A TREATISE

ON

DAGUERREOTYPE;

The whole Art made Easy,

AND

ALL THE RECENT IMPROVEMENTS REVEALED.

EMBRACING

A FULL ACCOUNT OF APPARATUS, PLATES, CASES, CHEMICALS, PLACES FOR PURCHASING, PRICES, ETC., AND A COMPLETE, SCIENTIFIC, AND SIMPLE EXPOSE OF THE MOST FAVORITE MODES OF OPERATING, WITH THE RECEIPTS FOR MAKING ALL THE CHEMICALS.

CONTAINING, ALSO,

The Process for Galvanizing Plates, and the whole art of Electrotype; the Reproduction of Daguerre's Images by Tithonotype; Directions for preparing Calotype Paper; and a description of all the known Methods of producing Photogenic Pictures, &c., &c., &c.

PART I.

BY LEVI L. HILL.

LEXINGTON, N. Y.

HOLMAN & GRAY, PRINTERS, OAK HALL BUILDINGS, N. Y. CITY.

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PREFACE.

THE necessity of a work like this has long been felt. Most of those who embark in this beautiful branch of industry, are like a traveller without a guide. A few days' "INSTRUCTIONS," (so called,) send them out through the country in swarms; and a few days' trial of their skill, either sends them back again, Jack-and-Gill-like, tumbling down the hill of science, or convinces them that, if they succeed at all, it must be by the efforts of their own unaided genius. Such persons are subject, moreover, to various impositions in the purchase of chemicals, apparatus, stock, &c.; for, though there are honorable men in the furnishing branch of this business, there are many knaves.* Besides, the little attention usually bestowed upon pupils, is utterly insufficient to make a successful operator of even the brightest artistical genius. Our opinion on this point is well expressed in the following extract from a letter, recently received from a distinguished firm in Albany, Messrs. MEADE & BROTHER: "There is scarcely one man in a thousand, whether daguerreotypist or not, that views this business in the right light. They imagine it to be a simple business, capable of being performed by any one; whereas, it is a very difficult and delicate business, and requires an experience of years, unless a person be taught *the experience of another correctly*. We will therefore, do all we can to encourage the sale of your book, and hope you will be amply repaid for your trouble and expense in getting it up."

But, while it is one object of this work to afford beginners all the information requisite, to conduct them through the mazes of daguerreotype theory and manipulation, it is also designed as a complete manual and book of reference for the more experienced.

* We trust honest dealers, whose names are omitted in our directory, will take no offence at this remark. We have not been able to obtain the cards of all; but if they will furnish us with them *soon*, they will be inserted in our second edition gratuitously.

The author feels pleasure in the belief that he has produced the long-sought desideratum, viz: a concise account of every thing yet known respecting this great discovery. Having availed himself of all the European works on photography, having spared no pains or expense in procuring receipts, modes of operating, &c., from the most reliable sources, and having put all to the *test* of a long and successful practice, his statements may be depended upon as minutely correct. He will not vouch for the accuracy of all the ideas presented on the *rationale* of the process; but in this he has endeavored to be guided by common sense, a quality never dreamed of, it would seem, in some men's philosophy of this subject.

If there is one in the profession who is disposed to hide the key of knowledge, him have I offended. Well, I am quite indifferent to the good opinion of such silly coxcombs. Men of this character are always contemptible to an ingenuous mind. Had the world contained no others, it would have been unblest with those brilliant discoveries which are constantly benefiting our race. M. Daguerre would have done his witchery with closed doors: and these very men, who are so tenacious of their *modus operandi*, would have "died without the sight."

It is, however, a relief to the author's mind to revert to those numerous *gentlemen*, in various parts of the country, who have furnished materials for the work. They have our warmest thanks. A continuance of such favors, from them, and others, is respectfully solicited, that we may be able to make additions to our second edition.

LEXINGTON, N. Y., Jan. 1, 1850.

LEVI L. HILL.

Post office address,
WESTKILL, *Greene Co., N. Y.*

☞ Though we claim to have given, in the following pages, a complete system of manipulation, we are not insensible to the fact that the work may be in some respects imperfect. Should any of our numerous subscribers desire farther information on any point, we shall be most happy to have them open a correspondence with us. Any information, or explanation, which is in our power, shall be cheerfully imparted.

HISTORY OF PHOTOGRAPHY.

CHAPTER I.

"Hail! Holy Light!
Offspring of Heaven—first-born."

THUS sings the poet who sang of Paradise. It is not our purpose, however, to sing of this holy thing, nor to write an essay on the science of optics; but to treat of the CHEMICAL ACTION of this wonderful agent.

The term *photography* is derived from two Greek words, signifying, *I generate*, and is applied to the art of making pictures by the means of light. That light acts chemically has been known for ages—and if we were required to trace this history back to its remotest antiquity, we should say that the honor of being the very first practical photographic artists, belongs to those ancient ladies who bleached their linen by spreading it in the sun-beams. The effect of light on chloride of silver, causing it to turn dark, appears to have first suggested the idea of photogenic drawing; and the earliest recorded experiments on this subject are those of Wedgewood and Sir H. Davy, which were published in the Journal of the Royal Institution, in June 1802. These philosophers obtained pictures on nitrated paper, but were not able to prevent the further action of light after the impression had been obtained, and the subject was in a short time abandoned. M.

Niepce, about the year 1814, appears to have been the next who turned his attention to the production of pictures by light: he continued his experiments alone for about ten years, when he became acquainted with M. Daguerre, who was also pursuing the same object. These two gentlemen continued their researches together, without publishing any of their results, till the beginning of 1839, when the discovery of *Daguerreotype* was announced; but the process was kept secret till the month of July in the same year, when the French Government purchased the secret.*

It is not our province to discuss, at length, the respective claims of Professor Neipce, and M. Daguerre, to the honor of this truly wonderful invention. It would seem, however, that the very name, *(Daguerreotype,)* given to it by common consent, both in France and other countries, would be a strong presumption in favor of the claims of the latter gentleman. Perhaps we cannot do better, in this place, than to give an extract from a late communication from our old friends, Messrs H. W. & C. R. Meade, of Albany. The latter says: "I visited M. Daguerre, who is the undoubted inventor of this art, although many claim a great deal of honor for Professor Niepce. I visited him at his residence, at *Brie Sur Marue*, France, about nine miles from the city of Paris. Ten thousand francs per annum were settled upon him for life, by the French Government, for this discovery, with the cross of the legion of honor, and he sold the patent right to a gentleman in England for a large sum. While I was at his residence he gave me some of the causes of the discovery. How a man could ever think of combining

* W. H. Thornthwaite's Guide to Photography. London, 1845.

so many things to produce such a result is quite astonishing. He stated that after iodizing his plate and exposing it in the camera, he held it over mercury heated in an iron crucible, by means of a furnace, to the *boiling point.* Every one acquainted with the art knows what would be the result with mercury at such a heat. One day, however, in trying an experiment, after exposing a plate to the mercury, he found a dim shadow on the outer edge of the plate, and it struck him that here the heat of the mercury was not so great; so he reduced the temperature of it, and at last a picture was obtained. This picture will appear in the *Illustrated London News* this year, and may eventually form the frontispiece to Mr. Hill's work on Daguerreotype." It is a little remarkable, by the way, that the French have not excelled in the practice of this art. The Messrs. Meade farther observe: "It is in America this wonderful art is the most extensively practised and appreciated, the pictures taken by European artists bearing no comparison with ours. The best artists in Europe are Americans; as for example: Mayall in London, and Thompson in Paris. These gentlemen use everything after the American plan. Their success induces other operators there to advertise portraits by the American process."

From the time of the discovery of Daguerreotype till the present, it has constantly been undergoing improvements. At first iodine alone was used for producing the photogenic effect. It then required *from five to seventy minutes* to obtain an impression in sunshine. The first step towards abbreviation appears to have been in the improved construction of the camera. *N. P. Lerebours*, optician to the Observatory, Paris, is I think fairly entitled to this

honor.* Soon after this, the application of *chloride of iodine*, as an accelerator, by M. Claudet, induced a reasonable hope of reproducing the form "of human face divine." Soon after this, the *bromine process* was discovered. The cadaverous looking images previously exhibited, were now superseded by a style of pictures at once animated and life-like; but they lacked in brilliancy; and, like other beautiful things, were liable to fade. We have in our possession what was at first considered a remarkably fine miniature of our humble self, taken in 1840, in the city of New York, but now scarcely discernible. Doubtless, the bromine process is the greatest improvement ever made in the *producing* branch of this art; but the *fixing process*, brought out by M. Fizeau, a scientific French gentleman, at once capped the climax of all preceding improvements: and, when skilfully employed, adds an irresistible charm and beauty to these incomparable images. We venture the assertion that there is not, in the whole range of practical science, a thing of equal simplicity which produces results more marvellous. Herein lies one of the very *witcheries* of this great art—that, by the simple heating of a little colorless liquid upon the impressioned plate, the picture seems, as it were, to rise up from its watery bed like a thing of life, and to assume a vigor and chatoyant play of color, which the pencil of the most skilfull artist utterly fails to equal,

* As soon as the defective construction of the first apparatus for the reproduction of portraits had been once discovered, a remedy was found in the adoption of object glasses of a very shortened focus. Messrs. Lerebours and Buron appear to have been the first to think of this innovation. By this improvement the concentration of the luminous rays in the camera was increased in intensity, and the time required reduced to three or four minutes.—*A Treatise on Daguerreotype, by an Amateur.*

A superb daguerreotype, with its nice gradations of light and shade, its harmony, and beautifully true perspective, its life-like vigor and mellowness of tone, and its wonderful perfection as a copy, can never be rivaled by the most exquisite aqua-tinta drawing or engraving. There are those, however, who refuse the daguerrian picture any farther credit than as being a cold and stiff copy of nature, devoid of that effect and animation which they suppose only colors can give. This notion has prevailed more or less from the beginning and was doubtless, a fruitful source of the "many inventions" which were sought out for coloring these beautiful pencilings of the sun-beams.

It is not a little amusing to glance at the various and preposterous devices of the *geniuses* for coloring their pictures. One person patented a process substantially thus: Lay the glass evenly on the plate, trace the outline of the picture; and then proceed to lay the colors on the glass over the cheeks, lips, &c., using such colors as are employed for painting the glasses of the phantasmagoria. Mr. Leotard, of Leuze, in France, proposed to stick upon the plate a transparent membrane, and apply the colors, properly mixed in gum-water, over that. At length, it was discovered that colors could be applied in the form of impalpable powders; and the thing was advertised to be done, in language that might induce the belief that the genius of M. Daguerre had been fairly eclipsed by these prodigies of the pestle and brush. The fact is, the mere contrivance was a small affair in itself: it is the person who heightens the effect, improves the tone, and adds to the life-likeness of his pictures by the skilful combination and use of colors, who is entitled to credit.

In the progress of this art, the possibility of re-

producing objects in their *natural colors* has received much thought, and is yet a consummation devoutly to be wished. Facts show that it would be vain to pronounce the object unattainable. M. Daguerre, in his experiments on phosphorescence, discovered a powder which emitted a red glimmer after the red light had acted upon it; another powder to which the blue rays imparted a blue phosphorescence; a third powder, which assumed a luminous green color by the action of the green light: he mixed these powders mechanically together, and thus obtained a compound which became red under the influence of the red rays, green with the green rays, and blue with the blue rays. Perhaps, by mixing together various substances, some one will succeed in obtaining a compound in which each species of light will imprint its color, no longer phosphorescently, but photogenically.*

It will not be neccessary to enlarge any farther on the history of this art. To do so, would be to swell the size of the volume, with matter quite irrelevant to our purpose, besides anticipating much of the contents of the subsequent chapters.

CHAPTER II.

THEORY OF THE PROCESS.

The following is the view of *Dr. Kane*, the eminent chemist: "The explanation of this process, which from my own observations I am disposed to suggest, is, that iodine combines with the silver and

* Notes of Mr. Arago.

forms iodide of silver, which is spread in an amorphous state, forming an excessively thin layer, like varnish, over the surface of the plate. Under the influence of the light, I consider that this crystalizes as melted sugar does, but so minutely as to be invisible to the eye, and the closeness and completeness of the crystaline structure being proportional to the duration and intensity of the light to which it has been exposed. When, then, the vapor of mercury attacks the plate, the iodide of silver *in both conditions* is decomposed, and the iodine being replaced by mercury, an amalgam of silver is formed, uniform in surface and perfectly metalic in its lustre, over the shaded portions; but the crystaline iodide, in being decomposed, gives a crystaline amalgam, which, from the minuteness of its particles, presents only a grayish tint, and, being mixed with interspersed points of bright, smooth amalgam, where the light had been less powerful, shades off proportionally all the intermediate effects."

Dumas, Professor of Chemistry to the Faculty of Sciences in France, thus expresses his opinion: "It is probable that the effect of light is to raise or crack the coating of iodide of silver, which allows the mercury to come in contact with the silver surface of the plate, whilst the iodine, that has not been affected by the light, remains the same. It may be asked in what consists this coating of mercury? It is mercury in powder, merely deposited on the surface of the silver, but *not amalgamated* with it."

Dr. Draper, Professor of Chemistry in the University of New York, differs entirely from both the foregoing. He says: "In the shadows no mercury exists; *the lights are an amalgam.* When a daguerreotype is exposed to the vapor of mercury to bring out its picture, a decomposition of all those portions

of the iodide which have been exposed to the light ensues; an amalgam is formed, and the iodine expelled unites with the metalic silver behind, effecting therefore a corrosion of the plate; no iodine is evolved, and for obvious reasons such an event is impossible. The light therefore imparts to those portions of iodine on which it has impinged, the quality of being decomposed at a lower temperature by the vapor of mercury than the temperature at which an unexposed iodide can be decomposed; an amalgam therefore forms on such portions, when the temperature does not rise beyond 175° Farenheit, though the whole surface might be decomposed and whitened if the temperature were carried high enough."

We have formed our own views of this matter from repeated experiments, and close observation. There is, we think, on the *white* parts of a daguerreotype, a complete amalgam—and on other parts a partial amalgam, proportioned to the amount of light which has acted on those parts. For example, et a plate receive the appropriate coating, and be sufficiently mercurialized, what is called a *white* picture will be produced: *i. e.*, the skin, linen, &c., will be pure white. At the same time, the deeper shades will be marked by numerous small black dots, while on such places as the lapels of a coat the shading will be more regular. This, I believe, is owing to the light having imparted to those parts on which it has had full effect, a susceptibility of being decomposed by a less amount of mercury than would be necessary to decompose those portions on which the light has acted but little. The small black dots just referred to must be owing to the slight action of the light on the little prominences which are found on nearly all bodies, and the entire absence of light

in the corresponding cavities; for, though we cannot readily discern them, it must be remembered that the daguerrian plate is much more, (one author says 40,000 times more,) sensitive than the human eye; indeed, by the aid of a microscope we may discover on a daguerrotype great numbers of *striae* which were before imperceptible. It is no objection to this view, that sometimes even the deeper shades of a picture are quite free from this jagged appearance; for this, as will be shown in a future chapter, is owing to the remarkable property of the accelerating substances, when used in a certain way, of rendering the oppositions of light and shade less marked. Again, it is known that if a plate is left too long over the mercury, the shaded portions become *embrowned.* Why is this? Doubtless, the explanation is to be found in the fact that the mercury does its offices in a given time, (with a given degree of heat,) during which time it only attacks those parts of the plate where the light has acted, but after which it acts where the light has not acted. Another fact illustrative of this view is, that mercury, at a sufficiently high temperature, will decompose the iodide of a plate instantly.

This subject may be of but little interest to the experienced and scientific artist: such persons, we presume, have a theory of their own. It is, however, a matter of very great importance that *beginners* should start right. We would not advise them to be tied down to the foregoing views; but we do most earnestly urge upon them the importance of their possessing themselves of intelligent ideas of the profession they have chosen. A man with no correct knowledge of the theory of the steam engine, who should attempt to construct and set in operation a locomotive, would soon run off the track. I never knew a skillful daguerrian artist who worked at

random; but among the many unskillful operators whom I have met, I never knew one who understood the first principles of the business.

CHAPTER III.

DESCRIPTION OF APPARATUS.

The Camera.

Without question, this instrument is the most important part of the daguerrian's apparatus. An operator who uses an inferior camera can never do good work. His manipulation may be strictly correct, but the results can never be satisfactory. A man can no more do good work with a poor instrument than he can see clearly with weak eyes. A camera is in fact an artificial *eye*, the plate being the *retina*, on which the images of objects are depicted.

In the hands of *Voightlænder* of Germany, *Lerebours* of France, and others, this *toy*, invented by *John Baptiste Porta*, has grown to be one of the most interesting and important of philosophical instruments. By using very superior glass, and by giving to the lenses new curves and combinations, these gentlemen succeeded in producing the *achromatic camera*. A few words may explain what we mean by *achromatic*. It may be remarked that *light* in the *white* form in which it strikes our vision, is the result of the combination of the colored rays of light. These colored rays are the elements of white light. They are divided into red, orange, yellow, green, blue, indigo, and violet; but Sir David Brewster, and many other philosophers, suppose

they may be reduced to three, viz., red, yellow, and blue, the other colors being formed by these overlapping each other. These colors can be seen by decomposing a ray of light by means of a prism: thus is produced what is called the *solar spectrum*. The same phenomenon is witnessed in the *rainbow*. Now, a *lens* is nothing more than a union of prisms, and an *achromatic camera* is therefore such a construction and combination of lenses as to prevent the decomposition of the luminous rays. Objects viewed through a glass which is not achromatic appear surrounded by the colors of the solar spectrum.

These eminent opticians also succeeded in preventing what is called *spherical aberration*. Thus a camera, constructed on their plan, will give all the foci nearly in the same plane. For example, in copying any flat surface, as an engraving, the rays emanating from all parts of it form what is called a *focus*, on a prolongation of the axis, or centre of the lens. It is evident, that an ordinary lens would give this focus at unequal distances; for the rays from the extremity of the surface could not form a focus in the same plane with that of those rays nearer the centre. By a nice arrangement of glasses of different densities this difficulty is overcome.

In referring to the above-named opticians, we have no design to depreciate the scientific and practical skill of American gentlemen in the same business. Within a few years, our own atificers have made vigorous efforts to rival the workmanship of foreign establishments. Many of them have been completely successful; and after all that has been said of Voightlænder's cameras, there are large numbers of American instruments now in use that are every whit their equals. We have used, and furnished pupils with a great many of Mr. J. Roach's

cameras, and have always found them perfectly satisfactory. GURNEY, an eminent artist in Broadway, New York, showed us some large pictures taken with a Roach instrument, which were equal to any we ever saw: they were, in fact, the very *acme* of splendid daguerreotyping. The same testimony may be given in favor of the instruments furnished by MEADE & BROTHER, of Albany. A late examination of some of their cameras satisfied us that, if they differ from Voightlænder's, the difference is very slight.

HOW TO PROCURE A GOOD CAMERA.

If you select it yourself, unscrew the tube and examine the lenses. If they have *seams* running through them, reject it at once: these refract the rays of light. A few minute specks are no detriment; but the general character of the glass should be that of extreme clearness and transparency. Next, examine the image of a *living person* on the ground glass, and do this at a window fitted up for operating. Just looking into a camera pointed at a building in the open day-light is a very limited test. In your examination, ascertain whether the focus is sharp and clear. Does it give the eye distinctly, and with expression and life? Does it give the texture of the skin clearly? Then look at the *field.* While you have the focus on the eye, does "each particular hair" of the head, the ears, lips, hands, &c., show out plainly? Being satisfied on these points, request the optician to fix correctly the chemical focus. This is not unusually in the same place as the *visual focus.* If you prefer to do this yourself, proceed as follows: take an impression of four or five printed cards, placed back of each

other, one inch apart. They may be inserted into slits sawn into a stick. Get the focus on the middle card. If that comes out the sharpest, all is right; otherwise, you must change the relative position which is occupied by the plate in its frame to that occupied by the ground glass in its frame. This may be done with some strips of card or paper.

Perhaps it would be better for beginners to commit the selection of their instrument to some experienced person.

☞It may be well to apprize some of our readers of a scandalous imposition practiced by some dealers. It is that of selling at high prices, American cameras, (some of them quite ordinary,) with "*Voightlænder and Sohn,*" engraved on the tube. A jeweler in New York told us that he had marked some two hundred in one year. A trick nearly if not quite as infamous, is that of selling very inferior American instruments under the assurance that they have been *tried* by some artist of note. This assurance is accompanied by a good picture, said to have been taken with the instrument.

COATING BOXES.

Those having heavy glass jars and a thick glass cover, ground air-tight, are alone to be used. The *high* ones we consider the best.

MERCURY BATH.

The neatest article of the kind we have seen, are those made by the Messrs. Lewis, New York. The precise form of this part of the apparatus is not essential; but it is advisable to purchase a neat article in preference to a clumsy one.

PLATE HOLDER.

This article is got up in a variety of style. Those with screws are objectionable from the fact that the screw soon wears out. The Messrs. Lewis' *Patent Plate Vice* is worked by a lever, and besides not being liable to get out of repair, is so perfectly convenient and charming in its operation, as greatly to lessen the tedium of this part of the process.

Some operators use a block of wood, about one inch thick, and of a surface not quite the diameter of the plate. The plate is fastened to this block by means of a composition of one part of rosin and two parts gum shellac, melted together and cooled under water. This is formed into sticks, and some of it melted over a spirit lamp, and dropped on the back of the plate. This is then softened over the blaze, the face of the plate laid on a clean pad or piece of paper, and the block instantly pressed upon the plate. The plate will adhere sufficiently for all the purposes of polishing, but may be easily detached by slightly lifting one corner. By having a supply of blocks, any required number of plates may be fastened in advance. Each block should have a hole in the bottom which fits to a stationary peg on the bench. Before gilding the picture, the resin must be scraped off and the back of the plate washed clean with a little alcohol.

The use of this block obviates the necessity of handling the plate during the process of polishing.

HEAD REST.

The "*Iron Independent Head Rest*" is preferable to all others. It is very difficult to accommodate the "Chair Head Rest" to the position of the sitter. One of the former kind, not too heavy, will not add

very much to the luggage of a travelling artist; with this, and one or two chair-rests, he will be sufficiently prepared for taking groups.

SCREEN.

The frame should be about 7 feet high and 8 long. This, covered with 2 or 3 thicknesses of white muslin, makes perhaps as good a screen as can be used. Some operators cover the frame with tin or varnished paper; but this plan throws a glare of light which in our judgment, is injurious. The effect is much like that of the direct rays of the sun; in certain positions of the sitter it will produce two white spots on each eye. Where there are two windows, a tin concave reflector, some 5 feet in diameter, and hung with a hinge, may be used with advantage. It should be suspended from near the top of the farther window. When a window is rather low, or the wall overhead dark, some advantage is gained by using a canopy of white muslin overhead.

BACK GROUND.

Formerly, folded drapery, landscapes, &c., were much in vogue, but are now discarded, having given way to a style of back ground more truly artistical. A plain, dark ground to a daguerreotype, such as are seen in rich steel engravings, is certainly preferable to all others. This may be produced in various ways. Where there is plenty of room behind the window, ordinary bluff flannel answers well. Rose blankets, on account of their furzy surface, are excellent. If they are wanted darker, they may be sprinkled over with lampblack and water, by means of a short broom, in a manner similar to that used

by bookbinders in sprinkling the edges of books. Canvass or muslin, painted a *dead* color may be used. A mixture of the paint, in milk and water, to which a little glue is added, should be applied evenly over the whole surface. Yellow ochre, with a little red-lead, forms an orange tint, which comes out a good slate color. Black and white paint form a grey, which works well. An artist should take great pains to prepare a back ground of *just the right tint.* One of the best we ever saw was made of what is called " sheep's grey" cloth.

CHAPTER IV.

RECIPES.

To prepare Rotten Stone.

Purchase of a druggist the best *Derbyshire rotten stone.* Pulverize it as fine as possible. Make it into a thin paste with pure soft water, and continue rubbing for some time. Put the paste into a tall earthen glass, or wooden vessel, and fill the vessel with pure water. Agitate, and let it settle two or three minutes, during which time the grit will fall to the bottom, when the turbid liquor is to be poured into another vessel, and allowed to remain motionless for some hours. Pour off the clear water, and spread the rotten stone on plates and dry. The cake thus formed must be again pulverized to the utmost degree of fineness. It is advisable to add to the water used a little nitre acid, say twenty drops to a quart. This will decompose any carbonates which may exist in the rotten stone.

ROUGE : OR COLCOTHAR OF VITRIOL.

Mix in a crucible, (one sufficiently large may be purchased for 25 cents,) 100 parts of green sulphate of iron, (*copperas,*) with 42 of common salt. Calcine the mixture at a red heat until it forms a glassy mass. Let this be thoroughly pulverized, and then wash it, as directed for rotten stone, a number of times. In this way the sulphate of soda, which has been formed, will be got rid of.

In this process, the sulphuric acid of the copperas expels the chlorine of the salt, in the form of muriatic acid gas, and saturates the alkaline base, or soda of the salt, forming sulphate of soda. Oxygen, from the circumambient air, aided by heat, takes the place of the sulphuric acid in the iron of copperas, and hence results the oxide of iron, or rouge.

The best sort of polishing powder, called *Jewelers' rouge*, or *plate powder*, is the precipitated oxide of iron, prepared by adding a solution of *sal soda* to a solution of *copperas*, washing, drying, and calcining the precipitate with a gentle heat, till it assumes a deep brown red color. It must then be finely levigated in a mortar, when it will have a bright red color.

BLACK POLISH.

This may be made in various ways. The charcoal of hard wood, especially maple, reduced to a very fine powder, is good. Calcined and well pulverized lamp-black, or ivory black, is equally good. Calcined wheat flour, or, better still, starch, is an excellent article.

HILL'S IMPROVED BUFF POWDER.

Mix intimately one part rouge, one part oxide of tin, one part black polish, two parts pulverized starch, the latter not calcined, and four parts fine plumbago.

We cannot too highly praise this compound. Nothing ever tried by us gives a plate such an exquisite polish. It exceeds every other preparation in producing that deep, black, mirror-like lustre, which differs from mere glitter; and which, other things being equal, insures a picture that may be seen in any angle.

VARIOUS ARTICLES FOR CLEANING BUFFS.

Strong solutions of *pearlash*, *sal soda*, *caustic potash*, or *aqua ammonia*, are very useful. The sal soda especially we have found most excellent. It may be employed as follows: Make a saturated solution in the purest water, and keep it in a phial ready for use. To cleanse a buff, stretch a piece of clean canton flannel over a block, and, wetting it at the mouth of the phial, proceed to wash every part of the surface of the buff. Then, with four or five clean pieces of the flannel, rub it dry. An article to which we have given the name of "Hill's Composition for cleansing Buffs," is made as follows: Mix equal parts of chloride of calcium (*rotten stone*), dry sal soda, and common starch. Let them be well pulverized, and thoroughly mixed, keep it in a dry place in a small muslin bag. If your buff is foul, dust it over with the composition, and rub thoroughly with several pieces of canton flannel, when the buff should be well brushed with a clean, stiff brush. This plan does not harden a buff as the wet method is apt to do. The chloride of calcium is used to absorb the dampness from the foul matter—the rotten stone as a scouring material, and the soda, being an alkali, to decompose the *grease*, a minute quantity of which is doubtless mixed with

the foul matter. The starch performs a very important office. A buff which has been much used acquires a sort of silvery surface, from its frequent contact with the silver of the plates. The accidental vapors of iodine and bromine, which are present in most operating rooms, go to this surface, and either form a minute quantity of iodide or bromide of silver, or are imbibed by the leather. Now, these are absorbed by the starch, forming an *iodide of starch*, which is conveyed away by the brushing.

The free use of a brush alone will sometimes restore a buff. Scraping with a dull knife, or rubbing with fine sand-paper, and a subsequent brushing, is frequently effectual. Our own practice is to use the *composition* every morning; and, as a result, our buffs are always in order.

HILL'S PORTABLE HEATER.

This simple but effective contrivance we claim as our own invention. It consists of a tin box, nearly as long, and twice as wide, as a buff stick, having a close top but no bottom. It should be about six inches high, and may be mounted on legs, or on a couple of plate boxes. There must be a slide at each end, on the top ends of which the buffs are placed, faces down. These slides may be raised or lowered at pleasure, and being made to fit rather tightly, will keep their place notwithstanding the slight weight of the buffs. The buffs should be elevated about three inches above the box. Riveted to the inside of the cover of the box is a sort of disk, made of tin, some four or five inches in diameter, and about one inch deep, which is to be filled with dry sand. This serves to equalize the heat. A spirit-lamp, with a small blaze, is to be kept under

the disk from morning till night. Thus the buffs will be kept in a warm, dry air, without being sweat in an oven heat.

N. B.—There should be a hole about one inch in diameter through each end of the box, and one also to correspond through each of the slides, one inch wide and two or three inches long. This will supply the lamp with air.

This heater, besides answering perfectly the purpose for which it was designed, may be very easily carried about by a travelling daguerrian, as by packing it full of materials it will occupy no more room than the tin of which it is made.

MAYALL'S QUICK STUFF.

Add to 1 oz. *bromine*, ½ oz. *hydrofluoric acid*, and then add, drop by drop, 1 oz. *concentrated sulphuric acid*. Reduce with two quarts of water.

Or, if you wish to make a small quantity, take 50 drops of bromine, 25 drops hydrofluoric acid, 50 drops sulphuric acid, and half a gill of water.

A battery of this should consist of about one tea-spoonful of the quick to half a pint of water, replenished with a like quantity of quick every morning.

ACID QUICK STUFF.

Put to 32 parts water 2 parts *bromine*, 1 part *dry iodine*, and 2 parts of *nitro-muriatic acid*. It is an improvement to filter the water through *chloride of lime*. For a batch, mix 2 drams with from 4 to 8 drams of water, according to temperature, and add from 10 to 20 drops of quick every morning.

CHLORIDE OF BROMINE.

This is most conveniently made, by mixing 2 drams of a saturated solution of *bromine* with 15 drops of strong *muriatic acid*. This should be used with from 5 to 40 parts of water. In moderately warm weather, from 5 to 20 drops in 1 gill of water, will work powerfully all day.

BROMIDE OF IODINE.

This is one of the best accelerators ever used; but it has been discarded by many operators, on account of the difficulty of preserving the original proportions of the components. The following method we have found invariably effective: Provide 40 or 50 small phials, into each of which put 30 drops of bromine. Add to each a little more dry iodine than the bromine will dissolve, and stop them close with beeswax. Make up the battery every morning, by adding the contents of one phial to 1 oz. of filtered soft water, throwing away the old batch. It is sometimes necessary to use a larger quantity of water.

FLUORIDE OF BROMINE

Is made and used the same as "Mayall's Quick Stuff," save the omission of the sulphuric acid. The hydrofluoric acid, having a great affinity for water, tends to keep down the aqueous vapor, and therefore *indirectly* accelerates the vaporization of the bromine. The sulphuric acid in Mayall's Compound does this *directly*; for, if you add this acid to pure bromine, copious vapors will be evolved. From this we infer, that the two preparations do not essentially differ, with which opinion our experience

has fully coincided. They are both excellent, inasmuch as they produce brilliant results; but they do not act as uniformly as some other compounds.

CHLORINATED BROMIDE OF IODINE.

To ½ oz. of *bromine* add 1 oz. of *chloride of iodine*, 1 quart of *lime water*, and 25 drops of *muriatic acid*. For use, make the battery with ½ oz. of this, to from 4 to 6 oz. water, and strengthen with a few drops of the quick every morning. It acts very uniformly.

DRY QUICK STUFF.

Place a quantity of any quick stuff you wish, in the bottom of a bottle. Suspend in it a small sack, made of book-muslin, and filled with *chloride of lime*, until the latter is saturated, which will require 24 hours. The sack must not come in contact with the liquid. It may be suspended by fastening a string between the cork and neck of the bottle. For use, it is to be spread evenly over the bottom of the battery. This is an excellent article, *not being liable to freeze*, and yielding the bromine vapor in a dry form. A better method is, to add to 1 pint of air or water-slacked lime, 1 oz. bromine, more or less, till the compound is a deep orange red; may be renewed when exhausted.

DRY METHOD OF USING LIQUID QUICK STUFF.

Pour a quantity of quick evenly over a slab of plaster of paris. The plaster holds down the moisture, which the vapor, if the quick is very strong, will escape in nearly a dry form.

Another method is, to place in the jar of the battery, about half an inch below the plate, a shallow basin of wood, or earthen, perforated with small holes, and scatter about in this, half an ounce or so of *chloride of calcium*. This will effectually absorb the moisture; but it is necessary to take it out occasionally, and expose it to heat, in order to expel the moisture it has absorbed. This may be done in a small tin vessel. To reap the full benefit of this, the iodine box and mercury bath should be treated in the same way.

The process is a troublesome one; but we have used it for weeks together, and always with exceedingly *quick* and *beautiful results*.

Any person may be convinced of the utility of this method, by simply breathing on a plate before exposing it to the mercury. No picture, or a foggy one, will be the result. A drop or two of water in the mercury bath, will produce the same phenomenon. All experienced artists know, that sometimes a sudden change of weather from dry to damp, or the breath of a crowd in the room, will interfere greatly with the beauty and clearness of their proofs. The reason is, that the plate, being colder than the surrounding atmosphere, condenses upon its surface a portion of the moist vapor of the room, in the same way that a cold window becomes coated with frost.

BROMINE WATER.

In our opinion, none of the compounds in use can be at all compared with simple *bromine water*, as far as concerns the production of splendid impressions, if it can be used with uniformity; for it is of little avail, to one who makes a business of this art, that he can occasionally bring out a superb picture, while dnring the interval, he is compelled to grope in the

dark. An iodized plate, exposed to the vapor of bromine, increases in sensitiveness, according to the quantity of bromine absorbed, up to a certain limit. Carried beyond this limit, the sensitiveness of the plate diminishes, until finally the photogenic effect cannot be obtained. To be guided by the color is impracticable, as this changes but little under the action of the bromine; it follows, therefore, that to use bromine at ali with uniform success, either it must be modified by a union with other substances, or some method must be employed to use it without regard to color. A solution of it of a uniform strength, made by reducing a saturated solution with about 40 parts of water, and a certain definite quantity renewed in the battery for every plate, has been recommended. In this way, I allow, tolerably identical results may be obtained; but it is very troublesome, and consumes too much time. The renewal must take place out of doors, unless some plan is adopted to do it in doors, without filling the room with fumes.* M. Fizeau, Lerebours, Egerton, and others, recommend the use of a *dropping tube*, i. e. a small graduated syringe. With this, a certain definite and invariable quantity is drawn from the bottle of bromine water, and injected into the battery, for each plate—that used for the preceding plate being thrown away. W. H. Thornthwaite, author

* "Amateurs, in the daguerreotype process, are often annoyed by the want of success which frequently attends them. They ascribe to the atmosphere, or to the light, or to other causes, their inability to obtain impressions. Most of these mischances are due to the accidental presence of the vapor of iodine, or bromine, or other electro-negative bodies, in the chamber or about the apparatus. It is incredible what a brief exposure to these vapors will entirely destroy a picture before it is mercurialized. The reason of this is easily understood; suppose a particle of iodine or a drop of bromine has fallen into the camera, as fast as the light makes its impression the vapor detithonizes it."—Dr. Draper.

of "A Guide to Photography," an English work, recommends the injection of *dry bromine vapor*, in definite quantities, connecting its use with the *oxide of chlorine*. The bromine vapor is prepared by placing in a large phial a quantity of sulphuric acid, and adding a small quantity of pure bromine: on agitating the bottle, the upper part will be filled with the vapor. The oxide of chlorine is prepared by adding a crystal or two of *chlorate of potash* to a small quantity of concentrated *sulphuric acid*, in the bottom of a small, wide-mouthed, stopped phial. The action is very energetic, and a deep yellow gas (oxide of chlorine) fills the upper part of the bottle. This gas will sometimes explode, and therefore but a small quantity should be prepared at a time, and the bottle containing it kept in a cool place. Now, draw into the syringe a small quantity of the bromine vapor, and then an equal bulk of the other, and inject them into the battery by a small opening in the cover, which should be immediately corked; or, it may be done by moving the slide a little one side. A few experiments, founded on your mode of iodizing, will soon determine the quantity to be used each time for different sized plates. The time of exposure is not material, as the plate cannot absorb more vapor than you introduced into the box.

A better method we have found is, to supply the battery with sulphuric acic, and drop into it, a few minutes before coating each plate, the precise quantity of bromine and chlorate of potash. In this way, we have used 2 oz. of the acid for a day together; but, generally, it must be renewed oftener.

☞ We have invented a battery which completely overcomes all the foregoing difficulties, and in which the bromine water may be used with per-

fectly identical results. Instead of getting it patented, we give the description of it for the benefit of our subscribers. Make a partition of *earthen* or *slate*, which will exactly fit the jar of the battery at the depth of about one inch from the rim. Through the centre of this, drill a hole about half an inch in diameter. Along each side of this, rivet two little cleats, parallel with the direction of the slide of the box. A piece of glass, slate, or earthen, a little more than half an inch in diameter, should now be fitted loosely between the cleats, and the end farthest from the plate, fastened close to the partition by means of a small hinge. This we call the *valve*. Underneath this, at the end nearest the plate, is a spring to hold it up. Immediately over the valve, at the end nearest the plate, projecting from the plate of glass which covers the jar, is a strong peg, which is so contrived as to press down the valve as the slide passes in. The valve is beveled at the end nearest the plate, so that as the slide passes out, and the peg reaches the beveled end, the valve rises and lets in the vapor from beneath, in readiness for the next operation.

It will be observed, that the space in the upper chamber is too great, as it will hold more vapor than is needed even for the largest plate. This is left so purposely, to make room for what we shall term the *guage-blocks;* these consist of pieces of glass of a size to leave just room enough for a sufficient amount of vapor—one for each sized plate. Let them be marked A, B, C, D. Then, if you wish to coat a large plate, place the glass A in the chamber, and so on.

In the lower chamber, we use a saturated solution of bromine, and keep up its strength by the occasional addition of a little pure bromine.

The *partition* is, of course, to fit close into the jar,

and be luted perfectly air-tight. A cement, made by forming sifted quick-lime into a paste, with the white of an egg, is excellent.

☞ Any skillful mechanic will construct this battery, guided by the foregoing description, and such hints as the operator may give him.

The advantages of this arrangement need not be dwelt upon; they will be at once apparent to every intelligent artist who gives it a trial. The most favorable tint for iodizing by this plan, we have found to be a *deep yellow*, just beginning to be tinged with *rose*. The plate is then to be left over the bromine a sufficient length of time to absorb all the vapor in the upper chamber, when it should be re-coated over the iodine, from one-quarter to one-half of the first coating.

N. B.—A more simple method, which answers a good purpose, is to leave out the valve, cleats, spring and peg, and to construct the guage-blocks in such a way, that by tilting the box, the valve-hole will be covered or opened at pleasure. In this case, the faces of the blocks and partition must be ground exactly level. If the guage-blocks are a little more than half an inch shorter, on two opposite ends, than the partition, and have a half-inch hole in the centre, it will be seen that by tilting the box the desired effect will be produced.

CHLORIDE OF IODINE.

Easy Method of preparing it.

Put into a glass *retort*, having a tube twice bent, some *peroxide of manganese*, broken into small pieces, and upon that some *muriatic acid*. The tube communicates with a small bottle containing some *dry iodine*, and should be inserted into the

mouth of the bottle air-tight. A small flame from a spirit lamp under the retort, will disengage the chlorine from the manganese, and the iodine will at once liquefy. When the liquid is brought to the color of a bright red, the operation is to be terminated. The bottle must be immediately closed with a ground glass stopper, and luted with tallow, which may be tied on with a piece of bladder.

If you wish to use this article, reduce a quantity of it with water to the color of brandy, and use in the same manner as the other accelerators. Or, pour two or three drops clear, into the jar, and place a little cotton wool over it to retard the evaporation.

HILL'S THREE-SECOND SENSITIVE.

Add to 1 dram of *saturated solution of bromine*, made in water filtered through *chloride of lime*, 20 drops *muriatic acid*. Make a saturated solution of *bromide of potassium*, in similar water, and add to it more *bromine* than it will dissolve, and 1 dram of *hydrofluoric acid*. Mix the two. Stop it tightly, and having kept the bottle surrounded with ice for a few minutes, add 40 drops pure *sulphuric acid*.

This compound is so exceedingly volatile, that the bottle should never be opened until after it has stood some time in cold water. From 3 to 20 drops of this, according to temperature, added to 1 oz. of water, will charge a battery for a day, unless the weather is excessively warm, in which case it should be strengthened oftener. Coat over iodine to the lightest possible shade of *lemon color*, over this to a light *gold* color, and back from *one second to as long as the first coating*, according to the tone you wish to produce. It will work exceedingly quick with the

other coatings; but, for taking children, the above is most desirable. It will be referred to again under the head of *polishing plates*.

We claim this peculiarly happy combination of accelerating substances as our own discovery. That it merits the title given to it, we know from long use, having repeatedly taken excellent proofs with it at a north window of 21 lights, 7 by 9 glass, in the time specified; and even in light rains we have worked it in from 5 to 10 seconds.

IODINE OF BROMINE

Is prepared by pouring into the *bromide of iodine* an alcoholic solution of iodide, until a precipitate is produced having the appearance of iodine. Dilute it for use until it has a saffron color, and an odor approaching that of cider. It is quite variable, and it must be modified every day, by adding solution of iodine or bromine water, as experience may dictate. If the coating is irregular, bromine is in excess; if the plate is not sensitive enough, iodine is in excess. The iodide of bromine, like the next article, is used alone, without the iodine or bromine box.

GERMAN MIXTURE.

This is nothing more than *chloride of iodine* diluted with about 300 parts of water.

The last two receipts, candor compels us to say, are worthless. Nothing but pure iodine should ever constitute the first coating of a plate; for nothing but this can form *iodide of silver*.

HYPOSULPHITE OF SODA.

Dissolve 12lbs. of *caustic soda* in 8 gallons of water. Add to this 4lbs of *flowers of sulphur*, and boil, in a tin vessel, until the sulphur is dissolved.

Then pass a stream of sulphurous acid gas into the liquor, until it smells strongly of it. Filter the liquor, and boil it down to a syrupy consistence. Mix the syrup with half its weight of alcohol, and shake it well. The alcohol takes up the *sulphuret of soda*, and swims on the surface of the aqueous solution. It is then set aside to crystalize, without removing the supernatent alcoholic layer. To procure the sulphurous acid gas, pour *sulphuric acid* on bruised charcoal, or bits of copper, in a glass retort with a long tube. Immerse the mouth of the tube under the liquor, and apply heat to the retort.

CHLORIDE OF GOLD.

This may be made from *gold coin, leaf, or foil;* but as these are alloyed, it is best to procure *pure gold* from a refiner.

A very simple apparatus for its manufacture may be made on the principle of a glue-pot. Ours is a tin vessel, holding about three pints, with a circular opening in the top large enough to admit a common tea-cup about two-thirds its depth. The vessel is mounted on tin legs, so as to admit under it a spirit lamp.

Fill the vessel about half full of water, and keep it boiling through the whole process. Place the gold in the tea-cup, and pour upon it about 10 times its bulk of *nitro-muriatic acid*, or a sufficiency to dissolve the gold. Now, place the cup in the circular opening, and keep the water boiling until the gold is dissolved, and until the solution is evaporated to as near dryness as it can be brought. Set aside a few moments, and it will crystalize, either in the form of long orange red needles, or that of a waxy mass, of the same color. Divide it by weighing it into such parcels as

you wish, and immediately place it in small phials, and cork tight, as it will deliquesce by much exposure to the air. The nitro-muriatic acid is made by mixing 1 part nitric and 2 parts muriatic acid. The process should be conducted in the open air, as the fumes of the acid are very deleterious. The above is *pure chloride of gold;* and, in our opinion, is superior to every other salt of gold for daguerreotype use.

DOUBLE CHLORIDE OF GOLD AND SODIUM.

Dissolve the chloride of gold in 8 times its weight of *salt water*, made by saturating very pure water with *decrepitated* salt; i. e., salt burned on a clean hot surface until it no longer crackles. Filter the solution, and evaporate to dryness, stirring it often with a glass rod. It crystalizes in the form of a bright yellow powder. This is the article usually sold under the name of chloride of gold. The addition of the salt makes it more profitable to the dealer, but does not improve the quality of the gilding made from it. Another way, is to dissolve 6 parts of gold, and add 10 parts decrepitated salt to the solution.

HYPOSULPHITE, OR WHITE SALTS OF GOLD.

Dissolve the *chloride* in an excess of water; and dissolve 4 times its weight of *hyposulphite of Soda*, in an excess of water, in both cases using the purest water. Pour the cold solution into the other little by little, agitating between each addition. Let it stand in a dark place, until it become colorless; filter, and evaporate to dryness. Dissolve the crystals again in some 200 times their weight of pure water, and stir into the solution 2 of 3 grains

of pulverized burnt alum. Let it stand two hours, filter, and evaporate to dryness, stirring it gently with a glass rod. By this second crystalization, it will usually be obtained very white and clean, in the form of very small needles. Sometimes, however, a third, and even a fourth crystalization is necessary. For use, it is simply dissolved in the proper quantity of pure water.

MISCELLANEOUS RECIPES.

Sealing Wax. Pulverize 1 part *resin* and 2 parts *gum shellac*, and melt them together by a very gentle heat. Add $\frac{1}{8}$th part of spirits of turpentine, and stir in red lead, vermillion, chrome yellow, or any color you wish. When partly cold, work it into sticks.

Sticking, or Sealing Paper. Dissolve, by the aid of heat, in 3 pints of war, 1 oz. *isinglass* or *fish glue*, and 2 oz. *gum arabic*. Boil down to about 1 pint and apply it to bank-post, or post-office paper, with a brush. A little "tincture of benzoin" is a good addition.

Cleaning Glasses. Rub them with *alcohol* and *rotten stone* on a piece of Canton flannel, and dry off with a clean piece. This method will be found very simple, easy, and effective.

To disinfect a Room of the Vapor of Iodine or Bromine. Sprinkle about freely *aqua ammonia*. The same article, if inhaled or smelled, will neutralize these vapors in the lungs or nose. Stains of these chemicals on the hands may be washed out with this, or with hyposulphite of soda. The best way is to keep these fumes where they belong.

To restore Soiled Cases. Rub them over with a paste made by stirring rye flour into a boiling solution of *gum tagacanth*.

Camphene. Thoroughly mix alcohol with spirits of turpentine, until the mixture is limpid. Add to each quart of the compound $\frac{1}{2}$ oz. camphor.

To Concentrate Alcohol. Place it in a bladder, and suspend it in the air for several hours. The water will pass through the bladder and leave the alcohol. Or mix it with *lime*, or what is better, *chloride of calcium*, and distil. The calcium will hold the water, while the alcohol will distil over. What is called "absolute alcohol" may be purchased from the chemists.

To Purify a Pail of Water in five Minutes. Stir into it a tea-spoonful of powdered *alum*. Let it settle about five minutes, and gently pour it into another vessel, leaving the sediment behind. This clarifies the water from dirt; but to neutralize the carbonates in hard water, 4 or 5 drops of *nitric acid* should be added to every quart.

Chloride of Calcium. Dissolve *marble* in muriatic acid, and evaporate to dryness.

To Purify Gold. Dissolve standard gold in nitro-muriatic acid, evaporate the solution to dryness, redissolve it in distilled (or very pure) water, filter, and add to the solution sulphate of the protoxide of iron, (copperas). A black powder falls, which, when washed in dilute muriatic acid and pure water, yields on fusion a button of pure gold.

CHAPTER V.

POLISHING PLATES.—PROCESS 1.

1. Provide a bottle of the best and finest *rotten stone*. Of this, mix in a phial of about the capacity of 4 oz., containing strong alcohol well filtered, a sufficiency to form a thin paste. In the summer, the alcohol may be reduced one-half with pure filtered water.* It is a good plan to add to this, a piece, half as large as a small pea, of *purified caustic potash*, as it helps to free the plate from all greasy matter, and it is thought by some, adds to the tone of the picture. Some artists use water acidulated with from 1-15th to 1-30th of *nitric acid*, instead of alcohol. In this case, it is necessary to absorb the acid with dry rotten stone, which, we think, scratches and diminishes the polish of the plate; and, unless the acid is perfectly absorbed, the plate will subsequently spot.

2. Next, procure some of the best bleached *Canton flannel*,† with a soft body and long nap. It is a safe way *always* to wash it in a strong solution of *sal soda*, rinse in 4 or 5 clean waters, and thoroughly dry. Cut it into squares about 2 inches in diameter, and keep in a clean, dry box.

3. Make 2 *blocks* of hard wood, 1½ inch long, 1 inch wide, and one inch thick. Cover one side of

* No water should be used for any part of the process, but that which is *pure* and *soft*. A little nitric acid, say 2 drops to a pint, will neutralize the lime, and other carbonates, in hard water.

† Some prefer "*prepared cotton*."

them with a piece of soft buckskin. To scour a plate, stretch over this a square of the cotton, and hold it in such a manner as never to touch the part which is to come in contact with the plate. Then, having placed the plate on the plate-holder, and turned the extreme side-edges with a hammer, take on some of the paste from the mouth of the phial, and proceed to rub the plate *circularly* and *uniformly*, for about one minute, then crosswise as much longer. The bottle of dry rotten stone should have a piece of muslin tied over its mouth, so that if the paste is not thick enough, a little rotten stone may be dusted on the plate. Care should be taken to keep the cotton constantly wet, and the paste of the proper consistency. Too thin, or too thick, it will not produce a good polish. A plate should always be rubbed crosswise, or in the direction of the view, to finish off. Then, with a fresh piece of cotton, dry the plate first nearest the plate-holder, and so on towards the end, being careful not to return with *that* piece towards the plate-holder, as you will draw up some of the paste from underneath. Having dried both ends, wipe off the back of the plate and the holder, and with a clean piece continue rubbing until you produce a clear surface, with the fine scratches (for these cannot be avoided), all parallel. Sometimes this process may be gone through with the second, and even the third time to advantage.

Plates with impressions should always have *two scourings*, the first to take off the impression, and the second to bring up the surface. A new plate requires more rubbing than one which has been polished.

The rubbing should be performed with a light hand, but with celerity of motion, long continued. For a quarter or medium plate, five minutes' skillful

rubbing is about the time required, though an expert workman will often do it in less time.

We sometimes use the cotton until it comes off clean and colorless; and we have found it an advantage, after drying off the plate, to rub it with a piece of clean cotton, on which has been dusted a *very little* rouge.

A plate, before going to the buff, should have a clear, uniform surface, free from every appearance of scum. Doubtless, the failure of many operators is owing, in part at least, to their depending on the buff to compensate for a deficient scouring. The object of the method we are now pointing out, is to produce a fine polish, and to bring the plate into a condition in which the surface is, as near as possible, *chemically pure*. Mr. Daguerre is of opinion that if the surface of the plates could be entirely freed *from all foreign matter*, daguerreotyping would be much in advance of its present state. He proposes, after polishing the plate, to float its surface with *distilled water*, and having boiled the water for a moment, to dry it off in such a manner that the organic matter, which now swims on the surface of the water, shall not come in contact with the plate. This plan, though not found to be feasible, shows how the mind of the great discoverer of this art has labored on the subject.

UNGILDING.

Use *rotten stone* and *camphene*, or spirits of turpentine, and rub with a square of woolen cloth; satinet is excellent. Dry off with a piece of cotton, and heat the plate with a spirit lamp until a white scum appears. If the plate has not been sufficiently rubbed, the image will re-appear on burning. Place the plate on a cold, level surface, as stone or iron.

This sudden cooling of the plate, it is supposed, increases its *refractive power*. Plates which are impressioned, but not gilded, should be heated until the image nearly disappears, and cooled as above. The object of this is, to vaporize the mercury, which is very detrimental if left on, and rubbed, as it were, into the silver, and would eventually ruin the plate. The above are now to be scoured as before directed. After the ungilding, the plate-holder should be carefully cleaned from the camphene, with a little alcohol.

BUFFING.

Wash a piece of the best *bleached buckskin*, (doe-skin is best,) of the size required, in a strong solution of *sal soda*, rinse in several clean waters, and hang it up to dry. When quite dry, grasp the extreme ends, being careful not to touch the side which is to form the face of the buff, and pull it briskly back and forth over a sharp corner, such as a chair back, its *wrong* side in contact with the wood. In this way the skin may be made soft as velvet. It may now be tacked on the buff stick, which should be previously padded with two or three thicknesses of canton flannel.

Heat a little buff powder on an old plate, to expel the moisture, tie it up in a piece of clean muslin, and dust a little over the face of the buff. Rub with two or three clean pieces of cotton, so as to spread the powder equally. Keep the buff over the heater, and it will work good all day, without any fresh buff powder. Some operators, however, put on a small quantity for each plate. The little bag of buff powder should be kept on the heater.

Generally, extremely *light*, but *long continued* buffing of a plate is the most effectual. This will pro-

duce a fine black polish, without causing scratches, or a scum. An additional buff, made of *white cotton velvet*, prepared and preserved like the foregoing, is in our opinion indispensable. Colored velvet will not answer, for obvious reasons. For the finishing touch, we prefer *white* velvet to buckskin. Used lightly and skilfully, it gives to the plate a lustre of the greatest possible beauty.

Any particles of dust may now be removed from the plate, by a clean camel's-hair duster, and by thumping the back of the plate, with its face down. The plate should now be placed immediately over the coating-box; for being warm, the chemicals will unite with it more readily.

PRECAUTIONS.

Care should be taken, in handling a plate, *that the fingers do not lap over the edges.* If this should happen, the plate must be re-polished. A little neglect here, will soon bewitch the buffs. In changing the plate on the holder, it should not be grasped from above, but spanning the holder underneath, lift the plate lightly by its under edges. The fingers, even when we suppose them to be perfectly clean, are greasy, of which any person may be convinced, by slightly rubbing them over a sheet of paper, and then writing on it; the ink will not *take* good, because the paper is greasy.

Avoid breathing on a polished plate, and keep it from strong currents of air, as these tend to oxidize the surface. Plates cleaned long in advance, become slightly affected in this way, even by the atmosphere of a dry box. Such plates should be rubbed with a piece of clean cotton, just previous to their being buffed. The rubbing will also free the

plate from *dampness*. Moisture is as detrimental to this process, as it is to the operations of the electrician.

We repeat it, *buff your plates lightly but a long time.* Buff *across* the plate only. Some use what is called *double buffing*. i. e. buffing in both directions, but it is not attended by any advantage.

PROCESS II.

The process we are now about to point out, was first suggested by Messrs. Choiselet and St. Ratel, and Messrs. Belfield, Lefevre, and Foncault, in communications to the Academy of Sciences in France. J. Egerton, in his Treatise on Photography, has given a letter from N. P. Lerebours respecting it; but the whole account is vague, and lacks in detail. He gives it, as he says, "without in any way guaranteeing its merits." These gentlemen considered "in a new light the chemical re-actions which take place in the formation of the daguerrian image." The coating of iodide of silver," observes Mr. Lerebours, "formed on the surface of a plate, is reduced in volume under the influence of light, so as to give rise to the formation of a *subiodide*, on the parts upon which the light has acted. This formation cannot take place without setting free a certain quantity of iodine, which tends, on the one hand, to combine with the iodide thus reduced in volume, and on the other, to attack the silver of the plate. It is, therefore, only at the end of a certain time, which may be longer or shorter, that this iodine becomes entirely absorbed by the plate, and that the latter may be withdrawn from the camera, without fearing that the action of the free iodine should destroy the effect produced by the light."

In view of this theory, it is easy to account for the action of the accelerating substances: they have a very great affinity for iodine, and absorb it as fast as it is liberated by the action of light. Any substance therefore which will increase this affinity, or any method of preparing and using a plate which will aid the absorption of the free iodine, will shorten the time required for producing the photogenic effect, and add to the beauty of the proof.

We now give the process, as we have practiced it for some time past with the most gratifying results.

1. *Polishing the Plate.* Rub the plate, about as much as by the ordinary process, with *rotten stone* and well filtered *spirits of turpentine.* Dry off, *as much as possible*, with a clean cotton; and with another clean cotton, *well wet* with good alcohol, rub the plate again for *some time*, keeping it wet with alcohol. Dust on another clean cotton an abundance of *very finely powdered starch*, and rub *one or two minutes*, frequently renewing the dose of starch. Then buff as usual, only use on the first buff *frequent doses of starch*, instead of buff powder, and use the velvet buff naked, *Carefully dust off* the plate, and it is ready for coating.

The plate in this way receives a high polish; but a *coating of resinous matter is spread over its surface*, which absorbs a portion of the free iodine, as the light liberates it.

2. Use the "acid quick stuff," with the addition of ½ a part of *hydrobromic acid.* We prefer this to any other, for general use, but especially for this process.

3. Mix 1 part *hydrobromic acid* with about 8 of water, and keep a wide, short phial partly filled with it, between the plate and lenses of the camera. This will aid in absorbing the free iodine; at the same time, it will keep the vapors from attacking the lenses of the camera.

In all other respects, proceed as usual. In saying that there is a *resinous coating left on the plate*, we do not mean that you can see such a coating. The peculiar *feel* of the plate under the buff, its *smell*, and the action of water upon it, is convincing proof that it is there. The process should be conducted in such a way that the plate shall *appear* bright and clear, and have a fine black polish. The plan recommended, if properly followed up, will invariably produce this result; but it will, at the same time, leave a slight, imperceptible film of organic matter on the plate, which, we KNOW, by the best of all tests, *practice*, is highly favorable to the photogenic effect. We cannot too highly recommend our readers to adopt the process at once. We do this, however, on condition that they will do *just as we have directed*, and persevere until they attain the desired point. This process, conducted carelessly, will give the most out-landish-looking images imaginable; but in skillful hands we may challenge the world to surpass its results.

GALVANIZING.

That a well-galvanized plate, i. e., a plate covered with a thin, fresh coating of pure silver, by means of galvanism, will produce a very superior picture, other things being equal, we make no doubt. The process is however a tedious, and, without great skill, and very careful manipulation, an uncertain one. It is not, we believe, as much in use among the best operators as formerly. The following directions are simple, and easy to follow: procure a "*Smee's battery*," and a "*solution cup.*" Charge the battery by filling it with a mixture of 1 part of *sulphuric acid*, and 15

parts of water. Prepare the *silver solution* as follows: dissolve, in equal parts of *nitric acid* and water, a silver dollar, or silver to that amount. Add to this liquid a large excess of strong salt water. This will precipitate the silver, in the form of a chloride, (the chlorine of the salt having united with it,) which has a curdy, white appearance. Let it settle, pour off, the liquid, and wash the precipitate with several waters. Dissolve in 1 quart of water 4 oz. of *cyanide* of *potassium*. Put into this the chloride of silver, and agitate until all is dissolved. Filter, and pour it into the solution cup. Attach a *buffed plate* to the wire coming from the zinc of the battery, and to the other wire attach a thin plate of silver. Keep the plate and *annode*, or silver plate, parallel with each other, and from two to four inches apart. If the action of the battery is too rapid, pour out part of the acid water. The plate should attain a fine, uniform sky-blue tint, in one or two minutes. If dark streaks are formed, the action is too rapid. When the plate is brought to a good sky-blue color, it should be well rinsed, dried, and slightly buffed, when it is ready for the coating-box.

Instead of the *chloride*, some prefer the *nitrate*, or *oxide* of silver. The nitrate is made by partially evaporating the first solution, and setting it aside to crystalize. The oxide is prepared by adding to the first solution, a large quantity of lime water. This will throw down the silver in the form of a brown powder, which should be well washed. Either may be used, with the above proportion of cyanide of potassium.

A plate may be galvanized without a battery, by placing its back upon a sheet of zinc, and immersing both in the silver solution. The zinc may be turned up on its lower edge in the form of a hook, to hold

the plate. The solution, on this plan, must be frequently strengthened.

CHAPTER VI.

COATING THE PLATE.

The iodine may be freed from moisture by the means pointed out in Chapter IV. A very excellent method, to quicken the chemicals in cold weather, is to *warm* the iodine and bromine boxes before a fire, frequently turning them round. They should have time to stand before using, that they may be cooled down to the temperature of the room. An operating room should be kept comfortably warm, and the dark place for coating the plates in, should be in a warm corner in winter, and a cool one in summer. A little cotton wool placed over the iodine, and a thin muslin cover underneath the little frame that holds the plate, in the other box, will prevent a too rapid vaporization. The iodine should be kept spread evenly over the bottom of the jar.

A plate properly coated, will have what is called the *maximum of sensitiveness;* i. e., the proportions of iodine and bromine will be such as to produce the greatest degree of susceptibility to the action of light of which the chemicals are capable. It is by keeping this in view, that an operator may employ a variety of coatings, thus diversifying the tone, while the sensitiveness of the plates will not materially vary. Thus, a plate iodized to a *pale lemon color*, and bromined to a *light gold color*, will give a picture in which the lights and shades are very intense, and in strong contrast. Iodized to a *deep red*,

and bromined to a *steel blue*, the proof will be dull and heavy. The two extremes, therefore, of light and heavy coatings, are to be kept in view, and the operations to be governed accordingly. An artist should, however, have a favorite tint, which he should carry with him as the "apple of his eye;" around this point he should work, and keep within reasonable limits, instead of shifting from one point to another of the solar spectrum.

What then, is *the tint* which has been found most favorable? We answer that, with our "*acid quick stuff*," a fair *gold color* over the iodine, and the first tint of *rose color* over the quick, is, in our judgment, the best. It is the best adapted to the great variety in countenances, and to produce, with slight changes, a diversity of tone. The plate should be placed back over the iodine from 1-10th to 1-2 the time of the first exposure. Iodizing to a light lemon, and bromining to a light gold, will give intense *whiteness* to the light parts of the picture, such as the face, linen, &c.; while a dark coat, or the like, will be very black. A straw color over the iodine, and a bright orange over the quick, will give a tone inclining to *yellow*. A fair *lemon*, united to a deep *straw* color, will give, with many countenances, a sort of grey tone, combining in an eminent degree, the qualities of *sharpness* and *softness*. A *deep yellow*, with a *deep rose*, give a strong, but not very sharp picture. An *incipient rose* over the iodine, and a deep red approaching violet, over Mayall's quick, fluoride of bromine, chloride of bromine, or the three-second sensitive, gives an exceedingly rich and deep-toned impression. In all the above, and in all other cases, the plate should be *re-iodized*, more or less, according as the shades are wanted more or less intense.

The accelerating substance employed, should be

of such a strength that it will coat a plate in from 3 to 30 seconds. The stronger it is used the better, provided it gives an even coating. A batch too strong may frequently be regulated by exposing it in the open air, with the cover off, for a few moments. When a battery has stood without use for an hour or so, the slide should be run in and out a few times to get rid of the excess of vapor.

☞ Whatever tint of coating you may employ, be sure and use the *right proportions* of iodine and bromine. A little practice will enable you to do this without difficulty. Look at your plate by the reflection of a sheet of white paper, in your dark room. Admit the light freely during the process of coating. When you get *almost* the color you wish, run the plate over the bromine for a second, and re-iodize it in *total darkness*.

☞ Frequently, from a movement on the part of the sitter, or something else, you may foreknow that you will not have a good picture. In this case, to save re-polishing the plate, replace it over the bromine a moment, and it will be nearly, or quite as sensitive as before. The bromine in this case, (and iodine will do the same,) destroys the action of the light; and hence the necessity of keeping plates, on which the light has acted, out of contact with these vapors, before mercurializing them.

CHAPTER VII.

THE CAMERA.

Focus. This should be obtained on the *eyes;* and then, if your camera does not work so close as to

admit of no latitude, it should be divided between the eyes, hair, lips, texture of the skin, &c. One cause of a want of sharpness, is often a neglect of the above simple rule. In taking a smooth, handsome face, or one with many wrinkles, as that of an aged person, this rule should be strictly followed. For a *freckly* face, it is better to reverse the rule, and throw the freckles a little out of focus. In taking a group, the faces should be brought in a range with each other, and the focus divided between them, and all so arranged as to balance the effect.

Position and *attitude* should receive a large share of the artist's attention. This being a matter of taste, cannot be taught. A *natural* attitude is always proper; but *the* natural posture of many persons is so ridiculously awkward, that it would be unpardonable in the artist not to make an effort to improve it.

The *view of the face* should depend much on its physiognomy. Some persons look well with a full front view, but generally the face should be taken a little quartering. Occasionally, a profile only will answer.

Children. Strive to get their confidence, and to obtain an influence over them. A little confidence in this respect will often secure success, where chemicals would otherwise fail. We recommend that a battery of our "Three-second Sensitive" should be kept on hand expressly for children.

Copies, such as paintings, engravings, &c., should be placed paraliel with the lenses, and in such a position as to obviate the gloss.

Landscapes. It is better to take these when the sky is overcast. A *reflector* will prevent the view from being reversed.

CHAPTER VIII.

MERCURY.

Purchase the pure *distilled quicksilver*, and keep it clean, by filtering it occasionally through a paper cone with a very fine opening.

The article usually sold by druggists is alloyed with lead and bismuth. We are indebted to *James Renwick, L.L.D.*, Professor of Chemistry in Columbia College, for the following simple method of purifying mercury: "Agitate it in a glass bottle having a ground glass stopper, opening the bottle from time to time to admit fresh air. The metals named will be oxidated, in consequence of their being rendered electro-positive by contact with the mercury. When their oxidation is complete, a sudden increase in brilliancy will be observed at the surface of the liquid. The oxides thus formed are solid, and the mercury may be separated from them by pouring it through a clean, white paper funnel, whose orifice is so small that the metal runs through in a fine stream. Another way is to agitate it with dilute nitric acid. The nitrate of mercury formed, will be decomposed by the other metals. Their nitrates may be dissolved by washing with water, until it runs off clear. The water is to be separated by heating the mercury until the whole of the water shall have boiled away. It is then to be filtered as above. When mercury has merely become dirty by exposure to the air of a laboratory, it may be cleansed by rubbing it it in a mortar with sugar, and filtering."

The proper quantity of mercury to be used in the

bath, is from 4 to 8 ounces. It may be used at a high or low temperature, but most operators prefer the former. A good way to determine the point is this: if you use a low temperature, ascertain what is the proper heat, by keeping the plate over a definite time, say five minutes, and observing the effect; the high temperature may be that just above which the picture will cloud. This last is as we use it; but we find it necessary to employ a steady heat by keeping the lamp under the bath all day. We keep the plate over from two to three minutes, according to the effect we wish to produce. It should be borne in mind that a daguerreotype picture is made of mercury; the plate should, therefore, receive as large a dose as it will bear, without producing the peculiar mist, or foggy appearance, which is due to an excess of mercury. The point on the thermometer scale of *Lewis Bath*, is, for the high temperature, 90; for the low, 75. Scales differ on different baths. The common Farenheit scale requires to be raised to about 175.

An excess of mercury may be known in several ways, viz.: those parts which would otherwise be *black*, will have a sort of brown, ashy hue; frequently a blue scum will settle in the shades, or the whole picture will look dim, somewhat as it does from an excess of bromine. There is, however, *no occasion whatever* for uncertainties in this matter. Only prepare the plates properly, and use the mercury at the right point, with a steady heat, and the time of exposition will vary but little. A large plate will require a little longer time than a small one.

As to the *manner* of exposing a plate, we recommend that the plate-box should be placed on the bath, and the slide withdrawn. In this way, any fumes of bromine or iodine, which may be afloat in the

room, will be avoided, besides the certainty of keeping the plate entirely excluded from light.

A long exposure, say from ten to forty minutes, at a very low heat, gives the minor details of the picture exceedingly sharp; but it does not give that bold, smooth, soft, deep-toned proof which is so desirable, and so much admired. Mercury performs an important part in giving tone to a picture, and we earnestly invite our daguerrian brethren to avail themselves of the gratification which is connected with an attentive observation of the beautiful and varied phenomena exhibited by this agent.

CHAPTER IX.

GILDING.

To prepare a daguerreotype for gilding, it is necessary to wash from it every trace of undecomposed chemical, with a solution of *hyposulphite of soda*. This solution may be made of the strength of 1 table-spoonful of the soda to 1 pint of water, which should be well filtered through paper. Much of the hyposulphite of soda which is sold, contains a portion of *sulphuret of soda*, which is very injurious to the process. From this it may be entirely freed, by adding to the solution about half an ounce of alcohol. This soda wash should be kept clean by frequent filtering, and renewed every few days.

Grasp about half an inch of the lower left-hand corner of the plate with a pair of nippers, and holding the plate with the other hand, turn up the corner at a right angle, towards the face of the plate. Draw the nippers back a little, and turn another

right angle towards yourself; thus you will raise the mouth of the nippers out of reach of the liquid, and prevent the gilding from running off. Breathe on the plate, pour on a sufficiency of the soda wash to cover it, and shake it about; repeat the dose of soda until no sign of chemical is left. Then drench the plate thoroughly with pure water, by pouring it across the top of its face, holding the lower right-hand corner inclined downward. Now, hold the plate level, and pouring on as much gilding as it will well hold, proceed to apply a *very strong blaze* from a spirit lamp to every part of the under surface, constantly agitating the plate. The picture will soon grow dark and cloudy, but will presently clear up, and assume a bright, lively appearance. Now pause, and examine the picture: if you think it may be further improved, heat it a few seconds longer. Rinse the plate by pouring clean water upon it, and dry it off by applying the blaze to the upper part of its back, and so downward, and gently blowing upon it.

The *Gilding Solution* is prepared thus: in a clean, dark* bottle, place 1 pint of pure, soft water, and 15 grains of pure *chloride of gold.* In another clean, dark bottle, place the same quantity of water, and 60 grains of *hyposulphite of soda*, or *hyposulphate of potash* (the former being preferable), and 1 tea-spoonful of *alcohol.*† Shake the bottles, and when the gold and soda are dissolved, pour the gold solution into the other, litile by little, agitating between each addition. The above corresponds with M. Fizeau's original recipe, excepting the alcohol; but

* Light decomposes the solution.

† Mr. Lerow, of Boston, adds a little *sulphate of soda*, commonly known as *Glauber's salts.*

we prefer to prepare the gilding much stronger, being in the habit of using a little less than a pint of water in all, for the above quantity of gold. It is also a great improvement to add to it, after it has stood a few hours, half a tea-spoonful of *chlorate of potash.* This gives it increased bleaching properties. Some persons add to every 2 or 3 ounces (filtered for use), 1 drop of *aqua ammoniæ.*

Errors in Gilding. Many operators get alarmed, and stop gilding, as soon as the *cloudy stage* comes on; whereas, this is but a sign of the mysterious union which is forming between the gold and the other metals. Others run into the opposite extreme, and continue the heat until the tone of the picture is destroyed; or, until the coating of gold becomes so thick as to dim the picture. Continued still longer, the compound metalic coating, which is formed upon the surface of the plate, will become oxidated, and exfoliate, when of course the picture is ruined. Another great error consists in using too small a blaze; for in this case, the metals are not sufficiently heated to fully develop their affinity for the gold. A very unreasonable mistake is made by some, in expecting that gilding will make a good picture out of a poor one. It would be no more absurd to suppose, that a mere daub of a bungler's brush, could be converted, by virtue of a little varnish, into a production worthy of the pencil of a Raphael. The most advisable way to dispose of a poor, dull impression, is to rub it out.

Solution for removing Specks. Impure water, used in mixing the gilding, or for rinsing, will generally deposit little specks, frequently so numerous as greatly to deface a picture. They usually make their appearance in, or after drying off the plate. The following is our method of removing them: dis-

solve in 4 oz. of water a lump of *cyanide of potassium* about as large as a small walnut. The precise quantity of the potash is not material, so long as you use enough to remove the specks, and not so much as to cause a scum on the plate. Filter the solution, wet the plate with water, pour on as much of the solution as it will hold, and heat until the specks disappear; rinse and dry. If you have no water but such as caused the specks, use a very small quantity in this last rinsing.

Liquid for increasing the brilliancy of the gilded picture. To a solution made as above, add 1 teaspoonful of a mixture of equal parts of pure *carbonate of potash*, (saleratus will answer, but is not so good,) *alum, purified borax, common salt, gallic acid, and sulphate of copper.* Pour a little on the plate while wet, and heat with a very powerful blaze for a *few seconds.* Rinse and dry as usual.

COLD PROCESS OF GILDING.

Dissolve 10 grains of *chloride of gold* in 3 gills of water, and 300 grains of *hyposulphite of soda* in another 3 gills of water. Pour the gold solution into the other, a little at a time, agitating between each addition. Of this, pour a sufficiency into a saucer to cover the plate, and add to it 1 drop of aqua ammoniæ. Immerse the plate, *with the chemical on*, and agitate briskly, so as to dissolve rapidly the coating. As soon as it appears white, cease all rapid motion, but continue to give it a slight undulating one; for if it were to remain still, the picture would cloud. The plate gradually takes on a yellow tint, continuing to grow darker, approaching to bistre. You stop, therefore, at the color you wish; if the operation has been performed with care, the picture will

be fixed, and will have an exceedingly warm tone, of a golden cast. By increasing the proportion of *chloride of gold*, or of the *ammonia*, the operation could be performed more rapidly, but the gold would be deposited irregularly, being thickest towards the border. The process, properly performed, requires from ten to fifteen minutes. The same solution may be used with heat, as usual, only it is poured on the plate while the chemical is yet on.

CHAPTER X

COLORING.

It is a trite remark with some persons, that a first-rate daguerreotype should not be colored—that it would be a mockery of the delicate executions of nature. In our opinion, if the time ever comes when nature shall clothe these images with her own exquisite hues, the person who then uses the brush will commit the above sin; but while she confines her mysterious pencilings to light and shade, it is no more of an intermeddling with her work to color a photographic image, than it is to dye cotton fabrics. Occasionally, we allow, there comes to light a daguerrian image so perfectly *messotint*, that it would be better to encase it at once, just to show what dame nature can do in this line. But as a *general* thing, a suitable amount of coloring, performed artistically, we consider an improvement.

Carmine, Indian Red or *flesh color*, applied only to the cheeks and lips, will sometimes give a very pleasing effect. Usually, however, it is preferable to give to the whole face, hands, &c., a tint of flesh-

color. The cheeks, lips, prominences of the forehead, chin, swell of the hand, arm, &c., should be most highly colored, making each of these points a sort of centre, around which the filling up should be made in regular gradations, with a view to connecting the parts in such a way as to avoid the appearance of the color having been put on.

But little color should be taken on the brush at once, and the brush lightly handled. It will be found advantageous to keep a little color spread on a piece of paper, as in this way it will be more free from moisture than that in the phials. It is found necessary to apply a little more color than you wish to have remain, the excess being carefully worked off with a duster.

COMPOUNDING COLORS.

Indian red king's yellow, and *carmine* used in different proportions, will give any desirable tint of *flesh color*. Spread a quantity of the very best and brightest copal varnish on a piece of glass or earthen, and let it dry, Scrape it off and pulverize it very fine in a porcelain mortar. Grind this and the above colors together, until they attain the utmost degree of fineness, and you will have a flesh-color as lustrous as the cheek of beauty itself, The very *best kind* of *ladies rouge* is super-excellent.

Prussian blue, *Chinese blue*, and *ultra-marine*, may be used on the drapery to advantage. The latter will adhere better for being ground with a little starch.

Oxide of bismuth is used for *white*.

Chrome yellow, *white* and *red*, form any shade of *straw*, *buff*, or *orange*.

Blue and *yellow* form *green*,—*red* and *blue*, a *violet*, *purple*, *or crimson*.

Gold and Silver Saucers. Grind gold or silver-leaf in honey, or gum water, to extreme fineness. Wash out the gum or honey. Mix the powder with a very small portion of a strong solution of isinglass, and spread it upon a shell, or piece of glass. This is used with a wet brush, for representing jewelry. A saturated solution of *chromate of potash*, put on with a fine pen, answers admirably. *Gamboge* may be used, in the absence of the above. The stones of breast-pins, bracelets, etc., may be represented with wet colors. *Diamonds* are handsomely imitated by picking the plate with a needle.

Carmine, to make. Boil 1 oz. of finely powdered *cochineal* in 5 or 6 quarts of rain, or distilled water, in a tinned copper vessel, for 3 minutes; add 25 grains powdered *alum;* continue the boiling 2 minutes longer, and let it cool. Draw off the clear liquor, as soon as it is only blood-warm, into shallow vessels; put them by for a couple of days, by which time the carmine will have settled. In case the carmine does not separate properly, a few drops of muriate of tin, or of a solution of copperas, will throw it down immediately. The water being drawn off, the carmine may be dried in a moderately warm oven.

Cochinellin. Digest *aqua ammoniæ* on carmine, until all the color is taken up; filter, and add acetic acid and alcohol, until the whole is precipitated. Lastly, carefully wash with alcohol, and dry in the shade. In this way, may be produced carmine of the richest and most lustrous hue, even from samples of an inferior quality.

ENAMELING, BRONZING, ETC.

Place the glass over the plate in exactly the po-

sition it is to occupy. Trace, on the upper side of the glass, with a very fine pen and ink, the outlines of the picture. Remove the glass, and trace its lower side. With a soft brush, cover the lower side of the glass, outside the tracing, with black or any other colored varnish. The varnish may be prepared by grinding with it lampblack, ultra-marine, vermilion, or any other color you wish. The operation, if performed neatly, has every appearance of the best enameling. The effect is heightened by placing the glass in immediate contact with the plate, and the mat outside.

Bronzing may be performed by covering the entire back ground of the *plate* with a suitable *sizing;* and, before the size has time to dry, dusting on it finely pulverized plumbago, oxide of cobalt, metalic antimony, gold, copper, or silver bronze, ultra-marine, vermilion, or carmine. When it is perfectly dry, it should be carefully dusted. The sizing may be made of copal varnish, spirits of turpentine, and a little white lead, ground together in such proportions that they will neither spread, nor dry too quick.

CHAPTER XI.

ON THE REPRODUCTION OF THE PROOFS BY THE ELECTROTYPE.

The first impressions reproduced by the electrotype, were obtained by M. H. Fizeau; and we may say, that these first essays have not been since surpassed; for the large plates that he produced were admirable.

We imagine that many amateurs, when informed

of the extreme facility with which they can now operate, by means of the new batteries invented by Bunsen, will devote themselves to this species of reproduction, which gives such fine results. We must confine ourselves here to pointing out to them the minute precautions which are necessary to avoid spoiling the original plate and its copy. Two apparatus are necessary to obtain a reproduction: 1st, One of Bunsen's cells; 2nd, A glass precipitating-trough, to contain a saturated solution of sulphate of copper.*

The plate must first be entirely divested of all traces of hyposulphite, and it is *indispensable* that it should be perfectly fixed by the chloride of gold.

When the metalic coating is judged to be of sufficient thickness—and, in this case, that of a stout card suffices—the plate should be rinsed copiously in water, and then dried either with sawdust or blotting-paper. If you wish to preserve on the plate the beautiful rosy hue of the mother-of-pearl opal, which the deposite should leave on its being taken out of the bath, hasten the drying of it, after passing it once through the water, by wetting it with spirits of wine, which you also dry up with blotting-paper.

The separation of the deposite from the plate may be attended with an accident which spoils them both. It often happens that a small drop of liquid remains unperceived under the wax which covers the borders of the plate, and that, at the instant when you lift up the deposite with the blade of a knife, this drop works itself into the capillary space thus formed, and wets the deposite and the plate which are in-

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* The electrotype of Boquillon may also be used; but only for the plates of the 1-6th size.

fallibly stained if the liquid contains any remaining particles of the sulphate of copper.

The most secure process for separating the two plates consists, when the deposite is not too thick, in cutting with a pair of strong scissors a band of about two millimètres in width all round the two plates, which then separate with the greatest facility.

The affinity of oxygen for copper being much greater than for silver, the counter-proof must be withdrawn as soon as possible from the contact of the air, by placing it in a skeleton frame; and above all, the greatest care must be taken not to touch its surface with anything whatsoever. It is, moreover, necessary to observe the nicest precaution in preventing all dust, or other foreign substances, from lodging on the surface of the plate, otherwise the copy would be found disfigured with their corresponding traces.

Having thus explained the most essential conditions to be observed, we will now enter into some further details of the operation. Lay hold of the silvered plate by one of its sides; or, if a small plate, by one of its angles, and keep that part free from oxidation, in order to attach it to the connecting wire of the trough, to which the positive pole (zinc) of the battery is joined, and the whole is held fast with a binding screw.

The back of the plate is then covered with a coating of varnish, composed of one-third of essence of turpentine and two-thirds of beeswax, or simply of beeswax alone, in order to avoid a useless deposite of copper. Care must be taken that this coating of varnish, which should be applied hot, should be of a certain thickness, and should not interpose between the plate and the connecting wire of the precipitating

trough, or it would interrupt the metalic contact necessary to the success of the operation.

The sulphate of copper solution must be carefully filtered, and it must be saturated in cold water.*

When all is prepared, put the positive electrode (a copper plate, which dissolves in the trough,) in connexion with the negative pole of the battery, (carbon,) and immerse it in the bath; establish also a connexion between the proof to be reproduced and the other pole, (zinc,) and when firmly attached by means of one or more binding-screws, it must be immersed in the bath, when it will immediately become covered with copper.

A single battery of Bunsen, charged outside with pure nitric acid, and with a mixture composed of one part of sulphuric acid and fifty parts of water, in the interior of the porous vessel, will suffice to reproduce, in the space of a few hours, a large plate of 16 centimètres by 0·22. The expense consists, therefore, only in the value of the copper deposited; and when it is considered that, with so very small an outlay, you may be able, after one or two experiments, to reproduce and multiply, without any risk of failure, the finest photographic impressions (which are always very much prized), with a very warm tone, and in an admirable degree of perfection; when you reflect that the same small apparatus may serve for a number of other applications, one is really surprised that it should not be more generally adopted.—*Egerton's Treatise.*

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* In order to have a solution always ready, it will be well to keep it in a large glass bottle; it will be known that it is sufficiently saturated, when after having shaken it several times, the liquid ceases to dissolve the few crystals of sulphate of copper which remain at the bottom in excess.

A VOLTAIC PROCESS FOR ETCHING DAGUERREOTYPE PLATES. BY W. R. GROVE, ESQ., PROFESSOR OF EXPERIMENTAL PHILOSOPHY IN THE LONDON INSTITUTION.

Dr. Berres, of Vienna, was the first, I believe, who published a process for etching daguerreotypes. His method was to cover the plates with a solution of gum-arabic, and then to immerse them in nitric acid of a certain strength. I have not seen any plates thus prepared, but the few experiments which I have made with nitric acid have given me a burred and imperfect outline: and I have experienced extreme difficulty of manipulation from the circumstance of the acid never attacking the plate uniformly and simultaneously. My object, however, in this communication, is not to find fault with a process which I have never perhaps fairly tried, or seen tried by experienced hands, and the inventor of which deserves the gratitude of all interested in physical science; but to make public another, which possesses the advantage of extreme simplicity, which any one, however unskilled in chemical manipulation, may practice with success, and which produces a perfect etching of the original image; so much so, that a plate thus etched can scarcely be distinguished from an actual daguerreotype, preserving all the microscopic delicacy of the finest parts of the impression.

One sentence will convey the secret of this process; it is to make the daguerreotype the *anode* of a voltaic combination, in a solution which will not of itself attack either silver or mercury, but of which, when electrolysed, the anion will attack these metals unequally. This idea occurred to me soon after the publication of Daguerre's process; but,

being then in the country, and unable to procure any plates, I allowed the matter to sleep; and other occupations prevented for some time any recurrence to it. Recently having heard much conversation as to the practicability or impracticability of daguerreotype engraving, I became anxious to try a few experiments in pursuance of my original notion; and for this purpose applied in several quarters for daguerreotypes; but, thanks to the exclusiveness of M. Daguerre's patent, I found that to procure a sufficient number of plates, for any reasonable chance of success, was quite out of the question.

On mentioning the subject to Mr. Gassiot, he, with his usual energy and liberality, offered to procure me a sufficiency of daguerreotypes; and it is owing to his zealous and valuable co-operation that I have been able to get such definite results as appear worth publication.

Five points naturally present themselves to the consideration of the experimenter on this subject:—first, the quantity of the voltaic current; secondly, its intensity; thirdly, the distance between the anode and cathode; fourthly, the time during which the process should be continued; and fifthly, the solution to be employed.

1st. With regard to the first element, or quantity, many previous experiments had convinced me, that to give the maximum and most uniform quantitative* action of any voltaic combination, the electrodes should be of the same size as the generating plates; in other words, that the sectional area of the electro-

* I say quantitative action; for, where great intensity is required, as in decomposing alkalis, &c., it may be advisable to narrow the electrodes, so as to present a smaller surface for the reaction of the liberated elements.

lyte should be the same throughout the whole voltaic circuit. It seems strange that this point should have been so generally overlooked as it has been; an electrician would never form a battery, one pair of plates of which was smaller than the rest; and yet the electrodes, which offering of themselves a resistance to the current, from the inoxidability of the anode, are, *a fortiori*, a restriction when of small size, have generally been formed indefinitely smaller than the generating plates; I, therefore, without further experiment, applied this principle to the process about to be detailed.

2nd. *The intensity of the voltaic current.*—Here it appeared to me, that, as in the electrotype, where the visible action is at the cathode, a certain degree of intensity throws down metal as a crystal, an increased intensity as a metalic plate, and a further intensity as a pulverulent mass; that degree of intensity which would show on the negative deposite the finest impressions from the cathode, would also produce on the anode the most delicate excavations, and consequently an intensity which would just fall short of the point of evolving oxygen from the plate to be etched, would be the most likely to succeed. This point was not, however, adopted without careful experiment, the more so, as in one instance Mr. Gassiot succeeded in procuring a very fair etching with a series of ten pairs of the nitric acid battery; however, the results of repeated experiments, in which the intensity has been varied from a series of sixteen pairs to one of the nitric acid battery, were strongly in favour of the above idea, and consequently went to prove that one pair gives the most efficient degree of intensity for the purpose required.

3rd. *The distance between the plates.*—As it was proved by De la Rive, that in an electrolytic solution,

when the electrodes are at a distance, the action extends a little beyond the parallel lines which would join the bounds of the electrodes, and thus, that the current as it were diverges and converges, it appeared advisable to approximate the electrodes as nearly as possible, so as to produce uniformity of action over the whole plate. Provided a solution be used which does not evolve gas at the cathode, I am inclined to think that the plates may be with advantage indefinitely approximated; but, as this was not the case with the solution I selected for the greater number of experiments, 0·2 of an inch was fixed on as the distance, in order that the gas evolved from the cathode should not adhere to the anode, and thus interfere with the action.

4th. *Time of continuing the operation.*—This was a matter only to be decided by experiment, and must vary for the voltaic combination and solution employed. With a single pair of the nitric acid battery, from twenty-five to thirty seconds was, after a great number of experiments, fixed on as the proper time: and as the plate may at any period be removed from the solution and examined, the first experiment should never exceed twenty-five seconds, when, if not complete, the plate may be again subjected to electrolysis.

5th. *The solution to be employed.*—Here a vast field was open, and still is open, to future experimentalists. Admitting the usual explanation of the daguerreotype, which supposes the light parts to be mercury, and the dark silver, the object was to procure a solution which would attack one of these, and leave the other untouched. If one could be found to attack the silver and not the mercury, so much the better; as this would give a positive engraving, or one with the lights and shadows, as in

nature; while the converse would give a negative one. Unfortunately, silver and mercury are nearly allied in their electrical relations. I made several experiments with pure silver and mercury, used as the anode of a voltaic combination; but found, that any solution which would act on one, acted also on the other. All then that could be expected, was a difference of action. With the daguerreotype plates I have used the following:—

Dilute sulphuric acid, dilute hydrochloric acid, solution of sulphate of copper, of potash, and of acetate of lead. The object of using acetate of lead, was the following:—With this solution, peroxide of lead is precipitated upon the anode; and, this substance being insoluble in nitric acid, it was hoped that the pure silver parts of the plate, being more closely invested with a stratum of peroxide than the mercurialized portions, these latter would, when immersed in the menstruum, be attacked, and thus furnish a negative etching. I was also not altogether without hopes of some curious effects, from the color of the thin films thus thrown down; here, however, I was disappointed: the colors succeeded each other much as in the steel plate used for the metallochrome; but with inferior lustre. On immersion in nitric acid of different degrees of dilution, the plates were unequally attacked, and the etching burred and imperfect. Of the other solutions, hydrochloric acid was, after many experiments, fixed on as decidedly the best: indeed, this I expected from the strong affinity of chlorine for silver.

I will now describe the manipulation which has been employed by Mr. Gassiot and myself, in the laboratory of the London Institution, with very uniform success. A wooden frame is prepared, having two grooves at 0·2 of an inch distance, into

which can be slid the plate to be etched, and a plate of platinum of the same size. To ensure a ready and equable evolution of hydrogen, this latter is platinized after Mr. Smee's method; for, if the hydrogen adhere to any part of the cathode, the opposite portions of the anode are proportionably less acted on. The back and edges of the daguerreotype are varnished with a solution of shell-lac, which is scraped off one edge to admit of metalic connection being established. The wooden frame with its two plates, is now fitted into a vessel of glass or porcelain, filled with a solution of two measures hydrochloric acid, and one distilled water (sp. gr. 1·1); and two stout platinum wires, proceeding from a single pair of the nitric acid battery, are made to touch the edges of the plates, while the assistant counts the time; this, as before stated, should not exceed thirty seconds. When the plate is removed from the acid, it should be well rinsed with distilled water; and will now (if the metal be homogeneous) present a beautiful sienna-colored drawing of the original design, produced by a film of the oxychloride formed;—it is then placed in an open dish containing a very weak solution of ammonia, and the surface gently rubbed with very soft cotton, until all the deposit is dissolved; as soon as this is effected, it should be instantly removed, plunged into distilled water, and carefully dried. The process is now complete, and a perfect etching of the original design will be observed; this, when printed from, gives a positive picture, or one which has its lights and shadows as in nature; and which is, in this respect, more correct than the original daguerreotype, as the sides are not inverted; printing can therefore be directly read, and in portraits thus taken, the right and left sides of the face are in their proper position. There is, however, *ex necessitate rei*,

this difficulty, with respect to prints from daguerreotypes,—if the plates be etched to a depth sufficient to produce a very distinct impression, some of the finer lines of the original must inevitably run into each other, and thus the chief beauty of these exquisite images be destroyed. If, on the other hand, the process be only continued long enough to leave an exact etching of the original design, which can be done to the minutest perfection, the very cleaning of the plate by the printer destroys its beauty; and, the molecules of the printing ink being larger than the depths of the etchings, an imperfect impression is produced. For this reason, it appeared to me, that at present, the most important part of this process is the means it offers of multiplying indefinitely daguerreotypes, by means of the electrotype. An ordinary daguerreotype, it is known, will, when electrotyped, leave a faint impression; but in so doing it is entirely destroyed; and this impression cannot be perpetuated; but one thus etched at the voltaic anode, will admit of any number of copies being taken from it. To give an idea of the perfect accuracy of these, I may mention, that in one I have taken, on which is a sign-board measuring on the electrotype plate 0·1 by 0·06 of an inch, five lines of inscription can, with the microscope, be distinctly read. The great advantages of the voltaic over the chemical process of etching, appear to me to be the following:—

1. By the former, an indefinite variety of menstrua may be used; thus, solutions of acids, alkalies, salts, more especially the haloid class, sulphurets, cyanurets, in fact, any element which may be evolved by electrolysis, may be made to act upon the plate.

2. The action is generalized; and local voltaic currents are avoided.

3. The time of operation can be accurately determined; and any required depth of etching produced.

3. The process can be stopped at any period, and again renewed if desirable.

The time I have given is calculated for experiments made with one pair of the nitric acid battery; it is, however, by no means necessary that this be employed, as probably any other form of voltaic combination may be efficient. It would seem more advisable to employ a diaphragm battery, or one which produces a constant current, as otherwise the time cannot be accurately determined. It is very necessary that the silver of plates subjected to this process be homogeneous. Striæ, imperceptible in the original daguerreotype, are instantly brought out by the action of the nascent anion; probably silver, formed by voltaic precipitation, would be found the most advantageous. I transmit with this paper some specimens of the prints of the etched plates, and of electrotypes taken from them; and in conclusion, would call attention to the remarkable instance which these offer, of the effects of the imponderable upon the ponderable; thus, instead of a plate being inscribed, as "drawn by Landseer, and engraved by Cousins," it would be "drawn by Light, and engraved by Electricity!"

METHOD OF BRINGING OUT A DAGUERRIAN IMPRESSION WITHOUT THE USE OF MERCURY.

The plate is iodized and exposed in the camera about fifteen times longer than when operating with bromine water. On taking it thence, carefully preserving it from the least ray of light, it is put into a kind of sheath covered with yellow glass, and ex-

posed to the direct solar radiation. The time for that exposition cannot be precisely determined; but the operation presents no difficulty, for the operator can see through the yellow glass the progress of the action. The proof is, therefore, only withdrawn when it will be found to have attained the proper point, which it is as easy to appreciate as when using the mercury-box.

By this process, views may be obtained of exquisite delicacy of detail, and of a very peculiar tone.

With the accelerating substances the red glass must be used, but we have never obtained by that process results as satisfactory.

CALOTYPING. BY H. F. F. TALBOT, ESQ., F. R. S.

The following is the method of obtaining the calotype pictures:—

Preparation of the Paper.—Take a sheet of the best writing paper, having a smooth surface, and a close and even texture.

The water-mark, if any, should be cut off, lest it should injure the appearance of the picture. Dissolve 100 grains of crystalized nitrate of silver in 6 oz. of distilled water. Wash the paper with this solution, with a soft brush, on one side, and put a mark on that side whereby to know it again. Dry the paper cautiously at a distant fire, or else let it dry spontaneously in a dark room. When dry, or nearly so, dip it into a solution of iodide of potassium containing 500 grains of that salt dissolved in one pint of water, and let it stay two or three minutes in this solution, then dip it into a vessel of water, dry it lightly with blotting-paper, and finish drying it at a fire, which will not injure it even if

held pretty near; or else it may be left to dry spontaneously.

All this is best done in the evening by candlelight. The paper so far prepared, the author calls *iodized paper*, because it has a uniform pale yellow coating of iodide of silver. It is scarcely sensitive to light, but, nevertheless, it ought to be kept in a portfolio or a drawer, until wanted for use. It may be kept for any length of time without spoiling or undergoing any change, if protected from the light. This is the first part of the preparation of calotype paper, and may be performed at any time. The remaining part is best deferred until shortly before the paper is wanted for use. When that time is arrived, take a sheet of the iodized paper, and wash it with a liquid prepared in the following manner:—

Dissolve 100 grains of crystalized nitrate of silver in two ounces of distilled water; add to this solution one-sixth of its bulk of strong acetic acid. Let this mixture be called A.

Make a saturated solution of crystalized gallic acid in cold distilled water. The quantity dissolved is very small. Call this solution B.

When a sheet of paper is wanted for use, mix together the liquids A and B in equal volumes, but only mix a small quantity of them at a time, because the mixture does not keep long without spoiling. I shall call this mixture the gallo-nitrate of silver.

Then take a sheet of iodized paper and wash it over with this gallo-nitrate of silver, with a soft brush, taking care to wash it on the side which has been previously marked. This operation should be performed by candlelight. Let the paper rest half a minute, and then dip it into water. Then dry it lightly with blotting-paper, and finally dry it cautiously at a fire, holding it at a considerable

distance therefrom. When dry, the paper is fit for use.

Use of the paper.—The calotype paper is sensitive to light in an extraordinary degree, which transcends a hundred times or more that of any kind of photographic paper hitherto described. This may be made manifest by the following experiment:—Take a piece of this paper, and having covered half of it, expose the other half to daylight for the space of one second, in dark cloudy weather in winter. This brief moment suffices to produce a strong impression upon the paper. But the impression is latent and invisible, and its existence would not be suspected by any one who was not forewarned of it by previous experiments.

The method of causing the impression to become visible is extremely simple. It consists in washing the paper once more with the gallo-nitrate of silver, prepared in the way before described, and then warming it gently before the fire. In a few seconds the part of the paper upon which the light has acted begins to darken, and finally grows entirely black, while the other part of the paper retains its whiteness. Even a weaker impression than this may be brought out by repeating the wash of gallo-nitrate of silver, and again warming the paper. On the other hand, a stronger impression does not require the warming of the paper, for a wash of the gallo-nitrate suffices to make it visible. without heat, in the course of a minute or two.

A very remarkable proof of the sensitiveness of the calotype paper, is afforded by the fact stated by the author, that it will take an impression from simple moonlight, not concentrated by a lens. If a leaf is laid on a sheet of the paper, an image of it may be obtained in this way in from a quarter to half an hour.

This paper being possessed of so high a degree of sensitiveness, is therefore well suited to receive images in the camera obscura. If the aperture of the object-lens is one inch, and the focal length fifteen inches, the author finds that one minute is amply sufficient in summer to impress a strong image upon the paper of any building upon which the sun is shining. When the aperture amounts to one-third of the focal length, and the object is very white, as a plaster bust, &c., it appears to him that one second is sufficient to obtain a pretty good image of it.

The images thus received upon the calotype paper are for the most part invisible impressions. They may be made visible by the process already related, namely, by washing them with the gallo-nitrate of silver, and then warming the paper. When the paper is quite blank, as is generally the case, it is a highly curious and beautiful phenomenon to see the spontaneous commencement of the picture, first tracing out the stronger outlines and then gradually filling up all the numerous and complicated details. The artist should watch the picture as it develops itself, and when in his judgment it has attained the greatest degree of strength and clearness, he should stop further progress by washing it with the fixing liquid.

The Fixing Process.—To fix the picture, it should be first washed with water, then lightly dried with blotting-paper, and then washed with a solution of bromide of potassium, containing 100 grains of that salt dissolved in eight or ten ounces of water. After a minute or two it should be again dipped in water, and then finally dried. The picture is in this manner very strongly fixed, and with this great advantage, that it remains transparent, and that, therefore, there is no difficulty in obtaining a copy from it. The calotype picture is a negative one, in which

the lights of nature are represented by shades; but the copies are positive, having the lights conformable to nature. They also represent the objects in their natural position with respect to right and left. The copies may be made upon calotype paper in a very short time, the invisible impressions being brought out in the way already described. But the author prefers to make the copies upon photographic paper prepared in the way which he originally described in a memoir read to the Royal Society, in February 1839, and which is made by washing the best writing paper, first with a weak solution of common salt, and next with a solution of nitrate of silver. Although it takes a much longer time to obtain a copy upon this paper, yet when obtained, the tints appear more harmonious and pleasing to the eye; it requires in general from three minutes to thirty minutes of sunshine, according to circumstances, to obtain a good copy on this sort of photographic paper. The copy should be washed and dried, and the fixing process (which may be deferred to a subsequent day) is the same as that already mentioned. The copies are made by placing the picture upon the photographic paper, with a board below and a sheet of glass above, and pressing the papers into close contact by means of screws or otherwise.

After a calotype picture has furnished several copies, it sometimes grows faint, and no more good copies can then be made from it. But these pictures possess the beautiful and extraordinary property of being susceptible of revival. In order to revive them and restore their original appearance, it is only necessary to wash them again by candlelight with gallo-nitrate of silver, and warm them: this causes all the shades of the picture to darken greatly, while the white parts remain unaffected. The shaded

parts of the paper thus acquire an opacity which gives a renewed spirit and life to the copies, of which a second series may now be taken, extending often to a very considerable number. In reviving the picture, it sometimes happens that various details make their appearance which had not before been seen, having been latent all the time, yet nevertheless not destroyed by their long exposure to sunshine.

The author terminates these observations by stating a few experiments, calculated to render the mode of action of the sensitive paper more familiar.

1. Wash a piece of the iodized paper with the gallo-nitrate; exposing it to daylight for a second or two, and then withdraw it. The paper will soon begin to darken spontaneously, and will grow quite black.

2. The same as before, but let the paper be warmed. The blackening will be more rapid in consequence of the warmth.

3. Put a large drop of the gallo-nitrate on one part of the paper, and moisten another part of it more sparingly, then leave it exposed to a very faint daylight; it will be found that the lesser quantity produces the greater effect in darkening the paper; and in general, it will be seen that the most rapid darkening takes place at the moment when the paper becomes nearly dry; also, if only a portion of the paper is moistened, it will be observed that the edges or boundaries of the moistened part are more acted on by light than any other part of the surface.

4. If the paper, after being moistened with the gallo-nitrate, is washed with water and dried, a slight exposure to daylight no longer suffices to produce so much discoloration; indeed, it often produces none at all. But, by subsequently washing it again with

the gallo-nitrate, and warming it, the same degree of discoloration is developed as in the other case, (experiments one and two). The dry paper appears, therefore, to be equal, or superior in sensitiveness to the moist; only with this difference, that it receives a virtual instead of an actual impression from the light, which it requires a subsequent process to develop.

The above communication from Mr. Talbot was made to the Academy by Mr. Biot, who, at the same time, announced, that he had placed the specimens of sensitive papers sent by Mr. Talbot, in the hands of Mr. Regnault, member of the Academy, who has long devoted his attention to the production of Daguerrian images, in which he has been very successful. Mr. Biot adds the following remarks:—

"As the impressionable papers are destined to become of great utility to travellers, it will not be uninteresting to show that their use may be much improved, if the following precautions are taken:—

"1st. To prepare them always with paper of a very uniform texture.

"2ndly. To adapt to the camera object-glasses, which are not achromatic for the light, but the curves of which are calculated so as to collect, in one focus, all the invisible radiations which act most efficaciously on the impressionable substance employed in their preparation.

"3rdly. To keep them for a very few instants in presence of the objects to be represented, and to continue the development of the image out of their presence, by the influence of the solar radiation, transmitted through a red glass, in conformity with the singular property which the latter possesses, and which was so ingeniously discovered by Mr. Edmund Becquerel."

CHAPTER XII.

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☞ Pictures are put up in a neat Morocco Case for $1.50.

NOTICE TO DAGUERREOTYPE ARTISTS.

Just received, a small invoice of Voightlaender's Quick Working Instruments—new construction. These instruments possess great advantages over all others ever made, covering a 2.3 size Plate, reducing the time of sitting one-half, and producing a sharper, clearer, and better defined picture. They therefore deserve the attention of all artists engaged, or intending to engage, in the business. Price of the tube, $175.

A general assortment of Voightlaender's justly

celebrated instruments, of all sizes, as well as Daguerreotype Materials, at the lowest rates.

Langenheim and Beckers, 201 Broadway, New York, are our authorized agents for the sale of the above instruments. A list of prices can be obtained by addressing (post paid),

W. & F. LANGENHEIM.
EXCHANGE, PHILADELPHIA,

Importers of Daguerreotype Materials, and general Agents for the sale of Voightlaender's Optical Instruments.

SAMUEL MASURY,—an experienced Artist, Providence, R. I.

APPENDIX.

LUNAR PICTURES.

MR. HILL:

SIR,—I succeeded in obtaining, with one of my instruments, a distinct and strongly marked impression of the moon. On that occasion I used a half size camera and medium plate, as prepared for taking a portrait. I found that one minute in the camera was sufficient time to obtain a strong picture, but that if suffered to remain longer, the indistinctness consequent upon the moon's motion, was as clearly exhibited as the movement of a sitter for a portrait. After this experiment, I endeavored to obtain an impression of some object illuminated by the moon's rays, and selected for this purpose a white wooden building. On the ground glass the image was strongly marked, a pane of glass in a window of the building reflecting the light like a concave mirror. The plate was then exposed in the camera for three-quarters of an hour, but no impression was obtained.

The above trial was made upon a clear, moonlight night in November. My next experiment was to obtain an image of some object illuminated by a candle. For this purpose I used a page of music. Its image on the glass was much stronger than that given by the moon in the previous experiment. The plate was allowed to remain in the instrument five minutes, but no impression was obtained save of the candle flame. The image on the plate, if the expression could be used, was strongly "*solarized*," a circumstance that deserves investigation. Another trial was made, and the time reduced to one minute, and a good picture of the flame was the result. Not having obtained by these experi-

ments a copy of the music, further trials were made. I now placed in front of the camera a spirit-lamp, giving a faint blue flame, a good tallow candle giving a whiter light, and an oil lamp giving a dingy yellow flame.

Several plates, prepared so as to be as sensitive as possible, were used, and exposed in the instrument from one to ten minutes. The lights were placed as close together as possible, and in such position that each gave its distinct image upon the ground glass. The page of music gave a stronger image upon the ground glass than the flame of the spirit lamp. On every trial, whether of one or ten minutes' duration, the different flames were strongly marked; but of the music page no impression was obtained until the last one, in which it had been exposed for ten minutes. The impression, however, was very faint, showing only two notes of music, and, on observation, they were found to be the two notes lying between the spirit lamp and tallow candle. It was with great regret that I had to discontinue this interesting pursuit; but I cherish the hope that some ingenious operator may successfully continue the investigation.

CAMERAS.

The formula of Professor Petzel, first executed by Voightlænder of Vienna, has given to the German camera a well-merited celebrity. The quality of the glass has been very uniform, and of the most favorable ratios of refractive and dispersive power. So much depends upon this matter, that attempts to construct cameras of American glass of different density, copying the German curves, are most always failures. If Petzel's formula be adopted, glass similar to the German must be used. If two pieces of flint of different density be ground into lenses of precisely the same curves, their focus will not be alike, and this difference is much greater than is generally supposed. Persons purchasing lenses at one place and tubes at another, expect to have a good camera when they have placed them together:—they would find, however, better instruments, at perhaps the same price,

by purchasing of persons whose stock of lenses and knowledge of adjustment, enable them to arrange the lenses according to their various qualities.

Curves of Petzul's formula or German camera:—

QUARTER.		FRONT LENS.	
Exterior lens.	convex.	Flint lens.	concave.
first surface	9 in. radii	first surface	2.4 in. radii
second do.	2½ do.	second do.	24 do.

The above are cemented together with Canada balsam, which has about the same refractive power as the crown glass. The combined focus for parallel rays, 8 inches.

BACK LENS.

Second flint.		These two are separated by a brass ring, one-eighth of an inch in thickness. Their combined focus is 11 inches.
first surface,	6 in. radii, convex.	
second do.,	2½ do. concave.	
Second plate.		
first surface,	2¾ in. radii, convex.	
second do.	8 do. do.	

The writer has devoted many years to the improvement of optical instruments, and constructed the earliest used by Professors Morse and Woolcott for Daguerreotyping. Having practically tested the different combinations and adopted the German system of arrangement, it is due to the correctness of Petzel's theory to state, that he has made lenses fully equal to the Voightlænder.

That this is the case is fully proved by the award of the American Institute to Mr. Gurney, "of a silver medal for the best large pictures." These were made with a full-size Roach camera, and were exhibited for competition against the work of all other instruments, at the Annual Fair of October, 1848.

The appearance of your work on the subject of Photogenic Drawing has invited the above remarks upon lunar pictures and cameras. A work of its merit was much needed, and the valuable information it contains on all the different processes of obtaining pictures by

the agency of light, renders it a most valuable assistant to artists.

I have to offer many apologies for my inability to reply to your inquiries at an earlier moment.

With regard, &c.,

JOHN ROACH, Optician.

Daguerrian Depot,
79 *Nassau Street.*

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