series of informal, unposed street scenes of London which showed how the life of a city could be documented in all its manifold activity. Alfred Stieglitz, after scorning the detective camera, made some of his finest photographs with its aid.

The comparative ease with which photographs could now be taken led to new applications. A New York amateur, Alexander Black, was reveling in the freedom of the new hand camera. His painter friend, William Merritt Chase,
was so impressed by the results that he urged Black to show lantern slides of 
them to the Society of American Artists. As the pictures were thrown on the 
screen, the distinguished painters found one another’s work mirrored in them. 
In his autobiography Black recollected that:

A picture of New York bootblacks in action elicited a recognizing shout, “A perfect 
J. G. Brown!” A park scene brought “A Chase to the life!” “Ah, a Thayer!” was the 
comment on a tenement madonna.

Following this success, Black lectured on photographing in its relation to art 
to the students of the National Academy of Design, and then took his talk on 
the road, billed as “Ourselves as Others See Us.”

In 1893 he had the idea of telling a story in photographs. He wrote a short 
comedy, Miss Jerry, about the adventures of a young lady reporter, which 
actors performed before his camera. The resulting two hundred and fifty 
lantern slides he projected to audiences on a screen, while he read the dialog. 
These picture plays of Black’s were forerunners in spirit, if not in technique, 
of the moving picture.

By carefully registering the backgrounds of the successive pictures in a scene the 
figures alone are made to appear to move, thus slowly producing the effect which 
Mr. Edison has wrought, in a different way, with his kinetoscope . . . The range 
of the picture play gave it peculiar advantages, for not only could I pass from one 
fictitious scene to another, but I could introduce the backgrounds of real life.

In Miss Jerry the part of Chauncey Depew was played by himself, and for 
A Capital Courtship, Black persuaded President Grover Cleveland to appear 
in his office with the cast, signing a bill.

Both the kinetoscope of Thomas A. Edison and the cinematograph of the 
brothers Auguste and Louis Lumiè¨re were presented to the public in 1895. 
These first practical moving-picture techniques relied for their success upon 
the perfection of flexible roll film by Eastman, which enabled action photog 
graphs to be taken at the rate of sixteen per second. When thrown upon the 
screen at the same rate, convincing illusion of relief was produced.

The gelatin emulsion not only led to the conquest of action, but it brought 
about standardization of materials and the scientific investigation of the photog 
graphic process.

In 1876 Vero Charles Driffield, a scientist and amateur photographer, per 
suaded his friend and colleague, Ferdinand Hurter, to join him in his hobby. 
“But, to a mind accustomed like his to methods of scientific precision,” Drif 
field wrote in his notebook, “it became intolerable to practice an art which —
at that time — was so entirely governed by rule-of-thumb, and of which the fundamental principles were so little understood.” They began a series of investigations. Their first aim was to devise a method of measuring the intensity of light, so that photographers could compute with accuracy the exposure time. When the first gelatin dry plates were marketed they found them so rapid in their reaction to light that the need for a method of calculating exposure became even greater. They studied the relationship between exposure, or the amount of light falling on the photographic plate, and the density, or the amount of silver produced by the light. With an apparatus made from an old sewing machine, and with a candle for standard illumination, they exposed plates to successively increasing amounts of light. The silver deposit they measured optically in a homemade photometer. From this data they drew a graph. One would expect that as the amount of exposure was doubled, the density of silver would double. This, however, is not the case. At first the blackening of the plate is greater, soon equality is reached, then the blackening decreases. The graph, with a concave foot, a straight middle section, and a convex shoulder, Hurter and Driffield called the characteristic curve.

By plotting such curves, manufacturers were able to test their product. Hurter and Driffield suggested that the “speed” of a plate (degree of sensitivity to light) could be measured geometrically from the characteristic curve.

In 1890 they announced the results of their researches in the Journal of the Society of Chemical Industry. They opened the article with a classic statement:
The production of a perfect picture by means of photography is an art; the production of a technically perfect negative is a science.

Perhaps the greatest value of their work to the practicing photographer was the simplification of the developing process. They showed that for every plate or film there was an optimum developing time, depending on the brilliance of the subject, the composition of the developer, and the temperature at which it is used. Negatives could be developed in total darkness by immersing them in the developing solution for a predetermined time. It was no longer needful to watch the gradual appearance of the image in red light. Thus plates sensitive to light of all colors, and which would be fogged in the red light of the darkroom, could be readily processed.

Wet-plate photographers had despaired at the tendency of their material to render blue sky with such a dark deposit on the negative that prints from them were "baldheaded," showing no clouds. This was due to the fact that the plates were sensitive to blue light only. In 1873 Hermann Wilhelm Vogel discovered that by using certain dyes in the preparation of the plates, they could be made sensitive to other than the blue rays of light. Plates thus made sensitive to all colors except red were called orthochromatic. Later plates were made sensitive to all colors and were named panchromatic.

Commercial large-scale production of panchromatic plates and film was made possible in the 1920's, largely through the work of C. E. Kenneth Mees of the Eastman Kodak Company, and the new emulsion soon came to be universally used.

The gelatin emulsion could be spread on paper, for the printing of positives. This innovation made it no longer necessary to rely on the sun for printing: exposures could be made by artificial light, and the latent image developed to a visible one. With this so-called "gaslight paper," enlarging at last became practical. In the wet-plate days, when photographers were limited to the relatively insensitive printing-out paper, the only light source bright enough to enlarge with was the sun. A cumbersome enlarger, the solar camera, had been invented by David A. Woodward in America in 1857. The exposures were hours long, and the camera, mounted on the roof, had to be turned with the sun. Quantity production was out of the question. Now artificial light—dependable and readily controlled—could be used in less cumbersome enlargers in the photographer's darkroom.

While these radical improvements in plate, film and paper manufacture were taking place, equally important improvements were being made in lenses.
In 1884 Otto Schott of the Schott Glass Works and Ernst Abbé of the Zeiss Optical Works, both in Jena, Germany, developed barium crown glasses which had a higher refractive index for a given dispersion than any glass previously available. For any lens to bring rays of different colors to the same focus, the positive elements must be of lower dispersive power than the negative elements, and in early days this meant that the refractive index of the positive elements had to be low, and that of the negative elements, high. This had two adverse effects: it gave a strongly inward-curving field; and it made the surface of the positive elements strong and those of the negative elements relatively weak. As the lens on the whole is positive, this resulted in considerable amounts of aberration. With the introduction of barium crown glass, many new types of photographic lenses became possible. The first to be de-
veloped were cemented triplets of the Dagor type, in which the three glasses are common crown, light flint, and dense barium crown in that order.

These new anastigmat lenses were of greater relative diameter than the rapid rectilinear lenses which they quickly replaced. The diameter of the first Zeiss Protar, for example, is its focal length divided by 4.5 or, as it is commonly expressed, f/4.5. This system of marking lenses by f/ numbers was devised as a way of designating their light-passing power regardless of focal length. The film in a miniature camera fitted with a 2-inch lens at aperture f/8 will receive the same amount of light in a given unit of time as the film in a portrait camera with a 1.4-inch lens of the same aperture, although measured with a ruler the diameters are 1\(\frac{1}{4}\) and 1\(\frac{3}{4}\) inches respectively.

By the end of the century, Daguerre's method of obtaining “the spontaneous reproduction of the images of nature received in the camera obscura” had become a highly refined technique. The camera was placed in the hands of every man. With the division of the taking and processing operations, skill of hand was no longer needed to secure results. At this very time ways were found to reproduce photographs in books and magazines on the same press with type. The public became more photograph conscious than ever. Camera clubs sprang up throughout the world; magazines for amateurs appeared in great number; the taking of snapshots became a fad. It was said that President Grover Cleveland on a fishing trip with Joe Jefferson used his Kodak all day long but, alas, never once turned the knob that wound the film. His disappointing experience was typical of the attitude that photography was an automatic process, an attitude inherent in the very genesis of photography (had not Talbot called it the Royal Road to Drawing?), but which had not been realizable until technical advances had reduced the mechanics of technique to a minimum.

Against this popularization there grew a movement on the part of photographers who called themselves “serious workers.” They passionately believed that photography was a potential art form, and they set about demonstrating their belief.
Photography as an Art

Art-photography, as championed by Robinson and Rejlander in the late fifties, was flourishing in England when the dry-plate revolution took place. Robinson himself was still the leader — subscribers still looked forward to his annual photographs — and the walls of exhibition galleries were crowded from floor to ceiling with anecdotal genre scenes, sentimental landscapes, and weak portraits, all reminiscent of the most academic of paintings.

Against the artificiality of these stiffly posed studio scenes and patchwork prints made up of pieces of different negatives, Peter Henry Emerson protested with a vehemence which shook the photographic world. His weapons were his own photographs, lectures, articles and books. In March, 1886, he spoke to the Camera Club in London on "Photography, a Pictorial Art." Sweeping aside John Ruskin as a "spasmodic elegant of art literature," because he denied any connection between science and art, and dismissing Robinson's book as "the quintessence of literary fallacies and art anachronisms," Emerson laid before his audience a theory of art based on scientific principles. He held that the artist's task was the imitation of the effects of nature on the eye, and pointed to Greek sculpture, Leonardo da Vinci's Last Supper, and the recent paintings of the "naturalistic" school of Constable, Corot and the Barbizon group as the peaks of artistic production of all times. Trained as a physician, he was greatly impressed by Hermann von Helmholtz' Physiological Optics, which he quoted as the ultimate authority on correctness of representation.

Emerson came to the conclusion that photography was "superior to etching, woodcutting and charcoal drawing" in the accuracy of its perspective rendition, and that it was second to painting only because it lacked color and, he believed, the ability to reproduce exact tonal relationships.

In the same year he published in a limited edition Life and Landscape on the Norfolk Broads, a collection of forty actual prints mounted to form a handsome folio volume. These photographs had all been made in East Anglia, and presented a record of the strange amphibian life of the marsh dwellers. The publication was followed by similar volumes with letterpress describing the manners and customs of the peasants, and photogravures made directly from
his negatives. These books were ethnological studies, of which the photographs were an integral part. Each picture had been made on the spot, often with great difficulty, always with direct honesty. Free from sentimentality and artificiality, they were diametrically opposed to the art-photographs of Robinson and his followers.

Having established himself as a photographer, Emerson proceeded to explain his esthetic and technical approach in a textbook, *Naturalistic Photography* (1889). It was not illustrated: students were referred to the plates of *Pictures of East Anglia*, copies of which he gave to camera clubs. *Naturalistic Photography*, called “a bombshell dropped in a tea party,” is a curious mixture of truth and fallacy. In it Emerson expanded his warped history of art and again propounded the Helmholtzian theory of vision. His practical advice was often sound, however, and the book can still be read with profit. For he had a respect for the medium and understood both the limitations and the capabilities of photography.

The equipment which Emerson recommended was the simplest—a view camera, preferably of whole plate size (6½ x 8½ inches), a sturdy tripod, and a lens of relatively long focal length—at least twice the plate’s longest side. He had no use for hand cameras. He condemned enlarging. He saw no relation between size and artistic quality: “An artistic quarter plate picture [3¼ x 4¼ inches] is worth a hundred commonplace pictures forty by thirty inches in size.” The student was advised to develop his negatives on the very day they were taken “whilst yet the mental impression of what you are trying for is fresh.” He rejected retouching as “the process by which a good, bad, or indifferent photograph is converted into a bad drawing or painting. . . . The technique of photography is perfect, no such botchy aids are necessary.” For printing he advised two processes, the platinotype and photogravure.

Platinum is a more stable metal than silver; its first use in photography was to make prints which would be permanent. The technique was worked out in England by William Willis, who took out his first patent in 1873. To Emerson the permanence of this method of printing, although important, was secondary to its esthetic quality. He liked the range and delicacy of values which it recorded, the tone of the image and particularly the variety of texture of the paper base, which he found superior to the “unpleasant glaze” of albumen paper.

Every photographer who has the good and advancement of photography at heart, should feel indebted to Mr. Willis for placing within his power a process by which he is able to produce work comparable, on artistic grounds, with any other black
and white process. . . . No artist could rest content to practice photography alone as an art, so long as such inartistic printing processes as the pre-platinotype processes were in vogue. If the photogravure process and the platinotype process were to become lost arts, we, for our part, would never take another photograph.

Photogravure is a means of producing the photographic image in printer’s ink. First a glass transparency is printed from the negative. A copper sheet is made light sensitive, and on it a negative image is printed from the transparency. By choice of material the image assumes the property of resisting the biting effect of acid in proportion to the lights and shades it represents, and so an etched metal plate is prepared which, when inked, yields prints on paper. Although it is today considered a reproductive process, Emerson saw it as a direct printing technique, allied to the traditional art process of etching. The photogravure plates of his albums were made under his direct supervision.

This much of Emerson’s advice was sound: it was an approach to photography based on tradition, and it formed the tenets of what has been called
“classical photography.” What raised debate was Emerson’s theory of focusing. He reasoned that our field of vision is not entirely sharp. The central area is clearly defined, while the marginal areas are more or less blurred. To reproduce human vision with the camera, he advised the photographer to put the camera’s lens slightly out of focus. But, he warned,

it must be distinctly understood that so-called “fuzziness” must not be carried to the length of destroying the structure of any object, otherwise it becomes noticeable, and by attracting the eye detracts from the harmony, and is then just as harmful as excessive sharpness would be. . . . Nothing in nature has a hard outline, but everything is seen against something else, and its outlines fade gently into that something else, often so subtly that you cannot quite distinguish where one ends and the other begins. In this mingled decision and indecision, this lost and found, lies all the charm and mystery of nature.

British photographic magazines in the 1880’s were full of stormy letters pro and con this theory. “Naturalistic focus, then, according to Emerson, means no focus at all, a blur, a smudge, a fog, a daub, a thing for the gods to weep over and photographers to shun,” wrote “Justice.” “It is not in man, even in f.64 man,” George Davison replied, choosing the technical designation of one of the smallest lens apertures to imply concern with overall sharpness in the negative, “to overlook the unnaturalness of joinings in photographic pictures, and the too visible drawing-room drapery air about attractive ladies playing at haymaking and fishwives.” Robinson thundered: “Healthy human eyes never saw any part of a scene out of focus,” and hinted that the Naturalists were indebted to his teaching for their knowledge of composition. Emerson retorted, “I have yet to learn that any one statement or photograph of Mr. H. P. Robinson has ever had the slightest effect upon me except as a warning of what not to do.” Many of Emerson’s followers ignored his qualifying advice, and “soft focus” photographs began to appear in quantity.

Then, in January, 1891, Emerson courageously and dramatically renounced what he had so passionately advocated. “A great painter” — unnamed, but apparently James A. McNeill Whistler — had shown him the fallacy of confusing art and nature, and the experiments of Hurter and Driffield convinced him that control of the image was less than he had expounded. Photography was not art.

In a black-bordered pamphlet, The Death of Naturalistic Photography, he explained that

the limitations of photography are so great that, though the results may and some-
times do give a certain aesthetic pleasure, the medium must always rank the lowest of all the arts . . . for the individuality of the artist is cramped, in short, it can scarcely show itself. Control of the picture is possible to a slight degree, by varied focusing, by varying the exposure (but this is working in the dark), by development, I doubt (I agree with Hurter and Driffield, after three-and-a-half months of careful study of the subject), and lastly, by a certain choice in printing methods.

But the all-vital powers of selection and rejection are fatally limited, bound in by fixed and narrow barriers. No differential analysis can be made, no subduing of parts, save by dodging — no emphasis — save by dodging, and that is not pure photography, impure photography is merely a confession of limitations. . . . I thought once (Hurter and Driffield have taught me differently) that true values could be altered at will by development. They cannot; therefore, to talk of getting values in any subject whatever as you wish and of getting them true to nature, is to talk nonsense.

. . . In short, I throw my lot in with those who say that photography is a very limited art. I deeply regret that I have come to this conclusion.

But Emerson could not recall the fresh spirit he had brought to photography
in a period when it was verging on academicism. He did not give up photography. Whether or not the delicate photogravures in his *Marsh Leaves* of 1895 are “art” seems to us of little importance; among them are fine photographs. His bold renunciation was more a matter of semantics than of esthetics, for to Emerson “art” and “painting” appear to have been synonymous. In 1898 he published a third and revised edition of *Naturalistic Photography*, which was substantially the same as the first two editions, except for the final chapter, which instead of “Photography, a Pictorial Art,” became “Photography—Not Art.”

The status of photography as an art, however, had become an issue which could not be summarily dismissed. Ever since 1853 the Photographic Society had held annual exhibitions which contained photographs of all kinds, including those made with esthetic intent. To the art-minded, inclusion was not enough, and in 1893 five members, including Robinson and Emerson’s one-time champion, George Davison, decided over a restaurant table to form a rival society in London which would have for its *exclusive* purpose the establishment of a distinct pictorial movement through the severance of this application of photography from the purely scientific and technical; and through the medium of independent exhibitions, its final universal recognition.

They decided to call the society the “Linked Ring,” and the annual exhibition the “Salon,” a name “suggested through its application by the French to certain fine-art exhibitions of a distinctive and high class character.” They abolished the custom of awarding medals, and insisted that the selection be made by a jury of photographers alone. Critics were irked by the group’s self-conscious assertion that the work exhibited was “The New Photography”; they were shocked by the dogmatic statement, printed in the catalog of the 1895 Salon, that “on the pictorial side, chemistry, optics and mechanism no longer predominate; they have become subservient and of secondary importance, very little knowledge of them indeed is in any way necessary.”

We can best reconstruct these rival photographic exhibitions from the annual issues of *Photograms of the Year,* a record of pictorial photography published since 1895. The editors not only reviewed the exhibitions in detail, but illustrated many of the contributions. The difference between the two seems less to us than it must have fifty years ago. In presentation the Salon took the lead: the pictures, instead of being packed frame to frame from floor

* The editor proposed the word *photogram* in the belief that it was a more correct derivation from the Greek than *photography* and insisted on its use editorially. He had no idea that the word would come to be used to designate a photograph made without a camera.
to ceiling, were asymmetrically arranged more or less on eye level, vases of flowers were placed above them on a narrow shelf, designs in pastels were drawn on the wall surface and “here and there elsewhere, even on the frames.” The “haphazard” arrangement was grudgingly admitted to be effective, for “each picture arrests your attention, and for this reason the Salon deserves praise for a bold experiment that offers a pleasant change to those who are wearied with many galleries.” The example of the Linked Ring was soon followed in Paris, Munich and Vienna, where similar exhibitions came to be called “Salons.”

The first three issues of Photograms of the Year contained articles by Alfred Stieglitz on “Pictorial Photography in the United States.” Stieglitz, while a student in Berlin, won his first recognition from Emerson, who awarded him the prize — two guineas and a silver medal — in a contest held by The Amateur
Photographer in 1887. It was the first of a hundred and fifty medals which Stieglitz was to win. Emerson wrote Stieglitz that of the thousands of photographs he had seen, the only truly spontaneous one was his Good Joke, a genre picture showing a group of Italian children clustered around a fountain, each one laughing heartily. While the picture lacked intensity, it had been taken directly and honestly, without straining for effect; it was not forced into an obvious compositional pattern. Emerson’s choice had been prophetic, for Stieglitz carried on the fight for the recognition of photography as an independent art from the point where Emerson renounced it.

Stieglitz had gone to Germany from New York in 1882, when he was eighteen years old, to study mechanical engineering. In a Berlin shop window he saw a camera, which he at once bought. It seemed, he later recollected, to have been waiting for him by predestination, and he soon found himself more interested in photography than engineering. He had the advantage of studying under H. W. Vogel, the famous photo-chemist who had invented orthochromatic emulsion, and he acquired a brilliant technique. While most of the pictures made in his student days were genre scenes that recall the popular paintings of the day, some showed a new vision. Paula of 1889 remains a brilliant photograph: a young German girl is writing a letter in a room filled with sunlight broken into bands of light and dark by a Venetian blind. It was a technical problem to resolve the harsh contrasts; it was an esthetic problem to see in the commonplace subject a picture of lasting quality.

When Stieglitz returned to America in 1890 to live, he found amateur photography in a flourishing but disorganized state. There were many camera clubs and photographic societies, but none of them seemed to have the passionate belief in pictorial photography which existed in England. He joined the Society of Amateur Photographers, became editor of The American Amateur Photographer, and through his photographs and writing, through his publication of the work of others, through his lectures and demonstrations, he began to show Americans the esthetic potentialities of photography.

He now began to push technique beyond the accepted limits. The hand camera had been universally regarded in artistic circles as unworthy of the “serious worker.” Stieglitz saw in it a challenge. Borrowing from a friend a 4 x 5 inch detective camera, he waited three hours on Fifth Avenue in a blinding snowstorm on February 22, 1893,* to photograph a horse-drawn coach;

* The date was thus given by Stieglitz in The American Annual of Photography for 1897. He later stated that the picture was taken on February 22 of 1892. On this date, however, no snow fell in New York City. Four inches were recorded by the Weather Bureau on February 22, 1893.
the next day he photographed the steaming horses of the Harlem streetcar as they started uptown from the terminal at the old New York post office. When he developed them, fellow club members called these negatives, made in such poor light, worthless. Yet from these negatives Stieglitz made excellent lantern slides.

He considered that a good lantern slide, properly projected, was one of the finest ways to look at a photograph. Here again, he was breaking down prejudices, because magic lantern slides had generally been used for entertainment or for illustrating lectures. Emerson had dismissed them as “toys” having no place in art. Stieglitz worked out ingenious techniques for controlling the contrast and the tone of the lantern slide by chemical means, and for expanding the range of values by the use of a mask, or as he called it, “compensating
cover glass." In 1896 he twice gave demonstration exhibitions of his slides to the Society of Amateur Photographers, showing pictures made in Europe and America. The Society's Journal said,

Mr. Stieglitz' pictures are examples of pure photographic processes — no retouching or hand drawing having been done on any of the negatives, even in the case of the large portrait heads — and wherever any softening of the detail or forms of the figures has been necessary, it has been obtained by the simple and legitimate expedient of additional exposure.

By this time Stieglitz had an international reputation. The editor of Photograms of '97, in noticing his contributions to the London exhibition, fairly ran out of words:

Mr. Stieglitz is so astoundingly clever that it leaves a critic with nothing to say. He pushes the limits of his craft a shade further every year, yet always in orthodox ways, and gains his sensation by legitimate effects. One wishes that he were a Briton, to add to the list of brilliant workers home-born.

But Stieglitz was an American, and he wanted to see American pictorial photographers equal the British, who were winning prizes right and left. He pleaded with his countrymen: "We Americans cannot afford to stand still; we have the best of material among us, hidden in many cases; let us bring it out . . . let's start afresh with an Annual Photographic Salon to be run upon the strictest lines."

The Society of Amateur Photographers and the New York Camera Club merged in 1896 to become The Camera Club. Stieglitz was elected its vice-president. As chairman of its publications committee he transformed the Club's journal into the handsome periodical Camera Notes, containing superb reproductions of photographs by members and non-members, articles and critical reviews of exhibitions. An exhibition billed as a Photographic Salon was held in Washington in 1896, but it was by no means exclusively artistic. In the following year, however, the Philadelphia Photographic Society announced an exhibition which would be limited to "such pictures produced by photography as may give distinct evidence of individual artistic feeling and execution." It was held in the galleries of the Pennsylvania Academy of Fine Arts; two painters and an illustrator had consented to serve with two photographers on the jury; and it seemed that a definite step forward had been made in the recognition of photography as an art.

Elsewhere pictorial photography was gaining ground. Throughout the country salons were held; younger workers received recognition: Edward
Steichen of Milwaukee, Clarence H. White of Newark, Ohio, Alvin Langdon Coburn of Boston. Their style of visualization was characterized by soft focus, deep shadows relieved with brilliant highlights and linear composition. The influence of Whistler and Japanese prints lay heavily upon them. They liked to fasten their photographs on mounts of softly colored textured paper which were in turn fastened to one or more additional mounts of harmonizing or contrasting colors and of increasing size. Prints so mounted were often signed with a monogram, and they were almost invariably exhibited in large frames.

In 1900 F. Holland Day brought an exhibition of the "new American School" to London. He and Steichen arranged the photographs in the Royal Photographic Society's building. Although many prominent American photographers, including Stieglitz, were not represented, and although Day included no fewer than one hundred of his own photographs, the exhibition demonstrated a new trend in photography, and was a sensation.

Some of the photographs exhibited at these various salons were actually mistaken by visitors for reproductions of paintings, to the pleasure of the more extreme pictorialists and to the scorn of those who believed in pure photography. Emerson explained this tendency as a reaction:

There was a time when the great bubble of sharpness enveloped the photographic world, but that has burst, and the explosion thereof seems to have upset the sanity of some, who have been carried away in the explosion, and lost all reason and sense, all tone and texture, those vital and great qualities of photography.

He denounced in particular the newly rediscovered gum bichromate process, a technique based on the property of gum mixed with potassium bichromate to change its degree of solubility in water upon exposure to light. The more strongly the light acts upon it, the less easily can it be dissolved. Pigments may be applied to paper with bichromated gum as a medium. After exposure to light beneath a negative the print is "developed" by washing it in warm water. Areas can be locally treated by applying hot water with a brush, or directing a stream of water on the print. Weak areas can be reinforced by recoating the print with light-sensitized pigment and again exposing it beneath the negative. The process can be carried on with pigments of different color on the same support. The temptation of this easily controlled technique is to imitate charcoal or chalk drawings by using rough paper, black or red pigments, and by freely washing away unwanted details. Criticizing a gum-print by Davison as devoid of photographic quality, Emerson said,

If pure photography is not good enough or "high" enough for such as he, by all
means let him become an artist and leave us alone and not try and foist “fakes” upon us.

But what was “pure photography”? Stieglitz and his friend Joseph T. Keiley had invented what they called the glycerine process, which permitted local development of platinotypes; they said it was a “purely photographic process” because handwork in the sense of retouching played no part in it. The matter could not be settled by accepting this or rejecting that technique; what mattered was the photographer’s intent, his taste and his vision.

As Stieglitz expressed it: “the result is the only fair basis for judgment. It is justifiable to use any means upon a negative or paper to attain the desired end.” He went on to point out that “some of the most maligned prints gen-
erally considered 'faked' are in fact nothing more than 'straight photography' from beginning to end."

He was speaking at the opening of "An Exhibition of American Photographs Arranged by the Photo-Secession" at the National Arts Club, New York, in 1902. It was a carefully selected show, hung with taste and a sense of intimacy unusual in photographic exhibitions. Art critics were positive about it: some found it a revealing demonstration of hitherto unsuspected esthetic possibilities of the camera, others condemned it as a pretentious display of imitation paintings and wondered if the aim of the photographers was "to hold as 'twere a smoked glass up to nature."

"What is the Photo-Secession?" the chairman of the exhibition committee of the National Arts Club had asked Steiglitz. "Yours truly for the present, and there'll be others when the show opens," Steiglitz answered. "In Europe, in Germany and in Austria, there have been splits in the art circles and the moderns call themselves Secessionists, so Photo-Secession really hitches up with the art world."

The society which grew out of this exhibition was informal in nature. Steiglitz was director of the Council, which was made up of the twelve founders: John G. Bullock, William B. Dyer, Frank Eugene, Dallett Fuguet, Gertrude Käsebier, Joseph T. Keiley, Robert S. Redfield, Eva Watson Schütze, Edward J. Steichen, Edmund Stirling, John Francis Strauss and Clarence H. White. Membership was divided into Fellows and Associates. Its stated aim was threefold:

To advance photography as applied to pictorial expression;

To draw together those Americans practicing or otherwise interested in art;

To hold from time to time, at varying places, exhibitions not necessarily limited to the productions of the Photo-Secession or to American work.

The group exhibited only as a body and upon invitation; Photo-Secession Loan Collections went from New York all over the world. The official organ of the group was Steiglitz' handsome new quarterly, *Camera Work*.

Steiglitz' determination to win for pictorial photography recognition as a fine art had not been shared by all the members of the Camera Club. Many had been slighted by Steiglitz in his eagerness to reproduce in *Camera Notes* the best, no matter by whom. The members felt that the periodical, with its emphasis upon pictorial photography, was not representative of the interests of the club, and Steiglitz found himself forced to resign the editorship. At the urging of his friends he planned the new magazine, *Camera Work*; to avoid
STEICHEN: J. Pierpont Morgan, 1903. Print 1948 by Steichen from original negative
confusion and compromise he took upon himself the entire responsibility of editing and publishing it, choosing as co-workers friends in the Photo-Secession. The associate editors were Joseph T. Keiley, Dallett Fuguet and John Francis Strauss, whose names had appeared in similar capacity on the masthead of Camera Notes. The first number was devoted to Gertrude Käsebier, the second to Steichen.

Steichen, while working as an artist for a lithographic firm in Milwaukee, first exhibited photographs at the Philadelphia Salon of 1898; the photographs which he submitted to the Chicago Photographic Salon of 1900 attracted the attention of Stieglitz and Clarence White, two of the five judges. They became friends and co-workers. A year later the Royal Photographic Society in London held a show of Steichen’s photographs which brought him international recognition. In Paris, where he settled to paint and to photograph, he met the sculptor Auguste Rodin, and made a series of highly romantic photographs of the great Frenchman and of his sculptures. The prints were reproduced in Camera Work with critical articles. Charles J. Caffin hailed Steichen as a photographer who was also a painter. To the Photo-Secessionists, this fact was the strongest proof that photography was a potential fine-art medium. In addition to the Rodin series, there were also reproduced many of Steichen’s portraits. In their direct spontaneity and in their dramatic posing and lighting they foretold the outstanding work which Steichen was to do in this difficult field. His best known portrait, of John Pierpont Morgan, was taken in 1903 ostensibly as a preliminary study for the use of the painter Carlos Baca-Flor. The painting lies forgotten in the Metropolitan Museum of Art; Steichen’s portrait remains the most striking interpretation of the financier. By accident or by design, a highlight on the arm of the chair suggests a gleaming blade.

What impresses one most, going through the fifty numbers of Camera Work published between 1902 and 1917, are the illustrations. The choice was varied, ranging from bold gum prints by Steichen to delicate architectural platinum types by the Englishman Frederick Evans, from the quasi-etchings of Frank Eugene to luminous, often high-key, prints of Clarence H. White, from the poster-like multiple gum prints of the Viennese trio of Heinrich Kühn, Hans Watzek and Hugo Hennenberg to the unmanipulated platinum prints of Stieglitz himself. Every reproduction was of the highest possible quality, printed on the finest paper and tipped in by hand in each copy of each issue. It was more than once remarked that the reproductions in Camera Work were often better presentations of a photographer’s work than his own prints.
white: In the Orchard, 1902. Platinum print. The Museum of Modern Art
The variety of visualization and technique in the work reproduced makes the common ambition of the contributing photographers all the more apparent. They were determined to win artistic recognition. Every step of the struggle was recorded, and the pages of Camera Work were open to all critics and to all who spoke with sincerity. Arguments broke out over the artistic legitimacy of some of the work, in which a large part of the effect was often due to skill of hand.

In 1905 the Photo-Secession opened its Little Gallery at 291 Fifth Avenue, where exhibitions were to be arranged not only of photographs, but also of "such other art production . . . as the Council . . . will from time to time secure." On the walls of "291," as the Little Gallery came to be called, the American public began to see work of the most daring and progressive modern painters and sculptors. Many of the artists whose work was shown had never before exhibited in America. There were drawings by Rodin, watercolors by Cézanne, sculpture by Matisse, abstractions by Picasso, Brancusi, Braque and Picabia. From the start, paintings by Americans were shown with those of European origin: by John Marin, Marsden Hartley, Max Weber, Arthur Dove and, later, by Georgia O'Keeffe. Camera Work published for the record and in extenso all newspaper criticisms. Stieglitz said that the Little Gallery was "a laboratory, an experimental station, and must not be looked upon as an Art Gallery, in the ordinary sense of that term." In this broadening of the scope of the Photo-Secession's activities, Steichen was of the greatest help. Stieglitz acknowledged his debt to him in Camera Work No. 42-43, the seventh issue of the periodical to contain reproductions of Steichen's work:

It was he who originally brought "291" into touch with Rodin, the recognized master, and with Matisse, at the same time that he was regarded as "The Wildman." It has been Steichen also, who, living in Paris, has constantly been on the watch for talent among young Americans there and, as for example, in the case of Marin, has introduced them to the spirit of "291."

In 1910 the Photo-Secession was invited to arrange an international exhibition of pictorial photography at the Albright Art Gallery in Buffalo. Complete control of the presentation was demanded and secured: Stieglitz, with the aid of his friends Paul Haviland, Clarence White and the painter Max Weber, transformed the Museum. They covered the exhibition walls with olive and blue cloth, and hung over five hundred photographs. Each photographer invited was represented by enough prints to enable his personal artistic development to be traced. Although the aim of the exhibition was stated to
KÄSEBIER: "Blessed Art Thou Among Women." Photogravure from Camera Notes, July, 1900
be historical, the only representation of the past was a collection of forty prints by D. O. Hill.

It was gratifying to the Photo-Secessionists to be able to show photographs with such dignity in an art museum; it was even more gratifying that the museum purchased fifteen exhibit prints for its collection and planned to set aside a room for their permanent display, for it was a vindication of their belief that photography had the right to recognition as a fine art. Camera Work No. 33 contains criticisms of the exhibition by various writers. They unanimously praised the exhibition as the most impressive they had ever seen. Its retrospective emphasis was so apparent that one critic asked if the show was the *nunc dimittis* of the Photo-Secession. Another, Sadakichi Hartmann, noted that "the pictorial army is divided in two camps," one favoring "painter-like subjects and treatment" and the other, in which Stieglitz was numbered, made up of those "who flock around the standards of true photographic themes and textures." He went on to observe that "the camp of the former . . . becomes more and more deserted, the old flag hangs limp and the fires burn low. . . ."

The year of the Buffalo exhibition marked a turning point. The Linked Ring had dissolved. Camera Work itself threw more and more emphasis upon modern art. It was found necessary to explain this editorial policy to those who complained that Camera Work had less and less photographic content: "Photography should take its place in open review with other mediums," Stieglitz wrote, "in order that its possibilities and limitations might be more fully judged." Charles H. Caffin pointed out that

after claiming for photography an equality of opportunity with painting, Stieglitz turns about and with devilishly remorseless logic shows the critics, who have grown disposed to accept this view of photography, that they are again wrong. As long as painting was satisfied, as it had been for half a century, to represent the appearances of things, photography could emulate it. Now, however, that it is seeking to render a vision of things not as they are palpable to the eye, but as they impress the imagination, Mr. Stieglitz proves what he has known all along, that photography is powerless to continue its rivalry with painting.
The name and the work of the Photo-Secession was carried throughout the world; it left a mark on photography which is still, a third of a century after its heyday, apparent. When its original photographic impetus died down in favor of the activities of "291," Clarence H. White formed the Pictorial Photographers of America. In England the Linked Ring was succeeded by the London Salon. In every country competitive salons became fixtures around which revolved the activities of amateur societies. In the American Annual of Photography Frank Roy Fraprie (who, like Stieglitz, received his first recognition as a pictorial photographer from P. H. Emerson) has reproduced year after year the most outstanding salon photographs, together with a "Who's Who in Pictorial Photography," listing, with statistics showing the number of pictures hung by each, the most successful exhibitors.

To those who were fighting for the recognition of photography as an art and the establishment of themselves as artists, the work of Jean-Eugène-Auguste Atget was virtually unknown. He never showed in a salon. Not a single one of the hundreds of photographs which he had taken since 1898 of his beloved Paris was reproduced in a photographic magazine. Painters had found his street scenes helpful documents, and the Surrealists, ever sensitive to the melancholy that a good photograph can so powerfully evoke, reproduced a few of his pictures in 1926 in their magazine La Révolution surréaliste. Only a year after this first, belated recognition of the artistic value of his photographs, Atget died suddenly. Berenice Abbott, the American photographer, rescued his negatives from oblivion, became custodian of them, printed them, arranged exhibitions and published his work: it is to her that we owe the rich heritage which Atget left.

Of his early life we know but little. From his friend André Calmettes, Berenice Abbott learned that he was born near Bordeaux in 1856, early lost his parents, was raised by an uncle, and went to sea. He was an actor when Calmettes first met him in Paris, but not a particularly successful one, and he decided, after considering painting, to take up photography. "He already had the ambition of creating a collection of everything artistic and picturesque in
and about Paris," Calmettes wrote. *Photographe d'art*, photographer of works of art, he called himself, and he hand lettered a sign "Documents pour artistes" for the door of his fifth-floor apartment-darkroom at 31 rue Campagne Première. A great deal of his work was photographing the historic buildings of Paris in detail. He made a series of photographs of iron grill work, another of the fountains of Paris. He photographed the statues in the park at Versailles, and statues on the medieval churches in Paris. These he sold to the Parisian museums. But he did not limit himself to works of art and historic monuments: he photographed the face of Paris in all its aspects: shop fronts and carriages of all sorts, the little people who earn their living peddling umbrellas or lamp shades, delivering bread or wheeling pushcarts. He photographed inside palaces, bourgeois homes and ragpickers' hovels. He photographed trees and flowers and fallen autumn leaves. Each of these categories is a series, each comprising hundreds of photographs. For Atget was in truth, as Calmettes wrote, a collector. He was, too, a picture maker, *un imagier*, in the words of his friend.

His technique was of the simplest: a view camera — always used on a tripod — for plates 18 x 24 centimeters (7.1 x 9.4 inches) in size. His lens was a rapid rectilinear, used well stopped down. Its focal length is not known — it was discarded after his death — but it must have been fairly short, for so many of his pictures show steep perspective and the tops of many of the negatives show bare glass where the image fell off. He printed the glass plates by daylight on glossy surfaced printing-out paper, toning them with gold chloride. Atget's technical approach was, therefore, that of the nineteenth century and, looking at his prints, it is often hard to believe that he did most of his work after 1900. He seldom made an exposure which could be called a snapshot: moving objects are often blurred, and when he photographed people it is obvious that he asked them to pose. In an Atget photograph every detail stands forth with a clarity which is remarkable.

For he had a remarkable vision. He could find the human quality where no human being appears. His interiors lead one to feel that the people whose home he is photographing have just stepped behind the camera while he focuses and makes his exposure and will return the moment the lens is closed. Out-of-doors he worked early in the morning to avoid being disturbed by the curious, and his pictures have the atmosphere of early light. His work has no reference to any graphic medium other than photography. When Atget's photographs were first shown in America in 1930, many younger photographers found them an inspiration, for they revealed the power of the straightforward,
direct use of the camera. The word "functional" was coming to be applied to architecture, machine art was being discovered, the esthetic of the moving picture was being investigated. This doctrine of "straight photography" brought about the esthetic recognition of Atget, as well as of Brady and Nadar; the historian learned of them from the practicing photographer.

The straight approach — the esthetic use of the functional properties of the photographic technique, the appreciation of both the camera's potentialities and its limitations, and the divorce of photography from the canons guiding the esthetic principles of other types of graphic art — was not so much discovery as the recognition of traditions as old as photography itself. Alfred Stieglitz consistently applied this approach to his work. Although he had frequently championed photographers whose prints often resembled paintings and drawings, and although he occasionally made gum prints himself and experimented with other manipulative processes, he preferred all his life to stick closely to the basic properties of camera, lens and emulsion. Charles H. Caffin said in 1901 that Stieglitz was

by conviction and instinct an exponent of the "straight photograph," working chiefly in the open air, with rapid exposures, leaving his models to pose themselves, and relying for results upon means strictly photographic.

In 1907, on a trip to Europe, he photographed The Steerage, a picture which he considered to be his finest. He related that he was promenading the first-class decks when he saw the striking scene of a crowd of emigrants on the deck below.

A round straw hat, the funnel leaning left, the stairway leaning right, the white drawbridge with its railings made of circular chains, white suspenders crossing on the back of a man in the steerage below, round shapes of iron machinery, a mast cutting into the sky, making a triangular shape . . . I saw a picture of shapes and underlyiing that the feeling I had about life.

Hurriedly he rushed to his cabin for his Graflex, hoping that the figures would not move in the meanwhile. He found all as he had left it, made the exposure, developed it in Paris, and brought the negative back in the plateholder. The composition was bold: some of his friends told him that the picture was split in two. He liked to tell that Picasso had praised it: the father of Cubism was at that time painting his Demoiselles d'Avignon, the canvas which was to mark a turning point in the style of the century.

Only a few of the photographs which Stieglitz made during the first two decades of the century were published in Camera Work. Many of the more
outstanding were taken in New York: ferryboats, the liner *Mauretania*, build-
ings rising sheer from the waterfront. He was making many portraits, and
they formed a pictorial biography of the participants of the activities of "291.”
Konrad Cramer has described sitting for him in 1911:

His equipment was extremely simple, almost primitive. He used an 8 x 10 view
camera, its sagging bellows held up by pieces of string and adhesive tape. The lens
was a Steinheil, no shutter. The portraits were made in the smaller of the two rooms
at "291" beneath a small skylight. He used Hammer plates with about three-second
exposures.

During the exposure, Stieglitz manipulated a large white reflector to balance the
overhead light. He made about nine such exposures and we then retired to the
washroom which doubled as darkroom. The plates were developed singly in a
tray. From the two best negatives he made four platinum contact prints, exposing
the frame on the fire escape. He would tend his prints with more care than a cook
does her biscuits. The finished print finally received a coat of wax for added gloss
and brilliance.

In 1921 Stieglitz, who had not shown his photographs publicly since the
war, arranged an exhibition of both old and new work in the Anderson Gal-
leries, New York. Every one of the photographs was startlingly direct, and the
effect upon the public was electric. John A. Tennant, editor of *Photo-Mini-
ture*, reviewed the exhibition:

Never was there such a hubbub about a one-man show. What sort of photographs
were these prints, which caused so much commotion? Just plain, straightforward
photographs. But such photographs! Different from the photographs usually seen
at the exhibitions? Yes. How different? There’s the rub. If you could see them for
yourself, you would at once appreciate their difference. One might venture the com-
parison that in the average exhibition print we have beauty, design, or tonal scheme
deliberately set forth, with the subject as motive or material merely, the subject as
the photographer saw it or felt it, an interpretation, a phase; whereas, in the Stie-
glitz prints, you have the subject itself, in its own substance or personality, as
revealed by the natural play of light and shade about it, without disguise or attempt
at interpretation, simply set forth with perfect technique — and so on, multiplying
words. There were portraits, some of them of men whom I knew fairly well. Some-
times it was a single print, at other times several prints side by side, giving different
aspects of the subject but grouped as “one Portrait.” Well, they were just portraits
of those men, compellingly intimate, betrayals (if I may so use the word) of person-
ality, satisfying in likeness, convincing in characterization, instinct with the illusion
of life. They gave one the impression of being in the presence of the men whom they
portrayed. They offered no hint of the photographer or his mannerisms, showed no
stieglitz: The Steerage, 1907. From a photogravure in 291, No. 7–8, 1915
STIEGLITZ: Grape Leaves and House, Lake George, New York, 1934. An American Place, New York
effort at interpretation or artificiality of effect; there were no tricks of lens or lighting. I cannot describe them better or more completely than as plain straightforward photographs... They made me want to forget all the photographs I had seen before, and I have been impatient in the face of all the photographs I have seen since, so perfect were these prints in their technique, so satisfying in those subtler qualities which constitute what we commonly call "works of art."

In the catalog Stieglitz wrote that the exhibition was "the sharp focusing of an idea... My teachers have been life — work — continuous experiment. ... Every print I make, even from one negative, is a new experience, a new problem. ... Photography is my passion. The search for Truth my obsession."
Those who knew Stieglitz knew the force of his personality, and they attributed his success in portraiture to a kind of hypnotic power. To answer this challenge, Stieglitz began to photograph clouds.

I wanted to photograph clouds to find out what I had learned in forty years about photography. Through clouds to put down my philosophy of life — to show that my photographs were not due to subject matter — nor to special privileges, clouds were there for everyone — no tax on them yet — free.

He produced hundreds of these pictures of sun and clouds, mostly made with a 4 x 5 inch Graflex. He processed them by means within the reach of any amateur, printing by contact on commercial Azo paper. He called these pictures “Equivalents,” and he put them in series with other pictures of expressive, often evocative, content and handling — a meadow glistening with raindrops, a woman’s hands pressed palm to palm between her knees. He found them to be equivalents to his thoughts, to his hopes and aspirations, to his despairs and fears. Viewed objectively, many of these rich prints with deep blacks and shimmering grays and incandescent whites delight us for their sheer beauty of form. They are photographic abstractions, for in them form is abstracted from its illustrative significance. Yet paradoxically the spectator is not for an instant left unaware of what has been photographed. With the shock of recognition he realizes almost at once that the form which delights his eye is significant, and he marvels that such beauty can be discovered in what is commonplace. For this is the power of the camera: it can seize upon the familiar and endow it with new meanings, with special significance, with the imprint of a personality.

Among the last photographs which Stieglitz made (poor health forced him to abandon using the camera around 1936) were pictures of New York taken from high windows, and the meadows and trees around the old family house at Lake George where he spent his summers. He continued all the while to champion modern art: at “An American Place” the series of exhibitions of paintings continued, with occasional photographic shows up to his death in 1946. Stieglitz was always there, and from him many a young man or woman found counsel and direction.

In the last two issues of Camera Work, dated 1916 and 1917, Stieglitz reproduced photographs by a newcomer, Paul Strand. They included a forceful series of people taken unawares in the streets with a Graflex camera, and pictures in which form and design were emphasized — a semi-abstraction of bowls, a downward view from a viaduct, an architectural scene dominated
by the vertical accents of a white picket fence. As Stieglitz said, the work was “brutally direct, pure and devoid of trickery.” It was in striking contrast to much of the work which had been produced by the Photo-Secession. It was prophetic of the re-orientation in photographic esthetics and of the return to the traditions of straight photography which was to gain force in the years after the war.

The photographer’s problem [Strand wrote in 1917] is to see clearly the limitations and at the same time the potential qualities of his medium, for it is precisely here that honesty no less than intensity of vision is the prerequisite of a living expression. This means a real respect for the thing in front of him expressed in terms of chiaroscuro . . . through a range of almost infinite tonal values which lie beyond the skill of human hand. The fullest realization of this is accomplished without tricks of process or manipulation, through the use of straight photographic methods.

Strand was among the first to discover the photographic beauty of precision machines. He made a series of extreme close-ups of his Akeley motion-picture camera (he was earning his living making films) and of power lathes. On a trip to Maine he discovered the beauty of large-scale details of driftwood, cobwebs, plants and other natural objects. In 1923, lecturing to the students of the Clarence H. White School of Photography, he made a strong plea for the revival of craftsmanship and told them of the need to free photography from the domination of painting, and to recognize that the camera had its own esthetic.

Strand’s negatives are seen with intensity and with sureness; his work has a quality rarely found in photography, a quality which can only be described as lyrical. He has photographed people and landscapes in the Southwest, Mexico, the Gaspé and, recently, in New England. He is a brilliant printer. Until it went off the market in the 1930’s, he preferred platinum paper. It will be remembered that this paper, in which the light-sensitive salts are imbedded in the fibers, was prized by Emerson for its ability to yield soft results. Strand used it to make brilliant, long-scale prints. Not content with the quality of the Japine platinum paper, which had a smooth, semi-mat surface, he persuaded the manufacturers, Willis & Clements of London, to produce doubly coated paper, after demonstrating to them the improved results which paper so prepared by himself could produce. All of his prints are made by contact, and are consequently the size of the negative, 8 x 10 inches or less. But physical size has little to do with the final effect, and it has been said that Strand’s 4 x 5 inch prints are the largest 4 x 5’s ever made.
STRAND: Window, Red River, New Mexico, 1930. The Museum of Modern Art
In 1914 Charles Sheeler began to discover with his camera the beauty of indigenous American architecture, photographing with honest directness the texture of white painted and weathered wood, and the beautifully proportioned rectangular forms of Pennsylvania barns. First and foremost a painter, Sheeler has a keen appreciation of the photograph as a distinct medium. He told his biographer, Constance Rourke,

I have come to value photography more and more for those things which it alone can accomplish, rather than to discredit it for the things which can only be achieved through another medium. In painting I have had a continued interest in natural forms and have sought the best use of them for the enhancement of design. In photography I have strived to enhance my technical equipment for the best statement of the immediate facts.
Sheeler: Stair well, 1914
Charles Sheeler's contribution to photography has been his sensitive interpretation of the form and texture and life of man's work in precise, clean photographs of African Negro masks (1918), the industrial architecture of the
MAN RAY: Arnold Schoenberg, 1926. The Museum of Modern Art
Ford plant at River Rouge (1927), the Cathedral of Chartres, seen in a series of details (1929) and, more recently, in the photographs of Assyrian and Egyptian sculpture which he did for the Metropolitan Museum of Art (1942–45).

Edward Steichen, placed in charge of aerial photography of the American Air Service during the second Battle of the Marne, was faced with the problem of securing photographs with a maximum of detail, definition and brilliance. He found such beauty in these straight photographs that in 1920 he repudiated his gum prints, abandoned painting, and set out to master pure photographic processes almost as if he were a beginner, setting himself such extreme problems as the rendition of the brilliant contrasts of a white teacup on black velvet. Armed with this mastery of technique, and with his brilliant sense of design and ability to grasp in an image the personality of a sitter, he
began to raise magazine illustration to a creative level (see chapter 13).

Around 1920 Edward Weston, a Californian photographer who had been honored by election to the London Salon (successor to the Linked Ring) began a critical re-examination of his work which, up to that time, had been soft in focus, but always done with a sense of light and form. He experimented with semi-abstractions: R. S. — A Portrait was a bold, unconventional placing of the upper half of the model's head at the very bottom of a composition of triangles and diagonals. A detail of a nude — circle of breast and diagonal of arm — was equally abstract. In Ohio he discovered the beauty of industrial constructions. His work was taking two trends: abstraction and realism. In 1925, while working in Mexico, he recognized this duality, and chose to emphasize the latter. "The camera must be used for recording life [he wrote in his Daybook] for rendering the very substance and quintessence of the thing itself. . . . I shall let no chance pass to record interesting abstractions, but I
feel definite in my belief that the approach to photography is through realism.” His technique and esthetic became one: “Unless I pull a technically fine print from a technically fine negative, the emotional or intellectual value of the photograph is for me almost negated.” He simplified his working method, preferring contact prints to enlargements, glossy bromide paper to the softer platinotype. He replaced his expensive soft focus lens with an inexpensive sharply cutting rapid rectilinear. “The shutter stops down to 256,” he noted. “This should satisfy my craving for more depth of focus.”

The most important part of Edward Weston’s approach was his insistence that the photographer should previsualize the final print before making the exposure. The classic 8 x 10 inch view camera which had become his favorite instrument enabled him to see and study the image in its full size upon the
ground glass. He respected this image so highly that cropping or trimming the final print he considered an admission of failure to see in a creative way.

Weston has developed this approach to the point of virtuosity. He still uses the 8 x 10 camera, still develops his negatives with finger-blackening pyro, still prints by contact on glossy paper. He rejects enlarging because he feels that it interferes with the direct simplicity of his way of working, and because there is inevitably some loss of that precision of image, that quality of definition, which he so highly prizes. He demands clarity of form; he wants every area of his picture clear-cut, with the substances and textures of things appreciable to the point of illusion. The fact that the camera can see more than the unaided eye he has long regarded as one of the great miracles of photography. "The camera," he wrote in his Daybook in 1926, "sees more than the eye, so why not make use of it?" In a Weston landscape, everything is sharp from the immediate foreground to the extreme distance: looking at the same scene in nature our eyes take in one detail after another. Constantly roving, jumping from spot to spot, they scan the panorama and send to the brain a series of reports from which a composite image is mentally created. In the photographs the details are so compressed and reduced that the scanning process requires

far less muscular effort on the part of the beholder, who unconsciously feels a physiological release. In 1909 Willi Warstat, in his *Allgemeine Ästhetik der Photographie*, a book which is perhaps the earliest systematic examination of photographic esthetics from the standpoint of modern psychological and physiological theories of vision, succinctly analyzed this aspect of the mechanics of seeing. He found that the compression of all-over detail was something to be avoided by the photographer in his “battle with realism.” Weston and other photographers who have no quarrel with realism and whose vision has led them to the straight, often brutally direct, approach, make use of the phenomenon with powerful effect. It must be noted, however, that the rendering of detail alone is not their criterion; it is a device governed by their taste, imagination, and feeling for form.

In 1937 Edward Weston was awarded a John Simon Guggenheim Memorial Foundation Fellowship — the first photographer to be so honored. His style has expanded, the variety of subject matter has increased, and a rich human quality pervades this later work. He is now living in Carmel, California, near Point Lobos, where so many of his most striking photographs have been taken, and is experimenting with color.

A number of younger photographers, greatly impressed by Weston and his work, formed in 1932 a society to which they gave the name “Group f.64,” choosing that technical term because they set their lenses at small apertures to achieve detailed images. The charter members — Ansel Adams, Imogen Cunningham, John Paul Edwards, Sonia Noskowiak, Henry Swift, Willard Van Dyke, and Edward Weston — formulated an esthetic based on the straight approach. It was a reaction against pictorial photography, which had become so conservative that it had been defined in the *Encyclopaedia Britannica* in 1929 as “photography applied to the production of pictures in the accepted artistic tradition.” There was no room in the salons for independent photographers who had no desire to follow an accepted artistic tradition, but felt a compulsion to break out upon new paths. They held their own exhibitions: the M. H. de Young Museum in San Francisco threw open its doors to them for the inaugural show in 1932. For several years the informal group was the most progressive photographic society in the country. Even after they disbanded, their influence persisted; and “f/64” came to be a convenient label for straight photography, applied to photographers who had nothing to do with the original group.

Ansel Adams, in his photography, his writing and his teaching, has brilliantly demonstrated the capabilities of straight photography as a medium of
BARBARA MORGAN: Head of Lloyd, 1944
expression. He was trained as a musician, and began to photograph as an avocation under the strong influence of pictorialism. In 1930 he met Paul Strand, whose negatives so impressed him that he realized the validity of the straight approach. He devoted all of his time to photography, and his new work received international recognition when the London Studio published in 1935 his Making a Photograph, an instruction manual distinguished for its illustrations, which are such faithful reproductions that they have more than once been mistaken for actual photographic prints. When the book appeared it seemed as if the substance of weathered stone, glass and flesh had never been so brilliantly rendered. Stieglitz showed his work at An American Place in 1936; it had sensitivity and direct, honest integrity that were rare. A man of the mountains — he lives in Yosemite Valley, California — and intensely moved by nature in her most spectacular aspects, Adams has long specialized in the interpretation of the natural scene.
He uses all kinds of cameras and constantly experiments with technique. He has worked out a rational linking technique and esthetic approach which takes the discoveries of Hurter and Driffield out of the laboratory and puts them into the hands of the creative worker. Adams first teaches the photographer to master the characteristics of the photographic emulsion by determining—not by laboratory test, but with the photographer's own working equipment—the interrelation of the three principal variables, subject brightness, exposure and development, so that he can obtain upon his negative any one tone which he has visualized, and will know exactly the tones that other subject brightnesses will create. The infinite gradations of light and shade found in nature are grouped in ten zones. Zone O is black; IX, white. Between these extremes are eight tones of gray, zone V being the "middle" tint—not by objective measurement, but by subjective judgment—and next to it, marked VI, the value which conveys to the photographer the feeling of the tone of average, well-lighted skin. By the use of a photo-electric exposure meter he measures the brightnesses of the various parts of the scene which he is photographing. These measurements are correlated with exposure and development procedures, so that the photographer can visualize precisely the entire gamut of values which will appear in the final print. The control is comparable to that which a musician has over his instrument. Guesswork is eliminated, and the photographer can concentrate upon esthetic problems, secure in the knowledge that his results will not only be of technical excellence, but will embody his subjective interpretation of the scene.

On the Continent, the functional spirit of the 1920's found its expression more in the design potentialities of the photographic medium, and in the ability of the camera to create distortions of interest as abstract form. A significant exception is Albert Renger-Patzsch, who in 1928 published a book of straight photographs with the title Die Welt ist schön—"The World is Beautiful." The realism of these photographs was found to be a counterpart of the New Objectivity in painting. At the great exhibition Film und Foto, held by the Deutsche Werkbund at Stuttgart in 1929, and subsequently circulated throughout Germany, the American section was chosen by Edward Steichen and Edward Weston, and included, in addition to their own work, photographs by other practitioners of the straight approach: Berenice Abbott, Anton Bruehl, Imogen Cunningham, Paul Outerbridge, Charles Sheeler, Ralph Steiner, Roger Sturtevant and Brett Weston. The tenets of their approach were stated in the catalog by Edward Weston.
The quality of authenticity implicit in the sharply-focused, unretouched “straight” photograph often gives it special value as evidence or proof. Such a photograph is, according to dictionary definition “document,” for Webster defines the noun “document” as “an original or official paper relied upon as the basis, proof, or support of anything else; — in its most extended sense, including any writing, book, or other instrument conveying information.”

In 1889 a plea was made in the *British Journal of Photography* for the formation of a great archive of photographs “containing a record as complete as it can be made . . . of the present state of the world” and it was pointed out that such photographs “will be most valuable documents a century hence.” *McClure’s Magazine* published in 1893–94 a series of photographic portraits under the title “Human Documents.” And Henri Matisse, the painter, stated in 1908: “Photography can provide the most precious documents existing.”

The documentary photographer seeks to do more than convey information through his photographs: his aim is to persuade and to convince. The United States Congress was persuaded to set apart the Yellowstone region as a national park by the convincing evidence of William H. Jackson’s photographs which had been presented to its members by Francis V. Hayden as documents; they made credible the reports of natural wonders which until then had been dismissed as the tall tales of travelers. Public conscience was awakened to injustices by the power of the camera’s evidence: in 1862 the editor of the English *Art Journal* found a series of photographs of Manchester to “have an especial, though painful, interest just now, from the fact that they were views of the great manufacturing districts, where terrible destitution prevails.”

Through photographs as well as his writing, Jacob A. Riis not only showed Americans how the other half lived, but persuaded them to take action which led to the betterment of the living conditions of the New York poor.

For seven years Riis, who arrived in New York from Denmark in 1870, suffered the lot of every immigrant. He took what jobs he could find. He came to know from personal experience the tenements, the police-station lodging houses, the all-night two-cent restaurants. When he came to be a police re-
porter his work took him back to those wretched quarters of the city, for they were the seed beds of crime. Horrified, he began the crusade which led to the condemnation of Mulberry Bend, to housing reforms, and to the building of the neighborhood house which bears his name.

He reported what he saw not only in words, but also in pictures. In 1888 the Sun published twelve drawings from his photographs with an article headlined “Flashes from the Slums” and told how

a mysterious party has lately been startling the town o’ nights. Somnolent policemen on the streets, denizens of the dives in their dens, tramps and bummers in their so-called lodgings, and all the people of the wild and wonderful variety of New York
night life have in their turn marvelled at and been frightened by the phenomenon. What they saw was three or four figures in the gloom, a ghostly tripod, some weird and uncanny movements, the blinding flash, and then they heard the patter of retreating footsteps and the mysterious visitors were gone before they could collect their scattered thoughts and try to find out what all the fuss was about.

The intruders were two amateur photographers, Henry G. Pi ffard and Richard Hoe Lawrence (members, be it noted, of that Society of Amateur Photographers of New York which later consolidated with the Camera Club), Dr. John T. Nagle of the Health Board, and Riis. The purpose of their trip, Riis stated, was to make a collection of views for lantern slides to show "as no mere description could, the misery and vice that he had noticed in his ten
years of experience . . . and suggest the direction in which good might be done.”

Facsimile reproduction techniques had not reached the point in the 1880's at which photographs could be printed in newspapers, and the column-wide drawings accompanying the article were not convincing. When Riis's famous book *How the Other Half Lives* was published in 1890, seventeen of the illustrations were halftones, but of poor quality, lacking detail and sharpness. The remaining nineteen photographs were shown in drawings made from them: some of them are signed “Kenyon Cox, 1889, after photograph.”

The result was that the photographic work of Jacob Riis was overlooked until, in 1947, Alexander Alland, himself a photographer, made excellent enlargements from the original 4 x 5 inch glass negatives which the Museum of the City of New York, through his efforts, had acquired. The exhibition held by the Museum, and the subsequent publication of some of the best of the prints in *U.S. Camera 1948*, revealed Riis as a photographer of importance.

The photographs are direct and penetrating, as raw as the sordid scenes which they so often represent. Riis chose unerringly the camera stand which would most effectively tell the story. Not all of his photographs were made at night, nor did he always use the flash and run technique which the *Sun* reported. There are glimpses in *How the Other Half Lives* of his experiences:

Yet even from Hell's Kitchen had I not long before been driven forth with my camera by a band of angry women, who pelted me with brickbats and stones on my retreat, shouting at me never to come back . . . . The children know generally what they want and they go for it by the shortest cut. I found that out, whether I had flowers to give or pictures to take . . . . Their determination to be “took” the moment the camera hove into sight, in the most striking pose they could hastily devise, was always the most formidable bar to success I met.

Riis was one of the first in America to use *Blitzlichtpulver* — flashlight powder — invented in Germany in 1887 by Adolf Miethe and Johannes Gaedicke. This innovation was a highly explosive mixture of powdered magnesium, potassium chlorate and antimony sulphide. Because it burned instantaneously — in a flash — it was an improvement over the magnesium flare, with its several seconds duration, which O'Sullivan had used in the Comstock Lode mines. Yet it was dangerous and difficult to control. Riis succeeded in its use: the blinding flash reveals with pitiless detail the sordid interiors, but deals almost tenderly with the faces of those whose lot it was to live within them.

He was always sympathetic to people, whether he was photographing street Arabs stealing in the street from a handcart, or the inhabitants of the alley
known as Bandits’ Roost peering unselfconsciously at the camera from doorways and stoops and windows. The importance of these photographs lies in their power not only to inform us, but to move us. They are at once interpretations and records; although they are no longer topical, they contain qualities which will last as long as man is concerned with his brother.

This is true, too, of the work of Lewis W. Hine, who began to photograph in 1905. A sociologist, trained at Chicago, Columbia and New York Universities, he found the camera a powerful tool for research. His training enabled him to comprehend instantly, and without effort, the background and its social implications; unbothered by unnecessary details, his sympathies were concentrated on the individual before him; throughout his pictures this harmony can be felt. When, with his 5 x 7 inch camera and open flash he
photographed children working in factories he showed them at the machines, introducing a sense of scale which enabled the reader to grasp the fact that the workers were indeed small children. His work was widely published; as Elizabeth McCausland has pointed out, the word “photo story” was first used to describe his work, which was always of equal importance with the writer’s and in no sense an “illustration” to it. His revelation of the exploitation of children led to the passing of child labor laws. In the years before the First World War Hine took his camera to Ellis Island, to record the immigrants who were then arriving by the tens of thousands. He followed them into the unsavory tenements which became their homes, penetrated into the miserable sweatshops where they found work, and photographed their children playing among the ashcans and the sprawling human derelicts in the slums of New York and Washington. Hine realized, as Riis did before him, that his photographs were subjective and were, for that very reason, powerful and readily grasped criticism of the impact of an economic system on the lives of underprivileged and exploited classes. He described his work as “photo-interpretations.” They were published as “human documents.” Hine by no means limited his photography to negative criticism. He brought out the positive human qualities wherever he found them. In 1918 he photographed American Red Cross relief in the Middle European countries; years later he concentrated on American workmen, and a collection of photographs of them was published in 1932 as Americans at Work.

Perhaps the best photographs in the book were chosen from the hundreds he took of the construction of the Empire State Building in New York. Day by day, floor by floor, he followed the steel work upwards. With the workmen he toasted sandwiches over the forges that heated the rivets; he walked the girders at dizzying heights, carrying over his shoulder his 5 x 7 inch view camera complete with tripod or, more rarely, a 4 x 5 inch Graflex. When he and the workmen reached the pinnacle of the world’s tallest building, he had them swing him out over the city from a crane, so that he might photograph in mid-air the moment they had all been striving for — the driving of the final rivet at the very top of the skyscraper. These spectacular pictures are not melodramatic; they were not taken for sensation; they are a straightforward record of a job that happened to be dangerous. Among the photographs there is not one of Hine himself perched high above the city. His interest was entirely absorbed by the workmen and their job.

On his death in 1940, Hine’s negatives were preserved by the Photo League, a society of photographers who had received much counsel from him and
who had frequently exhibited his photographs. They have published two portfolios of carefully made and sensitively interpreted prints from his more important negatives.

When the darkness of the depression fell upon the world in the 1930's, many artists at once reacted to it. In the field of painting, the return to realism became more pronounced; following the lead of the Mexican muralists, painters began to instruct the public through their work. A group of independent moving-picture makers had already begun to make films which, in contrast to the typical Hollywood productions, were rooted in real problems, real situations, in which the participants themselves were the actors. John Grierson, spokesman for a British group, recollects that they felt that the moving picture in the recording and the interpretation of fact was a new instrument of public influence which might increase experience and bring the new world of our citizenship into the imagination. It promised us the power of making drama from our daily lives and poetry from our problems.

They called this type of film *documentary*.

As social photographers they shied away from the word “artistic,” and the voluminous literature of the movement is full of insistence that documentary film is *not* art. “Beauty is one of the greatest dangers to documentary,” wrote the producer Paul Rotha in his *Documentary Film*. He came to the astonishing conclusion that photography—the very life blood and essence of the moving picture—was of secondary importance, and that, if too good, it might prove detrimental. “Photographic excellence in documentary must never be permitted to become a virtue in itself.” Yet Grierson said, “documentary was from the beginning . . . an ‘anti-aesthetic’ movement . . . what confuses the history is that we had always the good sense to use the aesthetes. We did so because we liked them and because we needed them. It was, paradoxically, with the first-rate aesthetic help of people like Flaherty and Cavalcanti . . . that we mastered the techniques necessary for our unaesthetic purposes.”

*Documentary* is, therefore, an approach, which makes use of the artistic faculties to give “vivification to fact” — to use Walt Whitman’s definition of the place of poetry in the modern world.

At the same time that film makers began to talk about “documentary,” here and there photographers were independently using their cameras in a similar way. Walker Evans had returned to America from Paris with a heightened perception of the American spirit. A number of his photographs published in
the magazine *Hound and Horn* for 1930 show a tendency towards abstraction somewhat Continental in feeling: *Wash Day*, for example, is a pattern of laden clothesline against the sky. In this year he began a series of photographs of the homespun and then little appreciated architecture of the Victorian period. In contrast to these sharply focused four-square architectural studies he also did pictures of people in the streets, catching them unawares in characteristic and revealing attitudes. These remarkable snapshots anticipated by three years the work of Cartier-Bresson.

Like so many citizens, Evans felt the consequences of the depression sharply; with a sense of responsibility to his fellow men he began to use the camera to awaken the public to the plight of the unemployed. *South Street 1932* shows men sleeping on the sill of a waterfront façade. It is a fine photograph. Its
LANGE: In a camp of migratory pea pickers. Photographed for Farm Security Administration, 1936. The Museum of Modern Art
sensitive rendition of texture and form reinforces by its beauty the comment and lends authenticity to the image.

In San Francisco Dorothea Lange, a member of Group f.64, had for years a successful portrait studio. During the depression she saw the breadlines of the homeless and unemployed and wondered if she could photograph them so that others would feel as she did. She met Paul Taylor, a professor of economics, who gave her work to do; on a trip with him she began to see how the photographer could complement the work of the economist. The State of California was her first employer, and she documented the problems of the migratory workers.

In 1935 the Federal Government turned to photographers for help in fighting the depression, for those in Washington found that the evidence of the camera could be a great tool for education. Photographers were hired at a fair salary, given the best equipment, and sent to stricken areas to report conditions. The Department of Agriculture, under Rexford G. Tugwell, formed a historical section of the Rural Resettlement Administration (later known as the Farm Security Administration). Roy E. Stryker, who had been a colleague of Tugwell's at Columbia, was put in charge. Among the first to be hired were Walker Evans and Dorothea Lange. Both brought to the FSA the very qualities which were needed to interpret the plight of agricultural workers. Both produced some of their finest work while in the service of the government. Both contributed to the formation of a distinct style in photography.

Evans continued his dual interest in American form and in the American face, the architectural and the portrait. He traveled to the South and documented the conditions of the land, the sharecroppers themselves, their houses, their belongings, the way they worked, their crops, their schools, and churches and stores. Much of what he photographed was necessarily squalid, but the interpretation was always dignified. Glenway Wescott pointed out that others have photographed squalid scenes wonderfully; but it has been a wonder dispersed, hit-or-miss in a thousand rotogravure sections, etc. Here is a lot of it, all hanging together: fantastic martyred furniture, lampshades and pictures, rags, hats. Usually Mr. Evans has dismissed the dweller from his dwelling, but we can deduce him. Thus one sometimes sees, in wild grass, the indentations where a rabbit has been lying, hungering, quaking. Countrysmen of ours like rabbits . . . For me this is better propaganda than it would be if it were not aesthetically enjoyable. It is because I enjoy looking that I go on looking until the pity and the shame are impressed upon me, unforgettably. And on the superb, absurd old houses . . . there has fallen — along with the neglect and decay — an illumination of pearl, shadows
ROTHSTEIN: Father and son walking in the face of a dust storm, Cimarron County, Oklahoma. Photographed for Farm Security Administration, 1936. The Museum of Modern Art
of sable, accentuations as orderly as in music. Look at them. I find that I do not tire of them. Look at the old mansion upon which the rottenness of the wood appears like the marks of a sort of kiss.

Dorothea Lange specialized on the problem of the migratory workers, and documented the long trek across the country of the people tractored off their land, the epic which John Steinbeck used in his novel, *The Grapes of Wrath*. And although there was no relation between the writer and the photographer, the work of the one complements the work of the other. Pare Lorentz noted in *U. S. Camera 1941* that

if there are transient camps, and better working conditions, and a permanent agency seeking to help migratory workers, Lange, with her still pictures that have been reproduced in thousands of newspapers, and in magazines and Sunday supplements, and Steinbeck, with two novels, a play, and a motion picture have done more for these tragic nomads than all the politicians of the country.

The scope of the FSA photographic project included all phases of rural America. The small town is such an integral part of our agricultural fabric that it could not be overlooked. Sherwood Anderson found enough material in the thousands of photographs in the FSA files to make a picture book *Home Town*, showing the positive side of typical American community life.

During the course of its seven years, until its entire resources were, during the war, turned over to the Office of War Information, the FSA photographic project employed, in addition to Evans and Lange, Arthur Rothstein, Ben Shahn, Russell Lee, John Vachon, Theodor Jung, Paul Carter, Marion Post Wolcott, Jack Delano, Carl Mydans, John Collier, Jr. and Gordon Parks. The work, which is now deposited in the Library of Congress, is remarkably cohesive and yet individual. Each photographer contributed to the project: working together, sharing common problems, they helped one another. The scope of the documentation and its general aim were controlled and guided by Stryker, who briefed the photographers on the sociological background of their assignments, stimulated their imagination and encouraged their curiosity. Not a photographer himself, Stryker wisely left all questions of equipment, technique and style of visualization to the individual photographers. Stryker has pointed out that

documentary is an approach, not a technic; an affirmation, not a negation . . . The documentary attitude is not a denial of the plastic elements which must remain essential criteria in any work. It merely gives these elements limitation and direction. Thus composition becomes emphasis, and line sharpness, focus, filtering, mood —
all those components included in the dreamy vagueness "quality" — are made to serve an end: to speak, as eloquently as possible, of the thing to be said in the language of pictures . . . The question is not what to picture nor what camera to use. Every phase of our time and our surroundings has vital significance and any camera in good repair is an adequate instrument. The job is to know enough about the subject matter to find its significance in itself and in relation to its surroundings, its time, and its function.

The documentary approach was eagerly pursued elsewhere. Margaret Bourke-White, who had made an enviable reputation as a photographer of industry and as an associate editor of Fortune and Life magazines, produced with her husband, Erskine Caldwell, a photographic survey of the South in
You Have Seen Their Faces (1937). Eleven pages of Life for May 10, 1937, were devoted to her photographs of Muncie, Indiana, the city which had been chosen by Robert and Helen Lynd for their sociological study, Middletown, published in 1927. Bourke-White’s photographic essay was presented as “an important American document”; it showed the aspect of the city from the ground and from the air, the homes of the rich and the poor; it was an unusually graphic cross section of an American town.

New York found its interpreter in Berenice Abbott, who in 1929 decided to give up her Paris studio, where she had produced many striking portraits of artists and writers, and return to America. Impressed by the complex and ever-varied life of New York, she began the task of interpreting not alone the outward aspect of the metropolis, but its very spirit. At first she worked alone, and then under the auspices of the Art Project of the Works Progress Administration. The photographs which she made are now in the Museum of the City of New York; they are already historical source material, for many of the landmarks which she photographed no longer exist. A selection of her work was published in book form with the appropriate title Changing New York in 1939. She writes,

To make the portrait of a city is a life work and no one portrait suffices, because the city is always changing. Everything in the city is properly part of its story — its physical body of brick, stone, steel, glass, wood, its lifeblood of living, breathing men and women. Streets, vistas, panoramas, bird’s eye views and worm’s eye views, the noble and the shameful, high life and low life, tragedy, comedy, squalor, wealth, the mighty towers of skyscrapers, the ignoble façades of slums, people at work, people at home, people at play . . .

In her instruction manual, A Guide to Better Photography, she advises the photographer to use as large a camera as possible, so that the records will be fully detailed and rich in information. Such photographs can be read; they are not mere illustrations, but actual source material.

Fox Talbot observed in The Pencil of Nature that

it frequently happens, moreover — and this is one of the charms of photography — that the operator himself discovers on examination, perhaps long afterwards, that he had depicted many things he had no notion of at the time. Sometimes inscriptions and dates are found upon the buildings, or printed placards more irrelevant, are discovered upon their walls . . .

It is significant that, time after time, the documentary photographer includes in his image printed words and wall scrawls. More than one photographer, in the bitterness of the thirties, chose to contrast billboard slogans with the con-
trary evidence of the camera. A sign, photographed as an object, carries more impact than the literal transcription of the words it bears. Signs alone have furnished subject matter: Todd Webb, returning to America from overseas service, made a moving series of documents of those temporary and homespun “Welcome Home GI Joe” signs which flourished in New York in 1945.

However revealing or beautiful a documentary photograph may be, it cannot stand upon its image alone. Paradoxically, before a photograph can be accepted as a document, it must itself be documented — placed in time and space. This may be effectively done by context, by including the familiar with the unfamiliar, either in one image or in paired images. A series of photographs, presented in succession on exhibition walls or on the pages of a book, may be greater than the sum of the parts. Thus in *American Photographs*, published by The Museum of Modern Art at the time of his exhibition, Walker Evans arranged his photographs in two separate series, and relied upon the sequence of images to show, in the first part, “the physiognomy of a nation,” and in the second part, “the continuous fact of an indigenous American expression,” to quote from Lincoln Kirstein’s text. Each photograph was numbered, and factual titles were supplied at the end of each section. In a collaborative work with the writer James Agee, *Let Us Now Praise Famous Men* (1941), Evans grouped photographs in the front of the book, in front of the title page itself. They were presented without a single word of explanation. They were, Agee wrote, “not illustrative. They, and the text, are coequal, mutually independent, and fully collaborative.”

In contrast to the austerity of this technique, Dorothea Lange and Paul Taylor in *An American Exodus* (1939) presented a close relation between the image and the word by printing with the photographs excerpts from conversation heard or overheard at the time of photographing — an approach in itself fully documentary in spirit. Yet another device was used in *Land of the Free* (1938), a collection of documentary photographs, mostly from the FSA files, to which Archibald MacLeish supplied a “sound track” in the form of a poem. He explained that:

The original purpose had been to write some sort of text to which these photographs might serve as commentary. But so great was the power and stubborn inward livingness of these vivid American documents that the result was a reversal of that plan.

In all of these, and in many other publications of similar nature, the chief characteristic is that the photographs assert their independence. They are not illustrations. They carry the message together with the text.
ABBOTT: Exchange Place, 1933.
The Museum of Modern Art
"Documentary," in the sense in which we have described it, has been accepted in Hollywood, in picture magazines, in radio and even in art criticism. Yet despite the fact that photographers and cinematographers gave currency to the now accepted use of the word, in an effort to avoid narrow classification they have suggested substitutes for it: historical, realistic, factual. While each of these qualities is contained within documentary, none of them conveys the deep respect for fact and the desire to create active interpretations of the world in which we live that mark documentary photography at its best apart from bald camera records.
The use of small cameras to produce big pictures was first suggested as a convenience. In 1840 John W. Draper reported that he was making copies of daguerreotypes with a view of ascertaining the possibility of diminishing the bulk of the traveler’s Daguerreotype apparatus, on the principle of copying views on very minute plates, with a very minute camera, and then magnifying them subsequently to any required size, by means of a stationary apparatus.

With the perfection of the collodion process, this system was put to use in Egypt by Charles Piazzi Smyth, Astronomer Royal for Scotland. In 1865 he studied the alleged mathematical and astronomical symbolism of the Great Pyramid. Unable to afford the initial expense and upkeep of a standard size camera, he devised a miniature one. For plates he used 1 x 3 inch microscope slides, which he sensitized and developed in the camera itself. In a pamphlet, *A Poor Man’s Photography at the Great Pyramid* (1870), he claimed that enlargements from his negatives showed as much detail as contact prints from whole plates. Unfortunately not one of them appears to have survived. He had planned to illustrate his three-volume *Life and Work at the Great Pyramid* with his photographs, and had made sixty positive transparencies for the purpose, but the cost of reproducing them was so great that he abandoned the plan and gave them away.

Piazzi Smyth argued that his system had the advantage not only of portability, but also of flexibility:

with his little box of very little negatives brought home modestly in his waistcoat pocket [the impecunious photographer] sits him down at a table, having a compound achromatic microscope before him . . . and then . . . wanders at will, truly the monarch of all he surveys, over the various parts of each picture; recalls the circumstances under which it was taken; discovers characteristic detail which he never dreamed of before; and then — each picture you will remember having been taken square — he decides whether a positive copy should be shaped as a long, i.e. horizontal, rectangle, or as a tall, i.e. vertical, rectangle; whether it should include from side to side of the negative plate or stop short of its extreme parts, in order to secure
What You Can See You Can Photograph

Advertisement for the Ermanox Camera, Photo-Miniature, May, 1926

a better balance of light and shade, or a more harmonious composition of light and angles; whether he should give preponderance to the sky or to the foreground; or whether some special scientific purpose may not be better served by extracting one little subject alone out of the whole scene, and making a very highly magnified picture of that one item by itself.

With all these notes taken at the microscope, the poor man then inserts his little negative into a copying and magnifying camera, and proceeds to realize all these various positive pictures, hitherto only sketched out in art or scientific idea, and makes them on any size that he can afford.

With the advent of hand cameras and dry plates at the close of the century, and with the perfection of enlargers and rapid printing paper, Piazzzi Smyth's system of choosing a portion of the negative for the final print became regular practice. Stieglitz in 1896 wrote that his hand camera negatives were "all made for the express purpose of enlargement, and it is but rarely that I use more than part of the original 'shot.' " Instruction manuals and camera magazines became full of a new kind of criticism; beginners were shown how their prints could be improved by cropping or trimming, and they were advised to try masking their proofs with L-shaped cardboards. Except for Piazzzi Smyth's isolated experiments, the entire image formed by the camera had previously been so rigidly respected that daguerreotypes, tintypes, cartes-de-visite and stereographs were all made in standard sizes.
The portable hand camera thus brought about a change in working methods. The photographer’s output was increased, and oftentimes the recorded camera image was merely a starting point for the final composition. The hand camera also increased the scope of photography, for with it many subjects considered beyond the limits of photography were brought within grasp.

In the early 1920's two innovations broadened the hand camera's field of operation still further. Lenses were designed with greatly increased light-passing power, and small, compact precision cameras were made on which these lenses could be used to produce negatives for enlarging to sizes rivaling the productions of big cameras.

Typical of these new lenses was the Ernostar, designed by the Ernemann-Werke A. G. in Dresden, and put on the market in 1925. Its diameter was at first half of its focal length, and marked accordingly f/2; later it was increased to f/1.8. Lenses of such large diameter are practical only in short focal lengths, for it is a rule of optics that, at the same f/ number, the greater the focal length, the shorter will be its depth of field, i.e. the zone between the nearest and farthest points that are in sharp focus. The Ernostar had a focal length of 4 inches and it was fitted to a camera called the Ermanox or Ernox, which used pieces of sheet or cut film 4.5 x 6 cm. (about 1¾ x 2¼ inches). The manufacturer's catalog said:

this extremely fast lens opens a new era in photography, and makes accessible hitherto unknown fields with instantaneous or brief time exposures without flashlight: night pictures, interiors by artificial light, theater pictures during performance, children's pictures, scientific records, etc.

Learning of this seemingly miraculous camera, Erich Salomon began in 1928 to use it to photograph famous people in Berlin. At first, when he asked permission to photograph at indoor functions, he was refused, for officials could not believe that a blinding flash would not interrupt the formalities, leaving a dense pall of acrid smoke to hang over the dignitaries. Salomon convinced them by taking pictures unawares and showing them the results. Soon he gained the confidence of prominent statesmen and began to photograph in the very rooms where they foregathered. He took diplomats attentive and suave at eleven and then at one in the morning, slumped in their chairs, exhausted and haggard. Aristide Briand is reported to have said, “There are just three things necessary for a League of Nations conference: a few Foreign Secretaries, a table, and Salomon.” When an English editor saw these pictures, so utterly different in revelation from the usual posed studio portraits, he called them “candid photographs,” a phrase which stuck with the public.
The camera most suited for Salomon’s approach, and that came to be dubbed the “candid camera,” was the Leica, which with its many imitators had the advantage over the Ermanox that thirty-six negatives, each approximately 1 x 1½ inches in size, could be taken on a single loading of inexpensive 35mm. moving-picture film. It was the invention of Oskar Barnack, who was constructing microscopes at the optical works of F. Leitz in Wetzlar, Germany. Just before the First World War he devised for his own use a camera to take single pictures on standard motion-picture film. He was an enthusiastic amateur cinematographer, and had built the little camera in order to test the film he was using in his moving-picture camera and so to determine, by empirical means, the correct exposures.

The Leitz company soon saw that the little camera had potentialities beyond its use as an exposure meter. After the war the design was improved, and in 1925 it was put on the market. A collapsible lens of 50 mm. focal length was permanently fitted into the original Leica. The first improvement was to make the lens removable, and to offer the photographer a choice of lenses of varying focal lengths which could be readily interchanged. In 1932 two important innovations were announced: a lens of great light-passing power (f/1.9), and a built-in range finder, coupled with the focusing mechanism in such a way that the photographer, by simply moving the lens until a double image of the subject became one, could be assured that the negative would be as sharp as possible.

The tiny negatives were useless until they were enlarged, and to insure the maximum quality Leitz built a precision enlarger. Largely through the work of Paul Wolff, a commercial photographer who had acquired one of the first Leicas, the public became aware of the potentialities of the tiny camera, which at first seemed more a toy than a precision instrument. When 30 x 40 inch enlargements were exhibited, Wolff was deluged with questions. He answered them in 1934 in the introduction to his book of pictures, My First Ten Years with the Leica. He explained that his technique was in no way unusual, but in reach of all. To the criticism that the Leica made photography too easy, so that the photographer would be overwhelmed with negatives, he replied that the greenest of his assistants could locate any one of his 50,000 negatives in a few minutes. And he emphasized that the Leica was not a substitute for the larger camera, but another instrument with its own field — a field which was growing wider as improvements were made in technique, and particularly in the production of special fine-grain film and developing agents. Wolff’s advice was sound, but it went unheeded by thousands of amateurs who were fasci-
nated by the convenience of the tiny Leica and the host of candid cameras that followed in its train. They vied with one another, not in making pictures, but in technical performance. At the height of the "minicam" enthusiasm, amateurs brazenly forced their way anywhere that off-guard pictures could be taken. Promiscuous snapshotting while the play went on became such a nuisance that theatres were forced to prohibit unauthorized picture-taking by the audience.

Professional work was, however, being done with the Leica and the somewhat similar Contax. Wolff was producing feature pictures by the thousand; Alfred Eisenstadt covered the Ethiopian War; Peter Stackpole made pictures of the construction of the Golden Gate Bridge in San Francisco as the workmen saw it, from vantage points hardly accessible to the cameraman with standard equipment; Thomas McEvoy took the readers of *Time* into President Franklin D. Roosevelt’s office and showed them a president at work, not consciously posing.
Useful as these applications of the miniature camera proved to be, the esthetic value of its new way of photographing had hardly been exploited. When miniature camera work by the French photographer Henri Cartier-Bresson was first shown at the Julien Levy Gallery in New York in 1933 it was called, awkwardly enough, "anti-graphic photography." The impression arose that the photographs had been taken almost automatically and that they owed their strange and provocative beauty to chance; they were described as "equivocal, ambivalent, anti-plastic, accidental." For Cartier-Bresson showed the unreality of reality: the rhythm of children playing in ruins, a child lost to the world as trance-like he catches a ball; a bicyclist streaking by iron grill work. It was hard to believe they were deliberate records of previewed images. Yet that was precisely how every photograph had been made.

Cartier-Bresson was able to seize the split second when the subject stood revealed in its most significant aspect and most evocative form. He found the miniature camera ideal for he could bring it into action almost at once, as "an extension of the eye." Far from relying upon accident he composed through the finder, invariably using the full negative area. In his earlier work - he
began to use the camera in 1932 — there is an emphasis on form, and a delight in capturing aspects of the ordinary unseen in time and space by the ordinary eye. His interest in people became stronger. Not infrequently he produced studies amounting to caricature as, for example, the pictures of the Coronation Parade of George VI in London in 1938, where he showed not the glittering pageantry, but the bystanders. He has the remarkable ability to capture those peak instants when the ever-moving image formed by his lens has attained a timeless harmony of form, expression and content. There have been few photographs of religious emotion more intense than Cartier-Bresson's picture of homage being paid to Cardinal Pacelli, or of more stimulating form than his picture of children playing in ruins.

This dynamic approach has been skillfully used by Helen Levitt, who has taken her Leica on the sidewalks of New York, patiently waiting for children to become preoccupied in their world of play. In her work there is a deep understanding of the psychology of people in relation to their surroundings;
looking at her pictures we feel ourselves identified with the subjects she has chosen to record. Not only people, and children in particular hold her interest, but expressive products made by them — sidewalk drawings and Halloween masks.

The miniature camera has its drawbacks. It cannot produce a picture so detailed as the larger camera. Only in the hands of a photographer who knows how to create a framework of dominant form can it carry its message, and then it is usually best in close-ups or in subjects large in scale, where the loss of detail is of no consequence. Many of the fields first explored by the 35mm. miniature camera have since been explored by somewhat larger cameras, of which the Rolleiflex is typical. First put on the market by Franke & Heidecke in 1927, it takes twelve negatives 21/4 inches square on roll film. It has two lenses: one forms an image on ground glass, the other forms an identical image on the film. The photographer by observing the ground-glass image can see exactly what he is taking. The focal length of each lens is 3 inches, the maximum aperture of the taking lens, f/3.5. While snapshots cannot be taken with this camera under quite such extreme light conditions as with the smaller 35mm. camera with its large-aperture lens, still it is possible to work rapidly and with mobility in situations closed to more bulky cameras.

But the approach suggested by the miniature camera has been brought within reach of all cameras by the development of powerful light sources which compensate for the low transmission of the lenses to which larger cameras are restricted.

With flash powder the photographer had little control over the quality of the lighting; it was hardly more than a way of creating enough illumination to take snapshots in dark places. In 1929 J. Ostermeier patented in Germany a radically new method of producing a flash: a bulb, resembling a common electric light, was filled with aluminum foil. When weak electric current was passed through the foil it ignited at once, giving forth, for a fraction of a second, brilliant light. This noiseless and smokeless photoflash lamp was immediately adopted by news photographers; its earliest use in America is said to have been photographing President Hoover signing the Unemployment Relief Bill. At first the “open flash” method was used; with the camera on a tripod, the shutter was opened, the flashbulb set off, and the shutter was closed. Then the release of the shutter was synchronized with the discharge of electric current and the camera could be held in hand. For convenience, the flashgun (battery case, flashbulb and reflector) was fastened to the side of the camera.

With this equipment pictures could be taken anywhere. But the results
were, for the most part, grotesque, because the harsh front light flattened out faces, cast unpleasant shadows, and fell off so abruptly that backgrounds were unrelieved black. This unreal lighting of the flash from the camera can be used effectively; in many instances the New York news photographer Weegee has made comments which reach into the field of social caricature. It is obvious, however, that photographs so lighted are far removed from naturalistic indoor pictures made with a wide-aperture lens on a miniature camera, in
which we seem to be magically transported into the very presence of people and to be an onlooker of their activities together with the photographer. A further mechanical development made it possible to ignite several flashbulbs, placed at distant points from the camera and connected to it by extension wires. With this “multiple synchroflash” technique the lighting can be arranged either for dramatic effect, or to simulate existing light sources; people can be photographed with it instantaneously, amid their normal surroundings, relaxed or in action. One of the first to make use of this technique was Margaret Bourke-White, of Life, who wrote in 1937:

I am deeply impressed with the possibilities of flash bulbs distributed through the room instead of using one attached to the camera in the usual way. I work mine with extension cords from a synchronizer attached directly to the shutter but always use two sources of light and sometimes three or four or even six distributed around the room. The flashlight gives a soft, very fine quality of light. The beauty of it, of
BILL BRANDT: Coal Searcher, England, 1937
course, is that you can watch your subjects until they show just the expressions or movements you wish and then release your flash. I feel, too, that it is very useful in dark places like night clubs and restaurants. Frequently I have set up a camera with remote control in the corner of a room, seated myself at a table some little distance, and released the flash, possibly an hour later, when everybody had forgotten about the camera.

Brilliant use of artificial lighting, and particularly of the synchroflash technique, has been made by Barbara Morgan in her photographs of the dance. She lights dancers specifically for the purpose of photographing them; they perform for her camera; instead of mere records of action, she gives us interpretations. Light is her medium:

I am grateful for man-made light and the creative freedom it gives . . . With syn-
chroflash and speedlamps I can illuminate what I want and no more. At will I can create zones of importance by dominant and subordinate lighting. I can impart sculptural volume or flat rendering to the same object. By controlling direction and intensity I can launch light as a dynamic partner of dance action, propelling, restraining, and qualifying. Light is the shape and play of my thought . . . my reason for being a photographer.

Too often dance photographs are nothing more than technical accomplishments, in which action is stopped, and the performers are left awkwardly in space. In Barbara Morgan’s photographs every shape has meaning. Sometimes “freezing” of action is demanded; at other times a slightly blurred image helps to convey the emotion. Often both renderings are needed simultaneously, to show part of the action arrested and part in flow. Experience has enabled her
to visualize what the lens will record during the fraction of a second it is open. She sees the dance not as a spectator, nor as a performer, but as a photographer. She has brought her sense of light and form to many other fields besides the dance, always bringing out the human qualities with warmth and acute sympathy.

When action is to be "frozen," so that each lock of hair and every thread of swirling costume is to be rendered with breathless sharpness, the so-called stroboscopic lamp or speedlamp is used, which gives brilliant light for as short a time as 1/10,000 or even 1/100,000 second.

In 1931 Harold Edgerton of the Massachusetts Institute of Technology designed an electronic lamp: current built up in a condenser to a high voltage was allowed to discharge in a gas-filled tube. The resulting flash was of great intensity, yet of extremely brief duration, and it could be repeated at will. He built it to examine rapidly moving machine parts, by the long familiar stroboscopic method. If a light flashes at exactly the rate that a regularly moving object revolves or oscillates, it will illuminate the same phase of the motion at each flash, and the object will appear to stand still.

Edgerton's light was so brilliant that photographs could be taken with it, and it was of such brief duration that the splash of a drop of milk, a bullet in flight, the beating of a hummingbird's wing could be recorded on film with a single flash. This use of the new light had many applications. Even with subjects comparatively motionless, more detail was secured because imperceptible movements of the camera and subject were eliminated. The flash was so brilliant that color film, which is of low light sensitivity, could be exposed instantaneously.

Recently portable stroboscopic units have been perfected which can be slung over the shoulder. News photographers are replacing their flashbulbs with these powerful lights because they can be used over and over again.

When repeated flashes are made in true stroboscopic fashion with the Edgerton lamp while the lens of the camera is open, a series of images is recorded on the film. This refinement of Marey's chronophotography spreads out in space phases of action normally invisible. Thus the rush of a tennis player's body, arm and racket is recorded in consecutive images which enable us to analyze each part of the stroke. Gjon Mili has used this multi-exposure technique to picture, in an imaginative way, the flow of motion—the cycle of drumsticks, a pas de ballet. The camera has gone beyond seeing and has brought us a world of form normally not seen.
In 1913 Alvin Langdon Coburn, a Photo-Secessionist who had first exhibited in 1900, included in his one-man show at the Goupil Gallery, London, a series of five photographs under the title "New York from its Pinnacles." They were all views looking down, and the distorted perspective emphasized the abstract pattern of streets and squares and buildings. In the catalog he pointed out that one of them was

almost as fantastic in its perspective as a Cubist fantasy; but why should not the camera artist break away from the worn-out conventions, that even in its comparatively short existence have begun to cramp and restrict his medium, and claim the freedom of expression which any art must have to be alive?

Four years later Coburn produced completely non-objective photographs. These *Vortographs* were deliberate abstractions:

There was at that time a notion that the camera could not be "abstract," and I was out to disprove this. The Vortographs were made with three mirrors clamped together in a triangle, into which the lens of the camera was projected, and through which various objects (bits of crystal and wood on a table with a glass top) were photographed. I greatly enjoyed making the Vortographs, for the patterns amazed and fascinated me!

Christian Schad, a member of the Zurich Dada group of modern artists, in 1918 produced abstractions photographically without a camera. He laid cut-out paper and flat objects on light-sensitive paper which, upon exposure to light, recorded designs that closely resemble those cubist *collages* made of pieces of newspaper and bric-a-brac stuck onto canvas.

Around 1921 Man Ray (an American painter in Paris) and László Moholy-Nagy (a Hungarian painter in Berlin) began to make, quite independently, their somewhat similar *rayographs* and *photograms*. They placed three-dimensional objects on the light-sensitive paper; thus not only were contours recorded and, in the case of translucent objects, texture as well, but also cast shadows. The photogram technique has been enriched by modulating the light which is allowed to fall on the object-strewn paper. A moving beam of
COBURN: The Octopus, New York, 1913
light may be used, or the projected image of textured objects. Sometimes the paper is first covered with glass on which an abstract design has been painted, or to which texture has been applied.

Technically, the photogram is a revival of Talbot’s photogenic drawing. Esthetically, however, it is entirely different. Talbot sought to exploit the representational characteristics of the medium. He related in 1839:

Upon one occasion, having made an image of a piece of lace of an elaborate pattern, I showed it to some persons at the distance of a few feet, with the inquiry, whether it was a good representation? when the reply was, “That they were not so easily to be deceived, for that it was evidently no picture, but the piece of lace itself.”

Moholy-Nagy, on the other hand, found that the photogram opens up perspectives of a hitherto wholly unknown morphosis governed by optical
RAY: Rayograph, 1923. The Museum of Modern Art
moholy-nagy: Photogram, 1923
laws peculiar to itself. It is the most completely dematerialized medium which the
new vision commands.

The photogram is visually so closely related to abstract painting that it may
be considered a branch of that artistic discipline. It was devised by painters;
the most significant results have been achieved by them: Moholy-Nagy dis-
covered the technique through painting, and a more recent photogram maker,
Gyorgy Kepes, speaks of his products as “photo-drawings.” It is a synthetic
rather than an analytic process, a tributary of the main stream of photography
in which the camera has been the indispensable instrument, second in im-
portance only to the photographer’s eye.

The phenomenon of solarization, long regarded as a technical failure of the
photographic process, was used as a plastic control, particularly by Man Ray.
With gross over-exposure, or with an after-exposure of the naked film to light
the sensitive material begins to bleach, until at length not a negative, but a
positive image is formed. The change is gradual, and begins at edges. Prints made from negatives in which this edge-reversal has taken place show, therefore, the contours rimmed with black lines.

Man Ray also made negative prints, processed both normally and with edge-reversal. He diffused the image by deliberately increasing the size of the silver grains. These controls are adaptations of the photographic process. Other physical methods of distorting the camera’s natural image have been devised. Texture is introduced in the gelatin emulsion of the negative by subjecting it to rapid temperature changes, producing reticulation, or a net-like struc-
U.S. ARMY AIR FORCE: Water-filled volcano crater from 15,000 feet above Onnekoton Island in the Kuriles
ture in the normally transparent film. Or the gelatin is melted, so that the image it bears droops and sags. A pseudo bas-relief appears when a negative and transparent positive are printed together slightly out of register. These methods have all been used singly or in combination by experimentalists who are impatient with the camera's normal image.

The vision which led to these applications of the photographic technique is quite separate from the vision of those who seek to interpret with the camera the world of nature and of man. Viewing these photograms and solarized prints and distorted negatives, we are constantly reminded, not of photographs, but of paintings. Indeed Louis Aragon has said, "one completely unfamiliar with the painters alluded to would not be able to appraise fully the results." James
Thrall Soby — the critic, historian and collector of modern painting — pointed out in *U. S. Camera Magazine*, 1940, that in his experience abstract photographs did not wear well when hung as pictures.

The non-objective photographs — the rayographs, the odd angle shots, the composite prints — have one by one been taken from their frames and filed away against the day when they may have some minor value as commentary on the aspirations of certain artists in the 1920’s.

In addition to making photograms and in working out various highly ingenious changes on the photographic technique, László Moholy-Nagy was deeply interested in all kinds of photographs. He always considered photog-
The image shows a close-up of zinc oxide smoke magnified 31,488 times with an electron microscope. This type of magnification allows for the visualization of individual particles that are otherwise invisible to the naked eye.

Radio Corporation of America Laboratories.
raphy as a means rather than an end, a tool for seeing. He was contemptuous of technique, and was content to send his films to the nearest photo-finisher, for he was not so much concerned with their intrinsic beauty, but in their revelation of form and structure. Like Coburn, he discovered abstract beauty in the very distortions which beginners had traditionally been warned against. He found the negative itself a thing for contemplation. He discovered beauty after the photograph had been taken, and it did not matter to him who made the photograph or why it had been made. Once, looking at a photograph which he had taken years previously from a bridge tower at Marseilles, his attention was held as if it were a new thing and the work of another. "What a wonderful form!" he said, pointing to a coiled-up rope. "I never saw it before!" It was this attitude of approaching photographs in the quest of form that led him to appreciate scientific photographs for their quite often accidental beauty. In them he found the new vision of the world.
Certain it is that the scientists by means of photography have made visible the unseen, laid bare the structure of the microcosmos, and penetrated the worlds which lie beyond seeing. While the scientific significance of these photographs may escape us as laymen, our imagination is gripped by their strange and often provocative beauty.

Already in 1839 Fox Talbot had showed the value of his process to record the image of the microscope:

The objects which the microscope unfolds to our view, curious and wonderful as they are, are often singularly complicated. The eye, indeed, may comprehend the whole which is presented to it in the field of view, but the powers of the pencil fail to express these minutiae of nature in their innumerable details.

His experiments were limited to low magnifications, but he clearly foresaw the time when the microscope would become a camera, its image thrown upon sensitive film. The form of the microcosmos has been laid open to all, permanently and beautifully. Complex crystalline structures which defy description are precisely recorded, and we can enjoy the beauty of their forms. With the electron microscope magnifications of unheard-of power are regularly attained: so evanescent a substance as smoke is seen to be an architecture of bold geometry.

The photographic emulsion reacts to rays which are invisible. In 1895 Wilhelm Conrad Roentgen discovered X-rays, and the world was startled to see photographs of living skeletons. The truth of the first radiographs was doubted: a photograph of the bones of the hand with one finger encircled by a ring was said to be considerably retouched if not actually a drawing. While the technique was still a novelty, readily verifiable and easily identified objects were X-rayed for the wonder of it, and many of these still lifes of a phantom necklace inside a locked jewel box, with every screw delineated through the wood, possess a strange and quite accidental beauty. Although the greatest use of X-ray photography is in medicine, industry finds it of value in the examination of cast parts for flaws and invisible imperfections.

The modern astronomer no longer watches the heavens, but studies a photographic plate. The telescope has become a camera, fitted with precision mechanism to guide it so that the images of moving heavenly bodies will remain immovable upon the photographic plate for hours. During these long exposures light so weak that it cannot be seen by the eye accumulates a silver deposit on the sensitive emulsion. Harlow Shapley, Director of the Harvard Observatory, has noted that
On one plate in the Harvard collection of stellar photographs more than a thousand external galaxies have been discovered, measured, and catalogued; each is probably a richer stellar system encompassing more space than that occupied by all the naked-eye stars . . . Whether galaxies or planets, stars or meteors, they all yield up their secrets through the agency of the photographic plate.

The land's surface seen from great heights often presents patterns of great beauty. The aerial camera allows us to isolate a section of the earth's surface
for contemplation. Our eyes alone are not of sufficient optical acumen to give us at once the over-all dominant pattern and wealth of enclosed detail. Most aerial photographs are dull enough records. But when the ground possesses a rich pattern, we can often select from photographs taken purely for scientific purposes some which will appeal strongly to our esthetic imagination. Many of the aerial reconnaissance photographs taken during the war are of intrinsic beauty. They were taken by pilots high above enemy territory flying straight and level on a predetermined course while three automatic cameras made exposures at intervals of a few seconds. The dozens of photographs taken on each flight overlap to form a topographical record of many miles of the earth’s surface. Each single print, therefore, is not an independent picture, but merely one unit of a series from which interpreters could extract military information. The pictorial quality which we see in a single print is a by-product.

This is true of all the scientific photographs which are reproduced in these pages. The similarity of such photographs to the work of modern painters has often been pointed out, and it is even possible to choose photographs which resemble specific paintings. The similarity is not mere coincidence. Our vision of the world has been conditioned by scientific discoveries: the artists were the first to be moved and stimulated by these revelations of the physicists. The new vision disclosed by the laboratory has, in general, been assimilated rather than imitated. Marcel Duchamp has stated that when he was painting his famous *Nude Descending the Staircase* in 1912, art circles in Paris were stimulated by stroboscopic and multiple-exposure high-speed photographs. The advance-guard magazine *L’Esprit nouveau* published in 1921 photomicrographs, astronomical photographs, and a record photograph of machinery was reproduced with the caption: “This plate is not related to any article. It is here only to give pleasure and to provoke thought.” Among the documents which Le Corbusier presented in his manifesto on decorative art (1925) are scientific photographs and drawings. He pointed out that the illustrations in popular scientific magazines take the cosmic phenomenon to pieces under our eyes; amazing, revealing and shocking photos, or moving diagrams, graphs, and figures. We are attacking the mystery of nature scientifically... It has become our folklore.
The camera and the printing press were linked from the very birth of photography. Daguerreotypes themselves were made into printing plates. A satirical lithograph of 1839 by Théodore Maurisset, captioned *Daguerreotyphonie*, shows Alfred Donné at work with camera, aqua fortis bottle and etcher’s press, while camera fans pass beneath him in procession bearing the banner, “Down with Aquatint!” Donné made the metal plates printable by etching out the clear silver areas and building up the highlights by the newly discovered electrotyping process; they could then hold ink and be printed like an etching or copper-plate engraving. The technique was improved by Hippolyte-Louis Fizeau, who borrowed from the aquatint engraver the trick of breaking up middle tones into minute divisions of black and white dots by sprinkling the plate with powdered resin. For the album *Excursions daguerriennes*, which N. P. Lerebours began to publish in 1840, he contributed two of these primitive photogravures: a view of the Hotel de Ville in Paris, and a detail of the Gothic carving on the Cathedral of Notre-Dame.

The negative-positive process brought more successful photo-mechanical reproduction techniques. Fox Talbot himself patented in 1852 and again in 1858 *photoglyphic engraving*, which produced printable steel plates. To reproduce the middle tones, Talbot broke those areas up into minute divisions of black and white either with grains of resin, or by double exposing the negative with a screen of fine-mesh muslin.

Experiments were also made in the production of photographic images which could be printed by the lithographic process.

Another method of reproducing the photographic image in facsimile with ink was invented in 1866 by Walter Bentley Woodbury. He printed negatives on gelatin, made light-sensitive with potassium bichromate. The exposed film, when “developed” in hot water like a gum print, becomes a relief map of light and shade: the highlights are valleys and the shadows are hills. A mold of these contours is made by forcing a block of lead against the gelatin under great pressure. The lead plate is then filled with a jelly-like ink, paper pressed against it, and a perfect facsimile of the photograph is obtained, with vari-
lations of tone reproduced by proportionate variations in the thickness of the
deposit. No finer process for reproducing photographs than the now unfor-
tunately obsolete woodburytype has ever been devised.

But all of these methods — photogravure, photoglyphic engraving, pho-
tolithography, woodburytype and dozens of variants of them, had a common
disadvantage. They could not be printed on an ordinary press together with
type. Although these methods made possible the reproduction of photographs
in great quantity, the reproductions themselves had to be published exactly
as photographic prints had been published: pasted down on blank pages of
books, bound into them as separate plates, or mounted on cards in portfolios.

Type is in relief. The ink is applied to the raised portions. To print pho-
tographs in the same press with type, a method was needed by which the high-
lights would be depressed and the shadows would remain upon the surface
of the block.
The goal was attained with the invention of the halftone plate in the 1880's. This important invention was perfected at precisely the time that the technical revolution in photography was taking place. Dry plates, flexible film, anastigmat lenses and hand cameras made it possible to produce negatives more quickly, more easily, and of a greater variety of subjects than ever before. The halftone enabled these photographs to be reproduced economically and in limitless quantity in books, magazines and newspapers. The consequent demand for photographs became so great that specialization became common: photographers began to produce pictures for the printed page.

The pattern had already been set. News photographs were taken as early as 1842, and the great illustrated weeklies began to use them from time to time as models for their wood engravings. Copies of the Illustrated London News and its counterparts, such as L'Illustration (Paris), the Illustrierte Zeitung (Leipzig) and Gleason's Pictorial Drawing Room Companion (Boston), of the
1850's not infrequently contain pictures of railroad wrecks, balloon ascensions, and collapsed or burnt-out buildings which bear the cut-line "From a Daguerreotype." The use increased with wet plates. Fenton's Crimean War pictures were reproduced in the Illustrated London News, and Brady's pictures of the Civil War appeared in Harper's Weekly.

But wood engravers were not draftsmen. They were skilled technicians, who faithfully followed with their burins the drawing which the artist had made on the block, cutting away the wood between the lines. To make a wood engraving of a photograph, a drawing of it had first to be prepared. So long as it was necessary to go through this intermediate step, relatively few illustrations were cut from photographs, and although artist-correspondents could make a living specializing in the pictorial reporting of news, it was hardly possible for a photographer to do so. The photographic reporting of war left Brady penniless, and Fenton gave up photography as a profession in 1862, and spent the rest of his life as a lawyer.

The entire economy of news photography was changed with the introduc-
tion of the halftone process, by which a facsimile relief block was made mechanically. The first use of the process in a daily newspaper appears to have been in the New York *Daily Graphic* for March 4, 1880. In this issue of the newspaper samples were given of all the various ways of reproducing pictures. Special attention was drawn to a facsimile, made by Stephen Henry Horgan, of a photograph by Henry J. Newton, showing "Shantytown," the squatters' camp which then disgraced uptown New York. The editors said,

We have dealt heretofore with pictures made with drawings or engravings. Here we have one direct from nature . . . We are still experimenting with it, and feel confident that our experiments will in the long run result in success, and that pictures will eventually be regularly printed in our pages direct from photographs without the intervention of drawing.

Yet it was years before prejudice could be overcome. While Stephen Horgan was art editor of the New York *Herald* in 1893, he suggested to its owner, James Gordon Bennett, that halftones could be printed in the paper. Bennett consulted his pressman, who told him that the idea was impossible and pre-
posterous. Horgan was fired. He had more success at the Tribune, and in 1897 halftones were first printed on speed presses.

By the turn of the century the public began to expect to see the news in photographs. Agencies were set up for the distribution of photographs, and photographers began to specialize in covering events of the day.

Obviously all news is not photogenic. Diplomats seated around the table may be reshaping the world, but it is the exceptional photographer who can make the reader feel the drama underlying such a conference. The immediate drama of accidents, the exaggerated emotions brought out on faces under the tension of disaster or crime, the violent split-second action of sports can be imparted vividly by the camera. The photographer needs not so much artifice, subtlety of light and shade and sense of composition as boldness, strong nerves, and a mastery of his camera so complete that handling it is an automatic reflex.

Although the technique of the news photographer does not differ from that of any other cameraman, the special demands made on his skill, daring and ingenuity in getting unusual pictures, and the need of turning out a print with all possible speed, make his work a special branch. Almost invariably he uses a Speed Graphic camera taking cut films 4 x 5 inches in size. Because he can seldom count on finding his subject well illuminated, and because he cannot risk underexposure, his camera is fitted with a synchronized electric photoflash.

Sensing the exact instant to release the shutter becomes instinctive. A second's hesitation, and a picture scoop may be missed. When William Warnecke of the New York World went on a routine assignment to photograph Mayor William J. Gaynor of New York as he was about to sail to Europe on a vacation in 1910, he arrived after the other cameramen. Hurriedly he asked the Mayor for a last minute pose. Just then an assassin fired two shots of a revolver at the Mayor. Warnecke, in the midst of the confusion, remained cool, and photographed that sickening moment when the victim staggered into the arms of his companion.

Chance often gives news photographers their opportunity, yet great news photographs are not accidentally made. Twenty-two photographers, representing New York and Philadelphia newspapers, were gathered at Lakehurst, N.J., on May 6, 1937, for a routine assignment: the dirigible Hindenburg was due, and although it was the airship's eleventh Transatlantic crossing, the event was still considered newsworthy. At dusk the great silver giant sailed majestically in from the Atlantic, and the cameramen were preparing to compose "art shots" for the feature editors, when suddenly flames shot out from the
hull. In forty-seven seconds the great dirigible lay on the ground, a mass of twisted flaming wreckage. In those forty-seven seconds, every one of those photographers produced pictures that are still memorable. Jack Snyder of the Philadelphia Record said,

I've been carrying my camera around for sixteen years, but I never got an opportunity for really good pictures before. I waited for hours for the Hindenburg in a pouring driving rain, as I wanted to get a close-up. I thought, "I'll get close to the mooring mast to see her tied up." Then I heard a crackling over my head, a sort of roaring crackle, and then w-h-a-a-a-a-m. There was a terrible flame and the heat singed my hair.

He rushed for shelter, but not before he had clicked his shutter. Another photographer worked so fast that he threw the filmholders on the ground at his feet after exposing only one of the two films which each contained, for fear that in his excitement he might make a double exposure. A messenger collected the holders; they were flown to New York. The metropolitan newspapers, all of them, told the story of the tragedy not in words but in pictures, which were often enlarged half a page in size. The New York World-Telegram carried twenty-one photographs; the New York Post had seven pages of pictures, the Daily Mirror, nine. Never had a disaster been so thoroughly covered by photography.

The news photographer works under pressure, both in taking the picture and in processing it. After telling the layman how a negative is developed and printed in less than five minutes, James C. Kinkaid, in his book Press Photography, adds: "That is fast work, and it requires concentration, especially when the rasping voice of the editor bellows through the door of the darkroom, 'How long do we have to wait for that print?'"

The press photographer thinks in terms of a single picture or a group of single pictures. He specializes in "spot news," and seldom has opportunity to plan a sequence of pictures which will build up a total effect greater than the sum of the parts. This approach to photography has been stimulated by the picture magazines.

Picture stories are not, of course, new: examples are legion. The pictorial press of the forties used picture essays: the first number of the Illustrated London News took its readers to Queen Victoria's masked ball in eight pictures; the following week it traced the overland route from India to England, and showed in pictures Horace Walpole's Strawberry Hill.

The rapidity with which pictures could be taken with a camera made it
possible for several views to be taken of a single incident. O'Sullivan took three photographs of a Civil War staff meeting near Massapomax Church, Virginia, on May 21, 1864, alike except for the position of General Grant: by viewing the three in succession we almost have the illusion of motion. In a similar 1-2-3 fashion, Brady photographed the hanging of the Lincoln conspirators. Full use of chronological sequences in magazines, however, awaited halftone techniques as rapid as photography.

On the occasion of the one-hundredth birthday of the French scientist Marie-Eugène Chevreul in 1886, Nadar's son Paul took a series of exposures
of him in conversation with his secretary and with Nadar père, which were published as a “photo-interview” in _Le Journal illustré_ for September 5, 1886. A stenographer noted the very words which Chevreul spoke at each exposure, and these were printed as captions. A second photo-interview was made two years later of General Georges Boulanger; some of the pictures were circular. They had been taken with one of the first Kodak cameras.

Perhaps the first magazine which was deliberately planned to exploit this type of photography was the _Illustrated American_. In its first issue, dated February 22, 1890, the publisher stated that “its special aim will be to develop the possibilities, as yet almost unexplored, of the camera and the various processes that reproduce the work of the camera.” The first number carried six photographs of the U. S. Navy, twenty-one of the Westminster Kennel Club Bench Show, eight of the Chicago Post Office, fifteen of a production of _As You Like It_, six of historical sites in Bordentown, New Jersey, fourteen to illustrate “A Trip to Brazil,” and five showing the latest millinery. Of a layout of twelve photographs of the Chicago Public Library in a subsequent issue the editors pointed out: “These are no fancy sketches; they are the actual life of the place reproduced upon paper, and they tell more than words could of the immense usefulness of the institution.”

But the _Illustrated American_ found that it could not rely upon photographs alone. Month by month more and more words appeared in its pages, until it had lost its original character.

The same tendency can be observed in other picture magazines. The _Mid-Week Pictorial_, founded in 1914 by the _New York Times_ as an outlet for the flood of war photographs which were arriving from Europe, was at first so dominantly photographic that the letterpress was limited to captions of one or, at the most, two lines. By 1915 the captions had become deeper, and there was a good amount of writing; before the war was over, feature articles had become numerous and drawings appeared frequently; emphasis on pictures had given way to the illustration of literary essays.

The idea of a purely photographic magazine was revived in 1936 by Henry Luce, publisher of _Time_ and _Fortune_. The new magazine was envisaged as the _Show Book of the World_. Its purpose was stated in a prospectus:

To see life, to see the world; to eyewitness great events; to watch the faces of the poor and the gestures of the proud; to see strange things — machines, armies, multitudes, shadows in the jungle and on the moon; to see man’s work — his paintings, towers, and discoveries; to see things a thousand miles away, things hidden behind
walls and within rooms, things dangerous to come to; the women that men love and many children; to see and to take pleasure in seeing; to see and be amazed; to see and be instructed.

To accomplish this ideal, the editors proposed to replace the "haphazard" taking and publishing of pictures with the "mind-guided camera," and to "harness the main stream of optical consciousness of our time."

The magazine was named upon its appearance Life. Its contents showed two types of pictures: spot news photographs, supplied for the most part by news agencies, and feature stories, written and photographed to order. What distinguished Life from earlier picture magazines was the number of pictures which it published and the theory of the "mind-guided camera." The typical
picture essay is the co-operative work of editors and staff photographers. A story is decided upon, background research done, and a shooting script is prepared to give the photographer the general type of pictures needed, their mood, and their purpose. Many more photographs are taken than will be used, for it is hardly possible to visualize the material which the photographer will find when he starts work. From the stack of prints delivered by the laboratory, the editors choose those they consider will best tell the story.

This approach lends itself to forceful statements and to clear exposition. Unfortunately it also tends to overemphasize the caption. John R. Whiting, in his *Photography is a Language*, made an illuminating experiment: he reprinted, in sequence and without the accompanying photographs, the cap-
tions of a typical *Life* picture essay. The result was a somewhat telegraphic, but completely coherent and readily grasped personality story to which the photographs were embellishments. Indeed, as Whiting states, “It is very often the caption you remember when you think you are telling someone about a picture in a magazine.”

In an effort to retain the informal quality of the miniature camera and the detail of the larger camera, the editors of *Life* have encouraged the use of synchroflash technique. In contrast *Picture Post*, founded in London in 1938, and originally edited by Stefan Lorant, formerly of the Munich *Illustrierte*
EUGENE SMITH: Saipan — Mother and child fleeing from cave, 1944. Courtesy Life
Zeitung, has preferred to use the miniature camera. Although the results do not compare in clarity to most photographs published in Life and Look, the "candid" approach gives spontaneity and directness. Even though they are not infrequently posed, the pictures consistently appear "natural." The Picture Post photographers will go anywhere—in the King's castle, to political meetings, to pubs, railroad stations, operating rooms, bringing back vivid pictures. The magazine does not carry spot news photographs; it is devoted entirely to essays.

Remarkable photographs have been made on magazine assignments, and often single pictures are remembered long after the story has been forgotten. Perhaps the majority of photographs of the last war which the public has seen were made by magazine photographers or under their influence. Life ran a school for army photographers, and sent its own cameramen to the front: Eliot Elisofon was in North Africa; William Vandivert was in London during the Blitz and in India; Margaret Bourke-White was in Italy and Russia; Eugene Smith was in the Pacific where, at the cost of serious injury, he produced some of the finest war photographs; Robert Capa covered the invasion and landed with paratroopers. Captain Edward Steichen, U.S.N.R., set up a special photographic project in the Navy to record the war at sea, and under his command were many photographers who had received their training on magazine assignments.

But it is, of course, too soon to evaluate the photographs of the last war, and the historian must reserve judgment. Thousands upon thousands of prints and negatives are buried in archives. Among them will be discovered photographs that have meaning beyond records, made by cameramen whose names will remain as anonymous as those of their brothers-in-arms who landed by their side on the beachheads, or who flew with them deep into enemy territory.

The fashion magazines were among the earliest to make regular editorial use of photographs. Vogue in 1913 began to publish photographs taken for them by Baron Gayne De Meyer; he founded a style in which the elegance of fashions are displayed with photographic feeling for textures. In 1923 Edward Steichen—who had taken fashion photographs both in black and white and color for Arts et décora­tion as early as 1911—joined the staff of Condé Nast. In addition to photographing fashions he produced a great quantity of portraits of celebrities, which appeared regularly in Vogue and in Vanity Fair. These photographs are brilliant and forceful; they form a pictorial biography of the men of letters, actors, artists, statesmen of the 1920's and 1930's, doing for that generation what Nadar did for the mid-nineteenth-century in-
intellectual world of Paris. Steichen's work is straightforward photography which relies for its effectiveness on the ability to grasp at once the moment when a face is lighted up with character, on the dramatic use of artificial lighting, and on a solid sense of design. He succeeds best with people of the theatre. In *U.S. Camera Magazine* he shows how he photographed Paul Robeson as "Emperor Jones" by reproducing twenty-eight of the exposures made during one sitting. His account of his approach is revealing:

I have almost invariably found that the sitter acted as a mirror to my own point of view, so that the first step was to get up full steam on my own interest and working energy . . . If everything moves swiftly and with enthusiasm, the model gains courage in the belief that he or she is doing well, and things begin to happen. The model
newman: Max Ernst, 1942. The Museum of Modern Art
and the photographer click together . . . In photographing an artist, such as Paul Robeson, the photographer is given exceptional material to work with. In other words, he can count on getting a great deal for nothing, but that does not go very far unless the photographer is alert, ready and able to take full advantage of such an opportunity.

Another approach has been taken by Cecil Beaton, in which there is an emphasis upon the setting, often of an elaborate nature. Beaton, who is a painter as well as a photographer, has produced stage sets for theatrical productions, and this interest is reflected in his camera work. George Platt Lynes and Arnold Newman show striking ingenuity in working out poses and new uses of materials to express the character of the sitter.

Recently the fashion magazines, perhaps under the influence of the picture weeklies, have turned to a more informal type of fashion picture and portrait: both Cartier-Bresson and Lisette Model have worked for Harper's Bazaar, photographing, not in the studio, but in natural surroundings.

Magazines have pioneered in the use of color photography. New techniques have brought color within the reach of all, and it is in this field that we may look for important esthetic developments in the future.
When Niépce described his early photographic researches to his brother Claude, he said, "But I must succeed in fixing the colors," and when he visited Daguerre in 1827 he was especially interested in the latter's researches into this problem. He wrote enthusiastically to his son:

M. Daguerre has arrived at the point of registering on his chemical substance some of the colored rays of the prism; he has already reunited four and he is working on combining the other three in order to have the seven primary colors. But the difficulties which he encounters grow in proportion to the modification which this same substance must undergo in order to retain several colors at the same time . . . After what he told me, he has little hope of succeeding and his researches can hardly have any other object than that of pure curiosity. My process seemed to him much preferable and more satisfactory, because of the results which I have obtained. He felt that it would be very interesting to him to procure views with the aid of a similar simple process which would also be easy and expeditious. He desired me to make some experiments with colored glasses in order to ascertain whether the impression produced on my substance would be the same as on his.

Apparently Niépce had no better results than Daguerre, but the immediate possibilities of daguerreotypes in monochrome outweighed the fact that the colors were not recorded. It was not long, however, before the lack was sensed, and daguerreotypists began to color their plates by hand. In the meantime experimenters sought for some substance which, chameleon-like, would assume whatever color was shining upon it. Although claims of success were made, no permanent results have come down to us.

The loudest voice was that of Levi L. Hill, a Baptist minister of Westkill, N. Y., who announced in the public press in 1850 that he had succeeded in fixing the colors of nature. He showed examples of his work to leading American daguerreotypists. The editor of the Daguerreian Journal was so impressed that he said "Could Raphael have looked upon a Hillotype just before completing his Transfiguration, the palette and brush would have fallen from his hand, and this picture would have remained unfinished."
The profession demanded to know the technique. They were prepared to pay roundly for the secret, but Hill fended them off by saying that “$100,000 would not purchase my discovery,” and declaring that he would publish his results “When I think proper.” Months went by, and not a word from Hill. In a pamphlet dated 1852 and addressed “To the Daguerreotypists of the United States and the Public at Large,” Hill stated that the invention was all that he had claimed for it, but that he was faced with difficulties beyond his control in perfecting it, by “the invisible goblins of a new photogenic process.” The profession became impatient, for their business had been ruined by Hill’s premature announcement. They denounced him in the press as a humbug, and as an impostor. He finally published in 1856 his Treatise on Heliochromy, a confused and complicated piece of writing, which contained, in place of specific workable directions, an autobiography and an account of endless experiments.

That Hill achieved some kind of result cannot be doubted; the evidence of daguerreotypists and particularly of so notable an artist and scientist as Samuel F. B. Morse, is too convincing to be dismissed. More than once daguerreotypists had, by accident, found colors upon their plates: Niepce de Saint-Victor in 1851 secured colored daguerreotypes by sensitizing silvered plates with chlorides which received acclaim in their day, but, alas, could not be made permanent. Hill had perhaps stumbled upon the same path which these other experimenters had struck out upon, but we can form no more definite conclusion about his work than what was written about him after his death in 1865: “He always affirmed that he did take pictures in their natural colors, but it was done by an accidental combination of chemicals which he could not, for the life of him, again produce!”

The search for a direct color-sensitive medium continued, but only once was success in sight: in 1891, Gabriel Lippmann, professor of physics at the Sorbonne, perfected his interference process, which relied upon the phenomenon that a thin film, such as oil upon water, will produce all the colors of the rainbow. The results were startling. Steichen in 1908 wrote Stieglitz:

Professor Lippmann has shown me slides of still-life subjects by projection, that were as perfect in color as in an ordinary glass-positive in the rendering of the image in monochrome. The rendering of white tones was astonishing, and a slide made by one of the Lumière brothers, at a time when they were trying to make the process commercially possible, a slide of a girl in a plaid dress on a brilliant sunlit lawn, was simply dazzling, and one would have to go to a good Renoir to find its equal in color luminosity.
Unfortunately the Lippmann process was not a practical technique, and is now obsolete.

The practical solution of photography in color was found in an indirect approach.

The British physicist James Clerk Maxwell performed a dramatic experiment at the Royal Institution of London in 1861. To prove that any color can be recreated by mixing red, green and blue light in varying proportions, he projected three lantern slides of a tartan ribbon upon a screen. In front of each projector was a glass cell filled with colored solution: one was red, a second, blue and the third, green. Each slide had been made from a negative which Thomas Sutton had taken through the identical glass cells or filters; each was theoretically a record of the red, blue and green rays reflected by the ribbon. The result was a color photograph — crude, but prophetic of the future.

Because Clerk Maxwell added red, green and blue light together, this technique is called additive. An equal addition of the three colors forms white; red and green add to form yellow; red and blue, magenta; green and blue, the blue-green known by photographers as cyan. It is important to bear in mind that this theory holds true only for colored light; the mixture of pigments is another matter.

Maxwell’s results were imperfect because the iodised collodion emulsion which Sutton used was not sensitive to all colors. When panchromatic emulsion was invented, his theory was put to practice with success. It is inconvenient to set up three magic lanterns whenever a color photograph is to be looked at. A portable apparatus, the Krömskôp, was devised in 1892 by Frederick E. Ives of Philadelphia, which optically reunited three transparencies so that they could be viewed in proper register by looking through an eyepiece.

Still, people could not look at these transparencies as easily as they could look at a black and white photograph. The first practical method of making a single picture which could be viewed without any apparatus was invented in 1893 by John Joly of Dublin. Instead of taking three separate pictures through three colored filters, he took one negative through a screen minutely checkered with microscopic areas of red, green and blue. The screen was the exact size of the photographic plate and was placed in contact with it in the camera. After the plate had been developed, a transparency was made from it, and this was bound permanently to the color screen. The black, gray and white areas of the picture allowed more or less light to shine through the filters; if
viewed from a proper distance the primary colors so modulated blended to form combinations reproducing the colors of the original scene. In 1903 the same principle was used by the brothers Lumière in their *autochromes* which were put on the market in 1907. The photographic plate itself was covered with minute grains of starch which had been dyed. One third were red, one third green and one third blue, and they were mixed together before application to the plate so that the three primary colors were evenly distributed over the surface. After development the negative was turned into a positive by the reversal process, and a transparency resulted which reproduced the original colors. *Dufaycolor* combined these two techniques; a film was ruled to form a multiple filter somewhat similar to the Joly screen, and the image was reversed as in the autochrome process.

These methods have given way to techniques based on the subtractive theory.

A black object absorbs, or subtracts, all of the light falling upon it: nothing is reflected to the eye, and hence it looks black. A white object reflects all of the light rays falling upon it. If white light shines upon it, white light is reflected; if red alone shines upon it, red is reflected. A colored object, however, absorbs, or subtracts, some of the rays and reflects others. When white light falls upon a red object the green and the blue rays are subtracted: when it falls upon a cyan object, the red rays are subtracted, while the blue and green are reflected. But when red light falls upon a cyan object there are no blue or green rays to be reflected and the red rays are entirely subtracted. No light reaches the eye, and the object appears black.

Transparencies printed from negatives taken through red, blue and green filters will, if tinted in the respective complementary colors (cyan, yellow and magenta), superimposed in register and held against the light, reproduce all the natural colors in the scene which was photographed.

As early as 1869 Louis Ducos du Hauron wrote a remarkable little book, *Les Couleurs en photographie; solution du problème*, in which he envisaged accurately not only the additive methods but also most of the subtractive processes employed today, at a time when satisfactory materials were not available. His summary of the subtractive technique could serve as an introduction to any textbook written today:

To obtain, by photographic techniques already known, and by the interposition of three colored media, three monochrome prints, one red, one yellow, the third blue, and then to form, by the superimposition or the mingling of these three prints, one
unique print in which will be found reproduced at once the color and the form of nature.

Many variations of this basic principle have been devised. Prints can be made from each of the three color separation negatives, as they are called, on paper sensitized with emulsions containing cyan, yellow and magenta pigments. The emulsion is stripped from each print and the three are superimposed in register on a fresh piece of paper. This technique, a modification of the carbon process, is called carbro. Another method of superimposing the three images is by dye transfer. A gelatin matrix is prepared which will absorb dye in proportion to the lights and shadows, and which will yield up this colored image when pressed in contact with paper.

These techniques require three separate negatives. Where the subject is stationary, the exposures can easily be made in succession, but in photographing moving objects they must be made simultaneously. "One-shot" cameras have been devised, fitted with half-silvered mirrors, which will allow this to be done. But this apparatus is cumbersome, expensive, and inefficient.

In 1935 color films were introduced which eliminated the necessity of making more than one exposure and which could be used in any camera. The first to be announced was Kodachrome film, invented by Leopold Mannes and Leopold Godowsky and manufactured by the Eastman Kodak Company.

A special film is prepared, consisting of three separate emulsions on one support. The top emulsion is sensitive to blue light only. Beneath it is a layer of yellow dye, which absorbs the unrecorded blue rays, allowing the red and green rays to penetrate to the two emulsions beneath it, one of which is sensitive to green rays only, and the other to red. Thus a simultaneous record is obtained of the three primary colors. After exposure the film is developed to a negative and then, by chemical means, is converted to a positive. During the processing special substances are introduced, dye-couplers, which cause the three emulsions to take on the appropriate complementary colors: yellow, magenta and cyan. The processing requires complex machinery and is done by the manufacturer. To answer the demand for a film which the photographer could process himself, Ansco brought out in 1942 its Ansco-Color film, which was followed by Kodak's Ektachrome film.

These techniques have the same limitation as the daguerreotype and the tintype; each color photograph is unique. A more recent development makes use of the negative-positive principle. Kodacolor film, announced in 1941, is similar in general principle to Kodachrome film, except that the image is not re-
versed to a positive and dye couplers are chosen which will convert each emulsion to an image complementary to the color which it records. Thus a color negative shows not only reversal of the lights and shades, but also of color. A blonde will appear with blue hair and green lips. From this negative any number of prints can be made by repeating the process with identical triple emulsion coated on a white opaque material.

Using *Ektacolor* film, announced by the Eastman Kodak Company, in 1947, the photographer can process his own color negatives. An important feature of this new technique is the incorporation in the film of a mask which automatically compensates for inaccuracies in color rendition. Theoretically it should be possible to choose dyes which will completely absorb each of the primary colors. In practice this cannot be done. To correct these errors, the dye couplers added to the emulsion are themselves colored, absorbing the very rays which are incorrectly absorbed by the dyes. From the Ektacolor negative three gelatin matrices can be made directly for printing by dye transfer.

For reproduction on the printed page, transparencies are rephotographed by normal means and through the primary filters: from each negative a printing plate is made, usually by the halftone process. The paper is run through the press four times, with cyan, yellow, magenta and black inks.

The color photographer is faced with many esthetic problems. The eye does not see color the way the camera does. Should he choose the naturalistic approach and, as P. H. Emerson did in black and white, limit himself to reproducing what the eye sees? Or should he follow the camera's lead, exploiting its potentials and respecting its limits? There seem to be colors which exist only in photographs: Kodachrome film, for example, gives blue of a richness and depth which can validly be used for its own sake with no attempt at realism. Already work has been done in every field with color; practically every photographer has worked with the new techniques, and although the complexity of processing and the expense of materials has been a deterrent to free experimentation, the esthetic capabilities are being explored.

The temptation is to choose subjects which are themselves a blaze of color, and to ignore the fact that color is everywhere, and that it is not the colorful subject itself, but the photographer's handling of it, which is creative. The most satisfying results appear to be of subdued colors, with here and there a brilliant, telling accent.

Comparison between color photography and painting is inevitable. Imitation is fatal, for the color photographer does not have at his command the controls which enable the painter to produce his own world of color. On the
other hand, the photographer has a medium which the painter cannot rival, an instantaneous process, which will record the vision of a moment with wealth and subtlety of detail beyond the power of the most skillful draftsman to reproduce.

The scope of color photography is being rapidly expanded; fields which only a few years ago seemed closed are now being explored with success. Similar expansion is taking place in every other branch of photography.

As Hurter and Driffield pointed out, photography is at once a science and an art. Its growth as a science has been a steady development from the inexact and capricious technique of Daguerre to the perfection of reliable, high speed emulsions; from the simple meniscus lens of Chevalier to the modern coated anastigmat; from the cumbersome box camera of Talbot to the precision miniature. Yet as pictures many of the earliest photographs remain unexcelled. The portraits of Southworth and Hawes and of Hill and Adamson are great portraits. If the action of war can now be recorded, its havoc has never been more poignantly interpreted in photographs than by Brady and his colleagues. We make no finer records of architecture than did the calotypists of the 1850's.

For the artist has always transcended his materials. Through his special vision we see the world afresh. In every photograph the moment is fixed forever. In some it is the very moment that we prize, because it is such vivid history. In a few the moment magically becomes forever.
"Source of Quotations"

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9, 11 "Close all the shutters . . ."

12, 27 "The experiments I have thus far made . . ."
V. Fouque, La Vérité sur l'invention de la photographie, Nicéphore Niépce, 1867, p. 61.

12, 30 "a kind of artificial eye . . ." Ibid., p. 62.

12, 36 "I placed the apparatus . . ." Ibid., p. 64.


14, 25 "Do you know . . . Daguerre?" Ibid., p. 126.

15, 7 "You ask me if I know M. Daguerre? . . ." Ibid., p. 129.

15, 18 "could in no way compromise . . ." Ibid., p. 132.

15, 28 "I have had . . . interviews with M. Daguerre . . ." Ibid., p. 140-42.

16, 25 "As regards your intention of publishing . . ."

16, 30 "Unfortunately I can't avoid it . . ."

17, 5 "in order that the name . . . Niépce . . ." Ibid., p. 222.

17, 9 "anyone can take . . . views . . ." Broadside, published by Daguerre before Jan. 15, 1839; Eastman Historical Photograph Collection, Rochester, N.Y.

17, 30 "In one, representing the Pont Marie . . ."
Mechanics' Mag., v. 31, 1839, p. 320.

18, 9 "the Palace . . . was stormed . . ." M. A. Gaudin, Traité pratique de photographie, 1834, p. 6-7.


28, 12, "from ten to twenty minutes . . ."

24, 4 "for eight minutes . . ."
American Jnl. Phot., n.s., v. 4, 1861, p. 41.

27, 11 "the mirror with a memory"

29, 15 "The United States . . . is . . . superior . . ."
Quoted from an unidentified British source in Humphrey's Jnl. Phot., v. 4, 1852, p. 243.

29, 30 "the pianoforte, the music box . . ."
Phot. Art Jnl., v. 1, 1851, p. 358.

34, 4 "out of a large box . . ."
Athenaeum, 1839, p. 116.

34, 19 "I was placed in a . . . dilemma . . ."
Literary Gazette, 1839, p. 235.

35, 4 "flowers and leaves . . ." Ibid., p. 72.

36, 2 "if the picture . . . is first preserved . . ."
Athenaeum, 1839, p. 116-17.

36, 12 "compared to the . . . daguerreotype . . ."
L'Artiste, series 2, v. 3, 1839, p. 64.

37, 4 "Various views of Lacock Abbey . . ."
Literary Gazette, 1850, p. 315-16.

40, 5 "It is . . . an effect of sunshine . . ."
Art Union, v. 7, 1854, p. 84.

40, 9 "there is . . . a royal road to Drawing . . ."
H. Fox Talbot, Pencil of Nature, 1844.

43, 14 "It is already sufficiently difficult . . ."

45, 14 "Is pyrogallic acid . . . a chemical equivalent . . .?"

6 Art Jnl., v. 7, 1855, p. 53.

45, 19 "was doing some of the very finest things . . ."
Letter from Brewster to Talbot, May 9, 1843; by permission of Miss M. T. Talbot and Harold White.

49, 15 "the proofs are permanent . . ."

54, 17 "The body . . . of Monsieur Bayard . . ."
Lo Duca, Bayard, 1943, plate I.

55, 5 "300, 500 . . . 1000 . . ."

61, 11 "really the Temple of Photography . . ."
E. Liesegang, quoted in Geschichte der Firma Ed. Liesegang, 1929, p. 8.

62, 6 "The year eighteen sixty-one is memorable . . ."
American Jnl. Phot., n.s., v. 4, 1862, p. 360.

62, 16 "it was a little thing . . ."


71, 1 "Hitherto photography has been . . . content . . ."
C. Jabez Hughes in Phot. Notes, v. 6, 1861, p. 56-60.

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72, 2 "obtain one of those soft . . . likenesses . . ."
N. P. Lerebours, A Treatise on Phot., 1813, p. 5.

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Humphrey's Jnl. Phot., v. 9, 1857, p. 92-3.

74, 4 "various draped figures . . ."

74, 15 "had three years practice in expression . . ."
British Jnl. Phot., v. 7, 1860, p. 95.

75, 6 "Look steadily at it a minute . . ."
Quoted in Practical Phot., v. 6, 1895, p. 68.

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76, 6 "after admiring the portraits . . ."
Alphonse de Lamartine, Cours familial de littérature, 1859 v. 7, p. 43.

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78, 14 "this perfect truth . . ."
Ibid., p. 51.
78, 18 "When an artist conceives . . ."
Phot. Notes, v. 6, 1861, p. 56-60.

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Quoted in H. Gernsheim, Julia Margaret Cameron, 1948, p. 71.

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V. Blanchard in Amateur Phot., v. 12, 1890, p. 344.

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83, 18 "If I refuse to take them . . ."


84, 12 "A battle scene is a fine subject . . ."
American Jnl. Phot., n.s., v. 3, 1861, p. 320.

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98, 8 "The boat party entered the . . . canyon . . ."

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Ibid., p. 196-98.


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From the rhyme "Gelatine" by Marke Oute in British Jnl. Phot. Almanac, 1861, p. 213.


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A. Black, Time and Chance, 1937, p. 103; by permission of Rinehart & Co., Inc.

114, 17 "By carefully registering the backgrounds . . ."
Scribner's, v. 18, 1895, p. 348.


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119, 12 "spasmodic elegant of art literature"
Amateur Phot., v. 3, 1886, p. 178.


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122, 17 "It is not in man . . ."

122, 22 "Healthy human eyes . . ."


124, 27 "on the pictorial side . . ."
Quoted in Photographs of '95, p. 14.

125, 3, "here and there elsewhere . . ."
5 Photographs of '97, p. 94.

129, 18 "We Americans cannot afford to stand still . . ."

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37 Photographs of the Year 1900, p. 33-42.

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The Photo-Section, No. 1, 1902. (Unpaged leaflet.)

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Unpublished letter from André Calmettes to Berenice Abbott; by permission of Miss Abbott.

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143, 24 "A round straw hat . . ." Steiglitz conversation recorded in Twice A Year, No. 8-9, 1912, p. 128; by permission of the publisher, Dorothy Norman.

144, 5 "His equipment was extremely simple . . ."
PSA Jnl., v. 13, 1947, p. 721; by permission of Photographic Society of America.
144. 22 “Never was there such a hubbub . . .”

149. 4 “I wanted to photograph clouds . . .”
   *Amateur Phot.*., Sept. 19, 1923.

150. 7 “The photographer’s problem . . .”
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152. 7 “I have come to value photography . . .”
   Quoted by C. Rourke, *Charles Sheeler*, 1938, p. 120; by permission of the publisher, Harcourt, Brace and Company, New York.

157. 12 “The camera must be used for recording life . . .”
   This and following quotations from his unpublished *Daybook* by permission of Edward Weston.

162. 28 “Photography applied to production of pictures . . .”

167. 13 “Photography can provide . . . documents . . .”
   *Camera Work*, No. 24, 1908, p. 22.

168. 8 “a mysterious party . . .”
   New York Sun, Feb. 12, 1888.

174. 13 “in the recording . . . of fact . . .”
   Introduction to P. Rothen, *Documentary Film*, 1936, p. 5; by permission of the publisher, Faber & Faber, London.

174. 20 “Beauty is one of the . . . dangers . . .”

174. 25 “documentary was . . . anti-aesthetic” . . .”

178. 29 “others have photographed squalid scenes . . .”
   *U.S. Camera Magazine*, No. 1, 1938, p. 47, 64; by permission of the publisher, T. J. Maloney.

180. 10 “if there are transient camps . . .”
   *U.S. Camera* 1941, v. 1, p. 98-116; by permission of the publisher, T. J. Maloney.

180. 34 “documentary is an approach . . .”


182. 4 “with a view of . . . diminishing . . . apparatus . . .”
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187. 23 “with his little box of very little negatives . . .”

188. 13 “all made for . . . enlargement . . .”
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189. 35 “There are just three things necessary . . .”
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192. 5 “anti-graphic . . .”
   7 Peter Lloyd in announcement of the Cartier-Bresson exhibition at Julien Levy Gallery, New York, 1933.

196. 10 “I am deeply impressed with . . . flash bulbs . . .”
   Letter to B. Newhall, June 28, 1937; by permission of Miss Bourke-White.

198. 12 “I am grateful for man-made light . . .”

201. 13 “There was . . . a notion that the camera could not be ‘abstract’ . . .”
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203. 7 “Upon one occasion, having made an image of a piece of lace . . .” *Athenaeum*, 1839, p. 115.

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216. 8 “The objects which the microscope unfolds . . .”

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218. 32 “take the cosmic phenomenon to pieces . . .”
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241. 5 “M. Daguerre has arrived at the point . . .”

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