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FIFTY YEARS OF PHOTOGRAPHY.

BY J. WELLS CHAMPNEY.

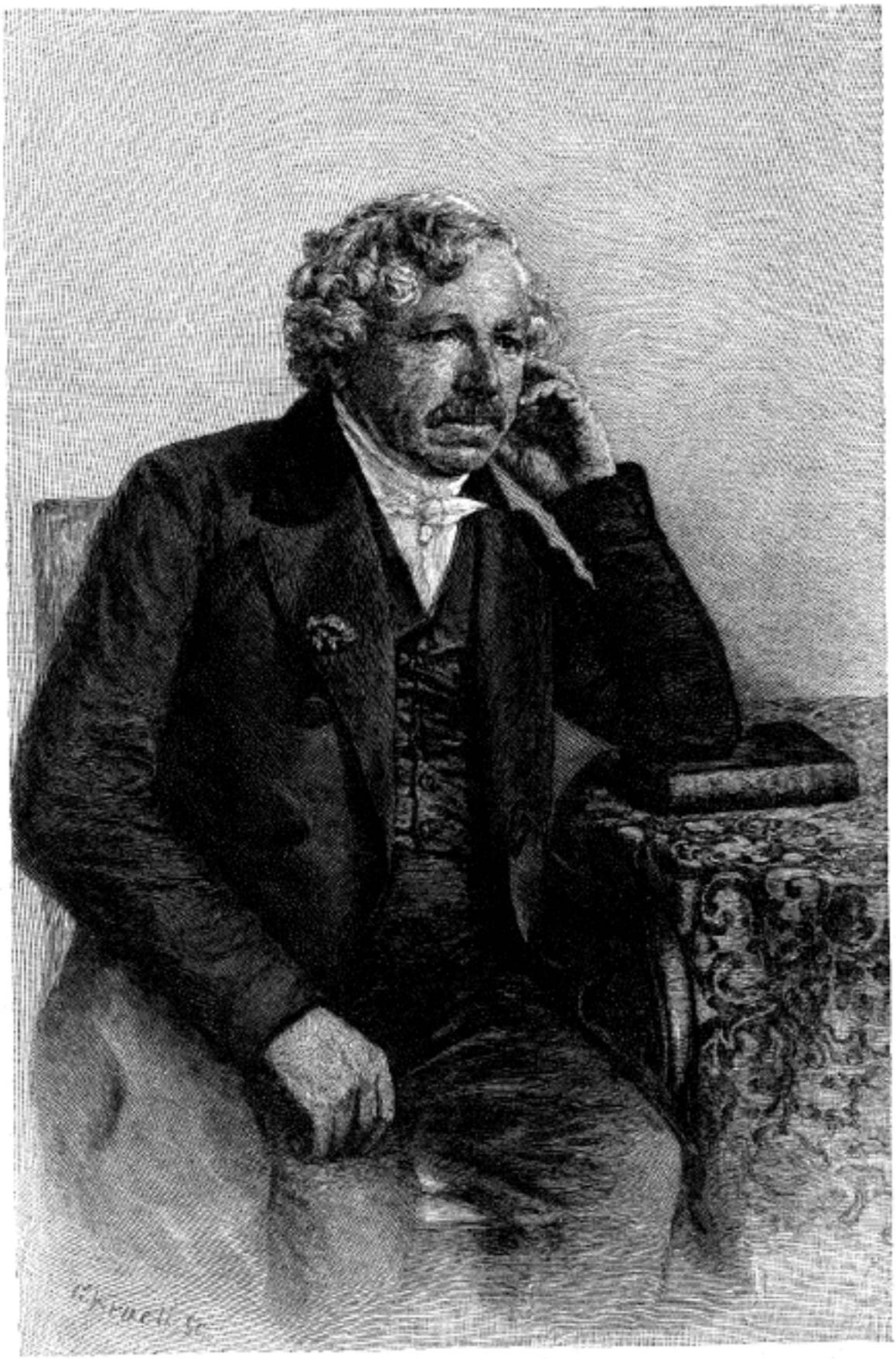
CAN our readers picture to themselves the comic situation of a victim of the daguerreotypist of 1839, screwed to the back of a chair, his face dusted over with a fine white powder, his eyes tightly closed, obliged to sit a full half-hour in the sunlight? Dr. Draper, of the University of the City of New York, to lessen the painful fatigue of the brilliant light, placed between the sitter and the sun a large glass tank filled with ammonia sulphate of copper, a transparent blue liquid which filtered out most of the heat rays, and before the end of 1840 succeeded in doing away with the whitened face, and reduced the sitting to a few minutes.

Contrast this with the possibilities of to-day, when in the darkest of dark caves or cellars, or on the blackest of nights, the tyro photographer, armed with his little camera, and pistol loaded with magnesium cartridge, can obtain a picture full of vigor and marvellous in detail. This chasm has been bridged over in the fifty years since Daguerre gave before the French Academy of Sciences the secret of his wonderful process. The journey down the photographic history of those fifty years is full of wonderful struggles of mind over matter, strange hopes awakened, magical discoveries set aside, fascinating theories exploded, practical inventions pushing to the front, larger areas covered, and more and more individuals of both sexes benefited by the discovery of the progressive scene-painter, until to-day hundreds of thousands contribute to our knowledge and happiness in the practice of photography whilst gaining their daily bread.

The story of Daguerre's struggles and victory may well be told at this time, after a lapse of fifty years since his grand discovery. It was on the 19th of August that Arago, the noted French astronomer, before crowded halls and courts, gave the practical details of the process for fixing upon a prepared plate the images of the camera-obscura, and France, by giving an annual stipend to Daguerre and his associate, M. Isidore Niepce, provided that all their compatriots should be free to practise the new art. Arago's speech is even now most entertaining reading, and should be familiar to all votaries of the art of photography; but we must content ourselves with little more than a review of some of the points which may indicate the appreciation in which the discovery was held at the time, and the prophetic insight that saw how full of value to science as well as art this great invention would prove to be. M. Arago dealt with the scientific problems of optics and chemistry involved in the search, showing the length of time after the knowledge that nitrate of silver blackened in the light before any successful experiments were made to fix the images of the camera by its use. He paid a tribute to the memory of M. Joseph Nicéphore Niepce, describing the process by which, after three days' exposure, he had succeeded in forming an image which could be retained on the plate. Such a process could of course only serve for copying engravings or drawings, and was impracticable for landscape, architecture, or portraiture.

By an accident a meeting was brought about between Daguerre and Niepce, and a partnership formed, which ended only with the death of Niepce in 1833, after which time his son Isidore continued the researches. Here it may be well to say, though it is not a part of M. Arago's speech, that Daguerre's processes proved to be so much more rapid and perfect than those Niepce was using that in the latter part of 1837 an agreement was signed between the two partners permitting the name of Daguerre to be associated with the discovery, and it was many years before the small d headed the word Daguerreotype.

Up to the time of Arago's explanation public curiosity had for a year or more been awakened by accounts of the wonderful pictures, and some of the pictures had been shown. Baron von Humboldt, Biot, Arago, and other *savants* were mentioned as having been made familiar with the work, and offering their testimony to the value they placed upon the discovery. One story was afloat that the Emperor of Russia stood ready to give Daguerre 500,000 francs for the secret, and English papers of the day expressed themselves as surprised that so magnificent a reward should have been declined. The sum finally paid was 10,000 francs annually to



LOUIS JACQUES MANDÉ DAGUERRE.

From a daguerreotype from life, made in Paris for Meade Brothers, New York, now in possession of Abraham Bogardus, New York.

both of the inventors—6000 to Daguerre and 4000 to Niepce, Daguerre receiving the larger sum as he also divulged his secret for making his very popular dioramas.

A hasty biographical sketch may not here be out of place. One hundred years ago Louis Jacques Mandé Daguerre was born near Paris, in the village of Cormeilles; consequently he was just fifty years old when his great discovery was announced to the world. When quite young he became a scene-painter, and early won renown in that field. Not content with painting for theatres, he tried higher forms of art with success, and then invented the diorama, which first greatly excited the curiosity of the Parisians, and made his name familiar out of his own country. As early as 1814 M. Nicéphore Niepce, a man of some means at Châlons-sur-Saône, had devoted his leisure to striving to fix the images of the camera-obscura. Long before, Wedgwood and Sir Humphry Davy had striven to that end. In 1827 M. Niepce had gone to London and in a paper before the Royal Society had explained a successful process for making pictures, and today in the British Museum some of his rude experiments may be seen. Then came the meeting with Daguerre brought about by the optician Chevallier, and the partnership of 1829, Niepce's death in 1833, the son assuming the place of the father in the partnership, and the final victory of Daguerre in making practical the process to which his name was given.

It would be proper here to describe this process, but other and more pressing matter crowds upon us. It is now practically obsolete, and though very beautiful, more delicate even than any processes by which it has been set aside, it still had shortcomings which soon condemned it. Other methods of picture-making, admitting a practically endless multiplication, became in time more popular, and have held their own to the present time. The daguerreotype was a *positive* process; that of Mr. Fox Talbot, of England, to which later improvements can be traced, was a *negative* process. In 1839, before Daguerre's methods were explained, we find Mr. Talbot writing to the French Academy claiming priority of invention, which certainly, in the light of what we know of Niepce's success, could not be awarded him. Mr. Talbot's process differed so entirely both in means and result from the daguerreotype that it was useless to compare results, so greatly superior was that of the Frenchman to the Englishman's. The one employed highly polished silver-covered plates of copper; the other, sensitized paper with a grain which deprived the resulting print of much delicacy. Daguerre did not with his invention succeed in portraiture, and the honor of first making a likeness has been always awarded Dr. J. W. Draper. From the time the news reached America we learn that experiments were made in constructing rude cameras and attempting picture-making according to Daguerre's principles; but the rules were not laid down very definitely, and no such helps existed then, as now, from published accounts of experiments. It was about a year after the report of Arago's speech reached this country before a firm of enterprising men started in business as portrait daguerreotypists.

Of them we read that they executed "miniatures by the Daguerreotype process with considerable success,.... correct as likenesses, and devoid of that severity of expression which, it has been thought, makes the Daguerreotype an unfit instrument for taking portraits." In England Daguerre obtained a patent before receiving his pension from France for giving his secret to the world, consequently the English were barred from the free use of the process which the French, Germans, and especially Americans, profited by. Dr. Draper's paper, published in the *London and Edinburgh Philosophical Journal* in September, 1840, contains much of interest. In it he tells of his first dusting the face with white powder (which he soon abandoned), of his success out-of-doors, of his use of mirrors as reflectors, and of his contrivance for holding the head and body still in the chair. Here, too, we find his warning against placing the hands upon the chest, as the motion of respiration made them look clumsy and thick in the picture, and at the same time he suggests the temporary placing of a drab false front over the white shirt. There was no retouching in those days, and "persons whose faces are freckled all over give rise to the most ludicrous results—a white mottled with just as many black dots as the sitter had yellow ones." We now have a fair idea of the state of things in 1839 and 1840.

In a few words we might lead up to Daguerre's discovery by rapid strides.

Without the camera it would have been impossible. That invention we owe to the brilliant experimentalist Porta, who in the sixteenth century was a leading scientist. It is a long jump from the so-called beginning of the art of drawing by the tracing of the pretty girl's shadow on the white wall to the chemical discoveries which made it possible to fix permanently that shadow. There is to be found the published record of a discovery by Fabricius, in 1536, when seeking the elixir which was to restore youth. He threw some sea-salt into nitrate of silver, and noted that the chloride of silver precipitated, though of a white color, became black as ink by exposure to sunlight. But this knowledge does not seem to have been utilized until Scheele in 1777 rediscovered the fact, and a few years afterward Professor Charles, the inventor of the hydrogen gas balloon, spread the chloride of silver on paper, and placing the head of one of his pupils in a beam of sunlight, saw that the shaded portion remained clear, whilst the rest of the paper rapidly darkened. Still there was no chemical substance known that would retain the image, so, unless the sheet were put away in a dark place, the whole of it would soon blacken. It might be looked at from time to time in a subdued light or by artificial light, or the silhouette thus formed could immediately be cut out and the perfect profile thus saved. The long-sought compound, hyposulphite of soda, was invented in 1799, but it was not until twenty years later that Herschel found its power of dissolving haloid salts of silver. Three other chemicals, chlorine, iodine, and bromine, were discovered respectively in 1774, 1811, and 1826, so that we find the materials ready only a little while before the final discovery of their marvellous powers.

Miniature painting, which was a popular mode of portraiture when photography was first discovered, was little by little driven from the field by its less expensive and generally more faithful rival. It is true the daguerreotype was a costly process at first, and efforts were constantly being made to cheapen it. It held its sway until 1851, but soon after that time was set aside by the albumen and the collodion process, this latter soon having the field all to itself. We may not permit ourselves to enter into the respective merits of processes, yet there are four great divisions, or perhaps we may say three great divisions and one small one, which it is well to bear in mind in reviewing the last fifty years. These would be the daguerreotype from 1839 to 1851; the albumen process on glass plates made practicable in 1849, but soon, in 1851, set aside by the collodion process; and fourth, the great popularizer of photography, the gelatino-bromide dry plate in 1871.

One of the first of illustrated works in which photography was employed was Mr. Fox Talbot's *The Pencil of Nature*, though in 1840, amongst holiday books advertised as suitable for presents is one in "beautiful binding," *Excursions Daguerriennes*.

The photographic art was early put to the service of medical study, and "delicate dissections, microscopic objects, and blood globules" were reproduced. After a few years' practice the need for orthochromatic photography was felt, and researches were made which have now borne fruit, though the new plates are still far from perfect. All through the years we note the patient search for the power not only to translate the image into black and white, but to retain the gradations of color so beautifully pictured on the ground glass in the camera.

A binocular camera was invented by Sir David Brewster for taking pictures for use in Professor Wheatstone's new stereoscope. Lenses of similar power were placed side by side, distanced by the average measurement between the eyes. This was in 1849. We must remember that up to that year paper and the silvered metal were the grounds sensitized for use in the camera. Then came the use of albumen spread upon glass so that it would hold the material used to sensitize the paper in the calotype process. This avoided the grain of the paper, and gave a more perfect picture.

In the United States it was estimated that there were ten thousand daguerreotypists by 1850, and some five thousand workmen who were engaged in the manufacture and sale of plates, cases, chemicals, and apparatus, or in other ways receiving their support from indirect connection with the art.

But the story is too long to tell how and when photo-lithography, photographing on blocks of wood for engravers, and the various uses to which photography is now put, were first employed. Little by little it has travelled the world over, edu-

cating and delighting everywhere. When we try to note the spread of this art we are astonished at the uses to which it is now put. How active the human brain is still in invention the thick octavo volume published each year by the Patent Office, containing only patents bearing upon photography, improvements in cameras, shutters, tripods, etc., etc., testifies. Many hundreds of books have been written upon the history of photography and its practice in every direction. Last year's *Annual* gives the titles of 44 added to the list. There are over 60 periodicals, appearing in different countries, some weekly, others monthly, a few semi-monthly. Of societies the list gives in America 54, and in foreign countries 107. Even in Japan there is a periodical devoted entirely to photographic matters, called *Sashin Shimpo*. It is a monthly, and sells for 15 sen, or about 12 cents.

The facility with which the prepared plates can be manipulated, the ease with which hundreds of the new celluloid films can be carried about, the quality they possess of retaining their sensitiveness for months, the fact that exposures may be made in Central Africa or in the neighborhood of the north pole, and the image not developed until the traveller returns to his comfortable laboratory at home, are all magical advances in the fifty years since Daguerre told his secret. What the next half-century will do with the subtle powers of the sensitive plate remains to be seen. To artists familiar with the study of color any hope that the gradations of hues shall be retained by a negative image and communicated to a positive print seems absurd. Constant progress is being made toward the bettering of the interpretation of color values. The mysteries of chemistry are being tested; chlorophyl, eosin, erythrosine, and other new compounds are being employed. Bright, thoughtful, intelligent men are reaching into the unknown world of light and chemistry, experimenting and recording with scientific accuracy the story of their researches. The difficulty consists in obtaining gradations of black and white corresponding to the luminosity of the colors of nature. In copying paintings this is especially desirable, and already a great advance has been made. Even the amateur finds in the market prepared plates with which he can produce results in which equivalent gradations of tones stand for the various tints of color. These plates are called orthochromatic (right color). Experiments in this direction will continue until the full beauty of the image of the camera will be kept in so far that our reds will no longer be coal-black, our blues not faded or white, and our bright yellows dull and gloomy. Experiment in photographing an orange by the ordinary and by the orthochromatic plate will show the advantage of using the latter.

Bearing upon this point comes the latest news, that the modern theory of color sensation due to the excitement of the three sets of nerve fibrils is put to service by Mr. F. E. Ives. He, the account says, "produces simultaneously three negatives from three differently prepared plates by light passed through three screens of various colors, his object being to produce negatives each representing the intensity with which light affects one of the sets of nerve fibrils in the eye. Lantern pictures are made from these negatives, and projected on a screen by a triple lantern. One picture passed through a red that affects only the fibrils excited by red, one through a similar green, and one through a suitable violet, the result being a representation of the landscape or object photographed in its true colors." Mr. Ives has published a book dealing with this subject, which he calls *A New Principle in Helichromy*.

Against the clumsy apparatus of the first daguerreotypists we can set an array of cameras of most perfect mechanical construction, each fitted with some special contrivance endearing it to its inventor, and possibly to others. We find the colossal structures in use in certain galleries, and the popular so-called "detectives," the inconspicuous vest camera, or still smaller ingeniously contrived boxes for photographic purposes. To the advance in the construction of lenses, and to improvements in the shapes and principles of cameras, is due, as well as to improved chemical processes, the quality of late photographic work. It is interesting to learn why the lenses in existence at the time of the invention of the daguerreotype could not do the work they were called upon to perform. The lenses constructed for use in the telescope and microscope embraced too small a field, including only at most a few degrees, whilst that for the camera frequently now embraces ninety degrees

when employed for landscape work. The portrait lens needed a much smaller field, twenty or thirty degrees being enough, but required to be so large as to let plenty of light through it, and thus reduce the time of sitting. Many were the defects in the early time due to badly constructed lenses. The fifty years have brought improvements of inestimable advantage, and the variety and quality of the lenses now in the market show the progress of the optician's art.

One of the latest improvements, for which the tourist must be very grateful, is the use which has been made of celluloid, on which, instead of glass, is spread the sensitive film. One firm calls these plates "ivory films." Where once the traveller burdened himself with boxes of heavy glass, he may carry to-day twelve dozen "films" for each box of one dozen glass plates. Stripping films or gelatine and the sensitive emulsion on rolls of paper are admirable for the traveller.

It is needless to dwell on the value photography has in corroborating the statement of the tourist who returns from a strange and little-known country. M. Le Plongeon told me of the incredulity with which his friends regarded the drawings he brought back from his first visit to Central America. Any artist of an inventive turn could have made such pencillings. Not so with the photographs taken during his second visit. The statements of the camera were accepted, their authenticity undoubted. However untrained in drawing, the author may now gather material for illustrating his writings as he journeys up and down the land, for from the lightning express even he may make his "snap shot," feeling quite certain he has a valuable record, which the trained artist can "work up" for him.

The uses to which photography is being put in this year 1889 can hardly be told. Its value in illustration is well known to all. Here it has helped popularize artistic work, and cheapen the cost of its production to a surprising extent. Now but a few hours need pass before the thought of the artist is made the joy of the reader, drawing, photographic copy, relief plate, and printing following one another with nineteenth-century speed. From the coarse outline of the newspaper "cut" to the wonderful reproduction of paintings by the photogravure process we mount on stepping-stones of victorious achievements in photography, made to serve with reliable accuracy the common and the elevated, the political cartoon and the *édition de luxe*. The reproductions in color of the works of aquarellistes are imitatively deceptive, and their educational influence of incalculable value.

We must not pass over the scientific value of Mr. Muybridge's publications on the action of man and the lower animals, or *The Horse in Motion*. Upon these records, however absurd and laughable some may be, we must base our knowledge, intelligently using it for artistic purposes. It is well known that the camera can tell us what it sees when the plate is exposed but $\frac{1}{2000}$ part of a second, whilst the human eye can open and shut in about the $\frac{1}{10}$ part of a second. We cannot then say that photography is true for us when it pictures the rapidly revolving wheel as if it were motionless. If an artist paints the spokes, the wheel does not appear to go round; if he paints the blurred effect of the whirling wheel, we accept it as a representation of speed. There are photographic and optical as there are microscopic and optical truths. We do not paint a drop of blood as it looks through the microscope, but as it appears to our eyes. From the unquestioned statement of fact as concerning the action of animals we must train our eyes to see better the combination of position of body and action of limbs, and determine how far old methods are good, though false, and how far the new scientific truths must force us to change the ordinarily accepted and conventionalized forms.

The uses to which science has put photography are very numerous, from records of the infinitely little to the infinitely great, from microscopy, which deals with the invisible, to the vastness of astronomical wonders. The latest contributions to our knowledge of the sun, moon, and stars made by photographs taken by the aid of the powerful telescope at the Lick Observatory strongly contrast with the researches into the invisible world of nature revealed through the microscope. Dr. Draper made the first daguerreotype of the moon in 1840; Foucault of Paris first succeeded in making a picture of the sun in 1845; and it was 1850 before Professor Bond, of Harvard College, made the first daguerreotype of a star. In 1851 Dr. Busch, of Koenigsberg, photographed

a solar eclipse. Two scientists, Professor Schuster and Mr. Lockyer, in 1882 obtained a photograph of the spectrum of the eclipsed sun. In 1881 Dr. Henry Draper had successfully photographed a nebula, and later the spectrum of a star. Even the aurora borealis has been photographed this year.

In connection with the study of spectrum analysis, photography has played a most important part, for it has recorded lines not visible to the naked eye—lines revealed only by the photograph in that part of the spectrum in the violet and lavender regions, and even beyond, where all is dark to us.

In the study of stars by this procedure we learn how some are like our sun, others glowing masses of matter just beginning to burn, and still others nearly burnt out, like Arcturus and Aldebaran. We marvel, when we think how feeble seems the light of the stars, to learn that only as much light as can come through a slit $\frac{1}{3\,\frac{1}{2}0}$ of an inch is permitted to affect the sensitive plate. Again, the movement of the earth would in the two hours required to form an image soon carry the light off the plate were there not ingenious mechanical apparatus by which the image is always kept at the same place on the plate.

And now photography is not only used for mapping out the known heavens, but the camera reveals to us the presence of stars which the human eye has not seen. For many years Miss Maria Mitchell and her assistants have photographed the ever-changing sun spots. Astronomers from all over the world have met in Paris and arranged a plan for using photography to obtain a picture of the entire heavens. Cameras will be set up in numbers of observatories in many countries, and many negatives made of the entire contents of the universe. It is proposed to catalogue two millions of the brightest stars and note their position with great precision, as until such maps exist many other astronomical problems cannot be solved. We know, for instance, that our sun with its planetary system is voyaging through space. These charts will help determine the route and circumstances of the journey.

We have already referred to the early use to which medical art put the daguerreotype, but now so rapid and sensitive are the plates that Dr. William G. Thompson, of New York, has been able to experiment in picturing the heart beats of animals, and enlarged our knowledge in a heretofore unexplored field. The ingenuity of the instrument he constructed, working somewhat on the principle of a Gatling-gun, capable of taking six pictures in a second, commands our admiration.

Dr. Galton's composite photography has been too well described to claim more than a word in recognition of an attempt to put photography to a scientific use. In this country Professor Stoddard, of Smith College, has made many interesting studies and published several articles upon the subject; and Dr. Noyes, in two pictures of the insane, gives composite types showing expressions that perpetuate themselves in individuals during mental disease.

Photography enables publishers to duplicate in little valuable works and store away small negatives of large folios or MSS. during the process of publication.

Trade uses photography to picture its new furniture, gas fixtures, china, etc., reproducing thus objects too bulky for "the drummer" to carry about with him. Instead of the slow process of copying by hand the geometrical designs furnished by the kaleidoscope, numberless changes can be readily photographed in a short time, and furnish suggestive material from which to work. The wall-paper manufacturer uses photography to reduce or enlarge patterns; the delicate figures on watch faces can now be made by its use. These watch dials have been painted by hand at a cost of a dollar apiece. Now, it is said, a photographic process has been purchased by a watch company by which these dials can be made at the slight expense of ten cents each, electric light serving as well as daylight for their manufacture. Even the quality of steel has been tested by photographic examination. The microscope shows steel to be composed of an agglomeration of crystals, by the difference in which its quality may be determined. The piece of steel to be examined at a certain foundry was heated until it was white, when it was photographed, and the resulting negative examined by the microscope.

Those little toy pictures in watch charms have to be made by the aid of the microscope: it is said that only one man in New York can do such work. Even fraud can be proved by the use of the camera. A Berlin merchant was detected in crooked

ways, and illegitimate after-entries of a number of his accounts were shown by photography. Blue inks appear much lighter than brown. A chemical test destroys the original, but the faithful plate leaves it intact whilst telling the story of the fraud.

In war photography has been used since the English made pictures in the Crimea. Balloon photography has become quite an art. Balloons are said to be perfectly safe from rifle or artillery fire if seven hundred yards above the ground. Electricity is made to play its part in exposing the plate in the camera attached to the balloon. During the Franco-Prussian war and the siege of Paris small photographic copies of valuable documents and daily papers were made and rolled into quills, which were fastened to carrier-pigeons, and thus taken to their destination without the lines.

The Eiffel Tower in Paris has been offered Professor Marey to enable him to make studies in photography of birds in flight, and very instructive results are anticipated.

Many will remember the picture of the experiment at Willett's Point when the donkey's head was blown off by the use of dynamite, but the picture was taken before the body fell.

The late Mr. Baden Pritchard, whose work in the Woolwich laboratory made him famous, conceived the very valuable as well as feasible idea of reducing the map of a country on little gelatine films so small that fifty or more could easily lie in the top of a field case. They could readily be employed and clearly read by the aid of a magnifier. To render them very serviceable they were so tanned as to be water-proof.

In the English army a photographic wagon is used which is fitted up with two cameras and several lenses, so as to make plates of different sizes or for varied purposes. One of the outfits is so contrived as to be readily packed on a mule. Bromide paper and materials for making platinotypes are also carried.

Both in our army and navy photographic outfits are furnished, and some of our officers have become very expert. Photography may be applied to surveying, as Lieutenant Reed, of the United States army, has described. It may also serve for studies in meteorology. Photographing rifle bullets and cannon-balls in motion has become an every-day matter, but a novel experiment is said to have been made not long since in Berlin by Professor Treeson, who arranged within a cannon-ball a sort of camera which recorded the character of its flight. A tiny pin-hole admitted light, and a sensitive plate within the ball recorded the twists and turns of the projectile in its passage through the air. The gun was fired point-blank at the sun, which sent a beam upon the plate, recording itself as a point, but as the ball swerved more away from the sun a spiral line was formed and marked upon the plate.

In Germany there are many photographic schools, and in one establishment in the midst of very beautiful scenery in the Bavarian Alps more than one hundred pupils have been educated. Last year there was a summer school of photography at Chautauqua, and lectures are given each winter at Columbia College. The result of such systematic study ought eventually to advance the art, though at present the students deal principally with practical and scientific problems. At the Cooper Institute and Young Women's Christian Association, in New York, students are trained to skilfully retouch negatives, and thus photography helps a large class in obtaining a livelihood.

There is a side of the practice of photography which humanitarians will welcome. It has been suggested that the camera be used as a substitute for the gun, and pictures rather than corpses be bagged. In all seriousness the suggestion is well worthy of consideration, for the health-giving tramp and the difficulty of the sport are equal in both cases. There would be a test of the veracity of the sportsman that would doubtless advance the morals of the hunting fraternity. To the fisherman the camera might be valuable to chronicle the marvellous size or number of the day's catch, even if it could not quite take the place of Ik. Walton's favorite sport. The naturalist might gain much information of the habits of wild birds and game from the sportsman's album at the end of a season.

There is one service to which photography has been profitably applied which demands consideration, and as it is practised most effectively in France, it may be well to make a few notes of the photographic establishment at the Prefecture of Police in Paris. Here there is a system

of picturing criminals, which in connection with another system of measurement, makes it easily possible to identify them. Head, ear, index finger, waist, foot, and the height of the whole figure, as well as the breadth of the extended arms, are carefully measured and recorded, as are also any distinctive birth marks, moles, scars, etc. Then the prisoner is taken to well-lighted galleries in the upper story of the building, where pictures of the face in front view and profile, of hand and full figure, are made. Since the late improvements in rapid plates it is possible to obtain these pictures even when the subject is refractory. By the use of artificial light 20,000 pictures the size of postage-stamps can be made in a single night, and sent broadcast over the country to the police force. There are said to be over 100,000 photographs of different criminals, 40,000 of this number being of women and children. These pictures are now, by the assistance of the classified measurements, so arranged that it is an affair of but little time to determine whether the new-comer has ever been in the clutches of the law or no; and if he has, to fix upon him his past crimes and punishments. Modern police the world over have found photography of great assistance, but the systematic care shown by the French might profitably be employed everywhere. The law recognizes the authoritative testimony of photography, and often employs it. Photography for the purpose of identification is not necessarily confined to the criminal class. It was employed in 1876 on the season tickets of exhibitors at the Centennial Exhibition at Philadelphia.

Another way in which it is serviceable is in reproducing, in small size, so that they can be mailed unmounted, the newly finished oil-paintings of artists, who may thus reach patrons and show the subject of the new work. Art dealers in America are constantly receiving such photographic notes from European correspondents, and, familiar with the general character of workmanship, they can readily determine whether they wish to order or no. Sometimes notes of color accompany the photograph.

Artificial light in the practice of photography has long been found serviceable. The burning of magnesium wire and the electric light furnished sufficient illumination under full control. Within the past two years various compounds have been put upon the market which have popularized the taking of pictures by night, either using fulminating compositions or employing the alcohol lamp and the dry powdered magnesium.

Early in the history of photography its service to architecture was discovered. To-day it brings to every student authentic records of the past, the story of every age, from the lintel architecture of far-away Egypt to the primitive log hut of the Western settler. In the quiet of one's study one may consult details of Moorish intricacy of design, the stately temples of Greece, or the strange gargoyles of a Gothic cathedral. Reproductive processes have cheapened the cost without lessening the value of these pictures, so that the student may store away treasures in his portfolios. Even in more practical ways the blue print is made to duplicate the design of the architect, and enable him by a little outlay of time and money to give his patrons a copy of his own elaborate work. So, too, may the architect keep informed of the progress of buildings being constructed in distant places away from his office, from plans he has made. Careful photographs taken frequently will show every stage of the work, and avoid many journeys which would otherwise be necessary. By this means our government is able to control from the central office the payments for work done in foreign lands. Engineers also employ photography for a similar purpose.

Philip Gilbert Hamerton may be quoted as an appreciator of photography when he writes in one of his thoughtful essays on landscape:

"Instantaneous photography is not so valuable for stormy seas in sunshine as in dull weather, because it confounds foam and glitter, but the fidelity with which it renders minor waves is quite beyond all human rivalry. The excellent photographs of yachts in motion which are now so common contain endless and most authentic information about all kinds of minor waves and ripples. A collection of them is even better than nature itself, so far as form only is concerned, for no memory can retain the natural forms with any approach to photograhic accuracy. Painters make constant use of these invaluable memoranda, and by their help, and the education they give to the eye in preparing it to see nature itself, a greatly increased veracity in the drawing of water has penetrated even our current newspaper illustrations."

One cannot close even so incomplete a review as this of the first half-century of photography without a reference to the position it holds with regard to art. Though it would require a long essay to deal with the subject as it merits treatment, it is important to make certain confessions of blighted hopes, and at the same time to look with tempered enthusiasm into the future. As an aid to science, as a recorder, as a duplicator, photography has helped advance civilization. Of itself it has failed to occupy the place it may yet hold as a means for expressing original thought of a fine order. With its recognized qualities, and in the hands of a thoroughly trained worker perfectly familiar with the laws of chemistry and optics, and with artistic feeling and training, it may be placed on a plane where its beauties will force from all acknowledgment that it has powers which rank it as one of the finest of the graphic arts.