THE HISTORY

AND

PRACTICE

OF

DAGUERREOTYPING:

BY A. BISBEE.

DAYTON, O.:
PUBLISHED BY L. F. CLAFLIN & CO
1853.

PREFACE.

It is not our intention to merely make a book, containing something about Daguerreotyping, and a little on Talbotyping, and perhaps something on various subjects of no practical utility to the manipulator in Daguerreotyping, and which perhaps would scarcely receive a passing notice from the majority of Artists; but it is our intention to be confined in our remarks entirely to the subject of Daguerreotyping, and give what we have to say, in a systematic and intelligible manner. Some authors have given so many directions to accomplish the same thing, that the reading of them, instead of placing the manipulator in the right path, tends only to confuse his ideas without rendering him any assistance. It is our wish in our remarks to be as brief and explicit as possible. We hope that our work will not be entirely wanting in interest to the most accom-

plished artist; and we trust that it will be of unspeakable service to the more inexperienced.

Having been engaged in this interesting art for some twelve years, we have confidence to believe, that our specimens of Daguerreotype will compare favorably with any in the Union. And when it is known, that we received the first premium at the late State Fair of Ohio, where many of our most celebrated artists were competitors, perhaps it may not be thought that our pretensions are unreasonable, or that the Plan of operating which we herein present, is unworthy of a careful perusal.

A. BISBEE.

Dayton, Montgomery Co., O., Feb., 1853.

CONTENTS.

CHAPTER IV.

CHAPTER V.

CHAPTER VI.

HISTORY AND PRACTICE

OF

DAGUERREOTYPING.

CHAPTER I.

HISTORY OF THE DISCOVERY OF PHOTOGRAPHY.

THE several names given to this science are so correctly indicative of its nature, that they may be said to be definitions of it. It was first called *Photography*, from two Greek words, signifying, writing by light; it was then called the art of *Photogenic drawing*, or produced by light; and, at length Daguerre gave it the name of *Heliography*, or writing by the Sun; the two last appellations, like the first being derivations from the Greek. But the name, *Daguerreotype* now universally adopted, is from *Daguerre*, the name of the principal one who discovered it.

It may not be uninteresting in this place, to give a short history of *Louis Jacques Maude Daguerre*, whose name is forever associated with the photographic process. He was an artist of considerable celebrity as a painter

and had long been an esteemed member of the French Academy of Fine Arts, and of St. Luke as well as of other institutions of a similar character in his own country, and stood high as a scientific man, long before his discovery of the science of which we treat, extended his reputation beyond the bounds of France.

He was much esteemed for his natural goodness as well as for his artistic powers.

He resided at *Brie Sur Marue*, about nine miles from the city of Paris. He died in Paris, on the 10th of July, 1851, in the sixty-second year of his age.

Giovanni Baptiste Porta, a Neapolitan physician, about two hundred years since discovered that if light were admitted through a small aperture into a dark room, all the objects without, from which reflected rays reached the aperture, would be delineated on the opposite wall, with their forms and relative situation, as in an extended picture. He subsequently found that the aperture need not be very small if covered with a lens. This, however, was only doubling the invention; for the increased quantity of light, which the larger aperture afforded, was condensed by the lens. But the images produced by the first, were faint and considerably confused, without any distinct outlines; while those produced by the aid of the lens were more brilliant and properly defined

This distinctness was much improved by the discovery of the achromatic lens, so that he had then invented the almost perfect design of the instrument used by Daguerre, called the Camera Obscura.

The idea had long been entertained that there was some method by which this fleeting image of objects could be retained and made permanent, but it appeared too visionary to be held by any rational philosopher. But the observation of the effects of light upon the colors of natural objects, had confirmed the opinion that there was the possibility of fixing its impress. And it was known that wherever light had fallen on, either nitrate or chloride of silver or upon any thing saturated with it, the color was changed to black.

The object of this science, then, is to fix the images of persons and objects upon a prepared surface by the reflection of light. By the well known and beautiful invention, the *camera obscura*, the appearance of objects external to the box, is beautifully delineated on a plane surface of ground glass, in their just proportions, colors, and perspective. Every part of the scene however minute or obscure, is faithfully depicted. Here then was a means by which the representation was secured for any desirable length of time; so that if there was a power in light to leave the trace of physical

things which it clad in beauty, it might by this means be secured. And it was with this object in view that Wedgewood, Sir H. Davy, Niepce, and Daguerre made their experiments.

The first authentic intimation of this new art was contained in a memoir of Mr. Wedgewood, the celebrated improver of the manufacture of porcelain in England, whose paper appeared in the June number of the Journal of the Royal Institute in 1802. The author was desirous of obtaining on paper prepared with chloride or nitrate of silver, the representation of objects for his pottery; and though he appears to have adopted a very close approximation to the present practice, he failed in his chief design. He says, "the images formed by means of the camera obscura have been found to be too faint to produce in any moderate time, any effect upon the nitrate of silver."

Sir Humphrey Davy, did not contradict the assertion of Wedgewood relative to the camera obscura. He added that he attempted to copy very small objects by a solar microscope, but only at a very short distance from the lens.

Neither Wedgewood, nor Sir H. Davy made any discovery for preventing their drawings from becoming black by exposure to light. Their copies in consequence never could be examined in broad daylight, for as soon as

they were exposed to its strength of action, the whole of the paper began to assume one uniform dark tinge.

After these imperfect and insignificant results, nothing more was attempted until the researches of M. Niepce and Daguerre. The former of these, was a retired man of business in the neighborhood of Chalons-sur-Saone, who devoted his leisure to scientific inquiries, and his first experiments in photography, or making permanent impressions by the aid of light, appears to have been made as early as 1814; but his first connection with Daguerre, took place in January, 1826. Through the indiscretion of an optician at Paris, he became apprised that Daguerre was endeavoring to accomplish the same object as that to which he had devoted his attention.

In December, 1827, Niepce presented a memoir upon this subject to the Royal Society of London. His paper was accompanied by illustrations on metal, produced by the methods which he had discovered.

Niepce knew in 1827, how to make shades correspond to shades, half-tints to half-tints, and lights to lights; and above all he knew, when he had accomplished his object of copying an engraving, how to make that copy insensible to the rays of the sun, thus resolving a problem which had defied the sagacity of Wedgewood and the genius of Davy.

The registered deed of partnership between Niepce and Daguerre, is dated the 14th of December, 1820; and they afterward prosecuted their photographic inquiries together. Subsequently the son of Niepce, took the place of his father in the engagement.

After a number of fruitless attempts Niepce nad nearly abandoned the idea of procuring images from nature. He could copy engravings but could not transfer the images of natural objects. The preparations which he used failed to render the shadows sufficiently strong under the influence of light. He succeeded in giving parts of a scene or landscape, but there was nothing complete.

The experiments were at this time made on plates of copper or silver coated with different kinds of varnishes and essential oils, without the use of iodine or mercury.

Through a long course of observations and experiments Daguerre finally exposed an iodized plate in the camera, and then over boiling mercury in an iron crucible, without any favorable result; but on repeating the experiment, after exposing the plate to the mercury he found a dim shadow on the outer edge of it, and the thought occurred, that here the heat had not been so great; he then reduced the temperature, and obtained a picture.

Daguerre says that the image is finer on copper, plated with silver, than on silver alone. If this be the case it seems to prove that electricity plays a considerable part in the operation.

M. Daguerre had submitted his designs and explanations to the Chamber of Deputies, with a view to obtain from the French Government a compensation for making the whole process of his invention public, in order to render it of general and immediate utility, and a commission was appointed to examine the project of law for this purpose. After sufficient inquiry, a report was made to the Chamber of Deputies by the celebrated philosopher M. Arago, and another to the House of Peers by M. Gay-Lussac; by which it appears that, after having had every opportunity of testing the certainty of the process, they were convinced of its capability to effect that which the inventor said it would accomplish. During the inquiry, M. Daguerre operated in the presence of one of the members of the commission, and made that gentleman as well acquainted with it as himself. In consequence of their reports a resolution was passed granting to M. Daguerre a pension of six thousand francs per annum, for life, and another of four thousand francs to the son of M. Niepce, who had joined with M. Daguerre in the attempt to bring the invention to a satisfactory issue since 1829, he

having at that period taken his father's interest in the affair. The pension to M. Daguerre was afterward increased to ten thousand francs, and the law received the royal assent on the 15th of June, 1839.

As it may be interesting to our readers, we subjoin the royal ordinance to the Chambers, which runs as follows:—

"Louis Philippe, King of the French, to all to whom these presents shall come.

We have ordered, and do order, that the bill which shall be presented to the Chamber of Deputies by our Minister, Secretary of State for the Interior, in our name, be explained by him and supported in the discussion.

Art. I. The agreement concluded on the 14th of June, 1839, between the Minister of the Interior, acting in behalf of the State and MM. Dauguerre and Niepce, jun., is added to the present law, and approved.

Art. II. There is granted to M. Daguerre an annual pension, for life, of six thousand francs, and to M. Niepce, jun., an annual pension, for life, of four thousand francs.

Art. III. These pensions shall be entered in the book of civil pensions of the public Treasury, with an enjoinment that they shall be published with the present law. They shall not be subject to the prohibitive law of accumulation. Reversions of one half shall be

settled on the widows of MM. Daguerre and Niepce.

Given at our palace of Tuileries, on the 15th of June, 1839.

Signed. LOUIS PHILIPPE.

Witnessed. DEUCHATEL."

In compliance with this ordinance, a law was passed, founded upon and embracing the folling agreement.

"Between the undersigned, M. Deuchatel Minister, Secretary of State for the Department of the Interior, on the one part, and MM. Daguerre, (Louis Jacques Mande), and Niepce jun., (Joseph Isidore), on the other part, the following has been agreed upon.

Art. I. MM. Daguerre and Niepce, jun., have ceded to M., the Minister of the Interior, acting on behalf of the State, the process of M. Niepce, sen., with the improvements of M. Daguerre, and the later process of M. Daguerre, for fixing the images of the camera obscura. They engage to deposit in the hands of M., the Minister of the Interior, a sealed packet containing the history and an exact and complete description of the said processes.

Art. II. M. Arago, Member of the Chamber of Deputies, and of the Academy of Sciences, who has taken a knowledge of the said processes, has verified beforehand all the portions

of the said processes, and has testified to the correctness of the representations.

Art. III. The packet shall be opened, and the description of the processes published, after the adoption of the Bill, which is spoken of above. M. Daguerre will then, if it is required of him, operate in the presence of a commission named by the Minister of the Interior.

Art. IV. M. Daguerre engages, beside, to give a description of the peculiarities which distinguish his painting of the diorama.

Art. V. He shall be bound to make known all the improvements which he shall make, from time to time, in any or all of these inventions.

Art. VI. As the price of these concessions the Minister of the Interior engages to require of the Chambers, for M. Daguerre, who accepts it, an annual pension of six thousand francs for life, and for M. Niepce, who agrees also to accept it, an annual pension of four thousand francs for life.

These pensions shall be entered in the Civil Pension Book of the Treasury. They are not to be subject to the laws which prohibit accumulations; and a reversion of a moiety of each pension, respectively, is settled upon their several widows.

Art. VII. In the event of the Chambers not adopting, during the present session, this project

of law granting these pensions, this agreement shall be null and void, and MM. Niepce and Daguerre, shall have their packet returned to them unopened.

Art. VIII. The present agreement shall be registered on payment of one franc.

Made triple at Paris, 14th of June, 1839.

Signed by M. Deuchatel, M. Daguerre, and M. Niepce.

An exact copy of the original has been annexed to the project of law.

Signed. DEUCHATEL.

Secretary of State for the Interior."

One of the greatest advantages of the Daguerreotype consists in this, that it acts with a certainty and extent, to which the powers of human faculties are perfectly incompetent. Not only does it delineate every object presented to its operation, with perfection in proportions, perspective, and tint—an attainment to which artists could never quite arrive, though which some of them of first rate genius, after long and indefatigable labor, might perhaps so closely imitate as to satisfy, if not deceive the casual observer—but it delineates objects which the visual organs of man would overlook, or might not be able to perceive, with the same particularity, with the same nicety, that it depicts the most prominent feature in the land-

scape. And thus may scenes of the deepest interest, be transcribed and conveyed to posterity, not as they appear to the imagination of the poet or painter, but as they actually are. Were there uncertainty in its operation, we would esteem the value of this science at a much lower rate; but such is not the case. The objects themselves are, in one sense, their own delineators, and perfect accuracy and truth in the result, are a matter of necessity, so that any one, though perfectly unacquainted with the art of drawing, who wishes to travel in different parts of the world, by the aid of this art, may carry with him the likeness of his friends, and the true and faithful delineation of his home, and of the objects most dear in his recollection; portrayed with a truth and fidelity that no manual operation can imitate.

Daguerre, in his discovery, used only iodine in coating the plate, since that time, improvements have been made by using accelerating substances by which the plate is rendered more sensitive to the action of light.

First bromine was used, then chloride of iodine, and finally, a compound of the three, was thought to be better, and is used by many celebrated artists at the present time.

CHAPTER II.

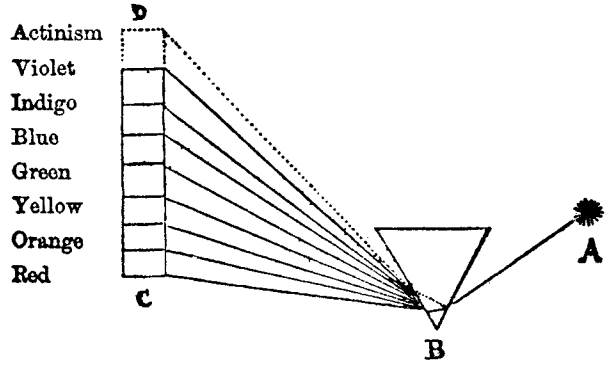
LIGHT, AND DESCRIPTION OF APPARATUS.

Although light is that principle on which the artist depends for his success, yet it is not so particularly necessary for him to understand all the laws which govern it. Therefore, we shall omit a general description of it; but will refer those who wish to pursue the subject further, to Brewster's Optics, and Herschel on Light. We shall speak more particularly of one property in light which was discovered by the aid of Photography; which is quite necessary for the artist to understand, as it relates directly to the camera obscura.

Light traverses the same transparent medium, such as air, water, or glass, in a straight line, provined no reflection occurs, and there is no change of density; but when it passes from one medium into another, or from one part of the same medium into another of a different density, a change of direction always ensues at the plane of junction of the media, except when the ray is perpendicular to that plane. When the ray passes from air into water it approaches the perpendicular, and in passing from water into air it recedes from a

perpendicular. The same remark applies to the passage of light from, or into air, into or out of liquid or solid media in general.

This property is called refraction, and by it the different colors of light are known. If a ray of light pass through a prism it is refracted twice in the same direction, approaching a perpendicular to one surface and receding from that of the other, and is separated into its several different colors, similar to the rainbow, and called the solar spectrum. The property of the medium which produces this is called its dispersive power, or chromatic aberation, that is, some of the colors which compose white light, are refracted more than others, and has been one great difficulty in constructing telescopes, cameras, and nearly all optical instruments; but is nearly or quite overcome by the achromatic lens.



By the annexed figure we see that a ray of

light from the object A, passing through the prism at B, is decomposed or separated; according to Newton's theory, into seven different colors, and constitutes the solar spectrum CD. The violet being refracted most and the red, least of all. Sir John Herschel has added two rays, lavender and crimson, to the luminous or visible spectrum, and makes the number nine instead of seven, the lavender rays being refracted most and the crimson least. But Sir David Brewster as proved that the solar spectrum consists of only three primary colors—blue, yellow, and red, and that the others are formed by these overlapping each other.

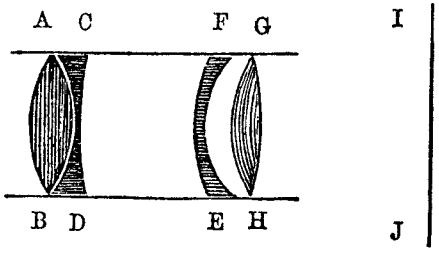
The new property of light discovered by the art of Photography, is generally termed Actinism, or the Chemical Ray; and is refracted more than any of the others; and extends beyond the violet ray; and is indicated, in the figure, by a dotted line. It contains no heat, and is not luminious; and its existence is only known by its chemical effects.

If a prepared daguerrotype plate be submitted to the action of the solar spectrun, we find the red light produces little or no effect; but the effect is increased towards the other end of the spectrum, and the greatest effect is found to be in and beyond the violet ray. This is also found in the old fashioned cameras, made with the common plano-convex

lenses, by which we find a better picture made when the plate is placed inside of the luminious focus, about one fortieth of its distance nearer the lense; showing that the chemical property of light is refracted more, and therefore has a shorter focus than the luminious rays. This is not the case however with the achromotic lens.

CAMERA.

A Camera Obscura, generally called the "*Camera*," consists of the lenses, tube, and box. The lenses are, one achromatic, and two others behind it or between it, and the place occupied by the daguerreotype plate in receiving the impression; as seen in the annexed figure.



The achromatic lense is composed of two pieces, crown and flint glass, cemented together, the crown glass A B, is double convex, and the flint glass C D, double concave. The flint glass has a greater dispersive power than the crown glass, and its refraction being in an opposite direction it corrects the aberation of

the other, and causes the light to pass on to a focus without being decomposed.

The back lens also consists of two pieces E F, made of flint glass, and G H, of crown glass, having peculiar curves, so as to lengthen the focus near the edges of the plate I J thereby giving a more extended field to the focus. All the cameras now made are constructed on this principle, and are much nearer perfection than the majority of those manufactured ten or twelve years since.

We have frequently met with operators who have taken the lenses out of their cameras, and were unable to replace them correctly. The preceding figure will show the true position in which to place them.

The opinion is prevalent that Voigthander makes the only "first rate" camera, but we have during the last few years, used none except American instruments, and find them to be equal, and in some respects, superior to the German. As a general thing, they have a better field, and are obtained at a much less price.

Every camera should be arranged so as to receive the plate in the chemical focus. When the lenses are perfectly achromatic, the chemical and luminous foci are at the same point and need no adjusting; but this is not always the case. Sometimes the aberation is not

entirely corrected, so that the chemical focus is a little shorter than the luminous. Then again in some cameras it is over corrected, which makes the chemical focus longer. To adjust the focus glass to correspond with the chemical focus, proceed as follows: Place several printed cards into slits sawn into a stick, six or eight inches apart, and have one end of the row nearer than the other, and the row almost in a line with the camera. Adjust the focus on the middle card, and take an impression. If the impression of that, is the sharpest, all is right. But if the cards more distant make the sharpest impression, it shows that the ground glass should be sunk lower in the frame. But if one of the nearest cards has the sharpest impression, it shows that the ground glass should be raised, which may be done by placing under the edges some narrow slips of paste board.

To determine what distance the glass should be moved, in either case, mark carefully the point where the tube is resting when the impression is taken, then compare the picture with the image in the camera on the ground glass, and adjust the focus to make the image precisely like the impression taken, and again mark the point where the tube is resting in the sliding part of it; the distance between the two points, is the distance that the ground glass should be moved.

It would be well for beginners to commit the selecting and adjusting of their cameras to some experienced person.

C. C. Harrison, L. Chapman, and Gardner & Harrison, manufacture the majority of cameras now in use.

CAMERA STAND.

For a whole plate camera, we consider the heavy iron stand preferable to all others. For a half plate camera, the smaller ones of wood, are generally used. We have seen a neat iron stand from Scovill's, which we thought very good.

HEAD REST.

The Independent Iron Head Rest is the best, and every artist should have one, at least. This, with one or two chair-back rests, will be sufficient for a traveling artist. But for a stationary room, the independent rest only, should be used.

PLATE VICE.

There are several kinds of this article. The one known as Lewis's Patent Lever Vice, is, on account of its low price, generally used, and is preferred by many. Peck's Patent Plate Vice, sold by L. Chapman, is very good. We have a swing plate vice, made on a new principle, which we prefer to all others, but on

account of the high price which this must necessarily retain, the cheaper articles are generally taken. We have seen a new article, manufactured by Stimpson, which appears to work very well.

BUFFS.

These should be about two feet long, besides the handle, and three, or three and a half inches wide, and made crooked or bent an inch in the middle, from a straight line. They should be padded with five or six thicknesses of woolen flannel, and one of canton flannel on the outside, then covered with buckskin or white cotton velvet. Some recommend washing the buckskin, but this is not necessary, and is injurious, by making it less elastic. The velvet should always be washed in warm water containing a little sal soda, then well rinsed in pure water.

As a substitute for washing the buckskin, after the buff is made, rub the surface thoroughly with a piece of common chalk, shaving the surface of the chalk frequently, to prevent the sand in it from wearing off, on the buff. Let it stand one day to absorb the grease and other impurities, then brush it well with a coarse brush, and cover it with rouge and black polish. Black polish alone should be used on the velvet buff. For a finishing buff, some use the velvet, which gives a fine surface and as clear as can be made by any other. But to give the highest polish, use a buff made of the softest buckskin and put on very loose, on which is used black polish and occasionally a little chalk. Finishing buffs should always be kept on the heater.

BUFF HEATER.

The best thing of this kind that we have seen is a drawer in the table or polishing bench, made of sufficient length and breadth to hold two buffs, and having a copper bottom made air-tight at the edges to exclude the vapors of the lamp. The sides of the drawer should project three or four inches below the copper, so as to retain the heated air. Under this is kept burning a spirit lamp, with a very small wick.

COATING BOXES.

Those having glass jars, with thick glass covers, are the best; a shallow one for iodine, and a deep one for sensitive.

MERCURY BATH.

Those known as the Lewis Bath, are now generally used. But we are using one which we made, and for whole plate pictures we prefer it. We also had an order for one, from Mr. A. Root, of Philadelphia, and understand he prefers it to all others.

These were formerly made of wood with an iron dish in the bottom for the mercury, but now they are made of iron, and should be made of nothing else.

ROOM FOR SITTING.

A traveling artist who can secure an upper room with a window three feet wide and six high, ean do very well, but if it be larger it is all the better. A side and sky-light combined make the best light. Each should be about eight feet square, and the sky light should be on an angle of about forty five degrees, They should always have a northern exposure if possible, or perhaps north-east would be as well.

A very large light with a part of it covered with bleached muslin or paper, makes a softer light than any other. A sky-light should be covered with a white or pale blue curtain, when the sun shines on it. A very good thing to keep the direct light of a sky-light from the top of the head, is to make a light frame, two by three feet square, and cover it with blue tissue paper, and suspend it over the sitter's head. It may be attached to a weight by a string over a pulley, so as to move it up and down as convenience requires. The sitter should sit directly under the eddge of the sky-light when this frame of paper is used, and farther back when it is not used.

SCREEN OR REFLECTOR.

The frame should be about seven feet high, and six feet wide, covered with bleached muslin, then, for a traveling artist, it may be covered with common white paper, which can be procured at any printing establishment. But for a stationary room it can be painted with white lead, put on with a size of glue, perhaps slaked quick-lime would be as good as the white lead.

Care should be taken not to have it too near the sitter in front, or it will make a second pencil light in the eye When the ceiling is dark or much higher than the window, a reflector may be used, extending from the top of the window to the top of the side reflector.

BACK GROUND.

A plain dark ground is preferable to all others for giving a rich fine finish to the picture. This is produced in various ways; anything will do, which gives the proper tint between white and black. Where there is but little distance behind the sitter, it is well to have the back ground hung up by the two upper corners, and kept swinging during the operation. The revolving back ground is another made. This is a large, light wheel, hung on a standard similar to the independent iron headest, and covered with the proper ma-

terial, and is kept moving on its axis during the sitting. There is the magic back ground, and illuminated back ground, the processes of which are patented.

CHAPTER III.

CHEMICALS.

SULPHURIC ACID.

This acid was discovered by Basil Valentine, about three hundred year since, and was named Oil of Vitriol, from its being obtained by the distillation of sulphate of iron (green vitriol or copperas). It is composed of sulphur and oxygen; and is a dense, colorless, oily fluid. It has a very great affinity for water, and the combination takes place with the production of great heat. It has a specific gravity, in its most concentrated form, of 1.85 and boils at 620° Fah. It is one of the strongest acids with which chemists are acquainted, and when undiluted, is powerfully corrosive.

MURIATIC, OR HYDROCHLORIC ACID.

Discovered by Priestly in 1772. It is composed of Chlorine and Hydrogen, obtained by the action of sulphuric acid on common salt,

forming muriatic acid gas, which is absorbed by water, for which it has a powerful attraction. Davy states that water at the temperature of 40,° absorbs 480 times its volume of the gas, and the solution has a sp. gr. of 1.21.

Muriatic acid of commerce has a yellow color, and usually contains a small portion of sulphuric and nitric acid, and oxide of iron. But when quite pure it is colorless, and emits white vapors when exposed to the air.

NITRIC ACID.

This acid is composed of nitrogen and oxygen, and is procured by distilling nitrate of potash with an equal weight of sulphuric acid. It is highly corrosive and when pure, and in its most concentrated state is a colorless liquid, of sp. gr. 1.50, chemically combined with water from which it connot be separated without decomposition or by uniting with some other body It emits dense, white, suffocating vapors, when exposed to the air. It frequently contians sulphuric and muriatic acid, but should be obtained pure for daguerreotype purposes.

If muriatic acid be present, a piece of silver dissolved in it, forms a white curdy appearance. If sulphuric acid be present the silver is blackened.

NITRO-MURIATIC ACID.

Composed of one part of nitric, and two of

muriatic acid. It should be mixed but a short time before it is used, as the acids decompose each other in a day or two.

IODINE.

Discovered in 1812. by M. Courtois, a manufacturer of saltpetre at Paris. And is procured from the impure carbonate of soda, called kelp, which is prepared in large quantities on the northern shores of Scotland, and west coast of Ireland, by incinerating sea-weeds.

Iodine at common temperatures, is a soft friable opaque solid, of a bluish black color, and metalic luster. Its vapor is of an exceedingly rich violet color, to which it owes its name.

The best quality is the resublimed, and is generally found in large scales. It is an elementary substance which fuses at 325 Fah., volatizes slowly at ordinary temperatures, boils at 347°.

The iodine of commerce is usually that of the first sublimation, and generally contains 12 to 15 percent of water. Coal, plumbago, oxide of manganese, crude antimony, and charcoal, are frequently mixed with it.

The price of Iodine is very fluctuating, varying from 37 cents to $1.50 per ounce.

CHLORINE.

Discovered in 1774 by Scheele, and formerly

called oxymuriatic acid, as it was supposed to be composed of oxygen and muriatic acid. But like iodine it is an elemetary substance.

The most convenient method of preparing this gas, is by mixing concentrated muriatic acid, in a glass retort, with half its weight of powdered peroxide of manganese, and applying a moderate heat. The tube conducting the gas, reaches to the bottom of the bottle, where the chlorine, being heavier than air, displaces it. When the bottle is full, which is known by the color of the gas appearing at the mouth of the bottle, it is stoppeed with a greased stopper. Or the tube conducting the gas may be placed under the mouth of the bottle after it is filled with warm water and inverted with its mouth in a bowl or other dish of water. The chlorine rises from the tube into the bottle and displaces the water.

Chlorine is a yellowish green colored gas which has a disagreeable odor, and is one of the most suffocating of the gases. Cold recently boiled water absorbs twice its volume of the gas, and if the mixture is exposed to the light, the chlorine decomposes the water, and unites with the hydrogen to form muriatic acid. Hence the necessity of keeping liquid chemicals which contains chlorine, in a dark place.

BROMINE.

An elementary substance, discovered by M. Balard, of Montpelier, in 1826.

At common temperatures, it is a liquid of a blackish red color. Its odor somewhat resembles that of chlorine, and is very disagreeable, and poisonous. It is very volatile and emits red fumes. It freezes at 4,° boils at 116.5,° and has a specific gravity of about 3.

American Bromine is obtained from springs near Pittsburgh. We consider its quality equal to any other.

HYDROFLUORIC ACID.

Is prepared by acting on the mineral called fluor-spur, which is a fluoride of calcium, with twice its weight of sulphuric acid. The mixture is made in a leaden retort, and the vapor distils over and is collected in a receiver of the same metal surrounded with ice. Its vapor is much more pungent than chlorine or any of the irritating gases. Of all known substances, it is the most destructive to animal matter. When a small drop comes in contact with the skin, a deep ulceration, of a malignant character is produced. On this account the greatest care is requisite in handling it.

Combined with bromine it is used by some artists as a sensitive. But it is a dangerous article, which we have never used.

CHLORIDE OF BROMINE.

This compound may be formed at common temperatures, by transmitting a current of chlorine through bromine, and condensing the disengaged vapors by means of a freezing mixture. The resulting chloride is a volatile fluid of a redish yellow color, and emits deep yellow vapors.

Chloride of Bromine is soluble in water without decomposition. But a less difficult method of making the solution is to fill a bottle with chlorine gas, then filling it one-third full of water, a little at a time and shaking it. After the water has absorbed the chlorine, add bromine till the liquid is orange color.

CHLORIDE OF IODINE.

Is made by passing a current of chlorine gas into a bottle of iodine. The iodine absorbs the chlorine with the evolution of heat, and becomes liquid. That which is made by Chilton is considered the best.

CHLORIDE OF LIME.

Fresh slaked lime exposed to chlorine gas, until it is saturated, is called chloride of lime, which can be obtained at nearly all druggists, but it is not always of the best quality. For daguerreotype purposes it should be perfectly white and dry, and have a strong odor of chlorine.

CHLORIDE OF CALCIUM.

Dissolve marble in muriatic acid, and evaporate to dryness; then melt at a red heat, let it cool, pulverize and preserve in bottles, sealed with care. Owing to its strong affinity for water, it is much used for freezing mixtures with snow. It is also used for drying gases, and etherial and oily liquids.

CYANIDE OF POTASSIUM.

Heat yellow prussiate of potash to redness, pulverize and boil in weak alcohol, and set aside to crystalize. A dangerous process. It may be obtained of daguerreotype stock dealers generally.

SOLUTION FOR REMOVING SPECKS.

It sometimes happens that innumerable small black specks are formed by the sediment in the gilding solution getting on the picture, while gilding. To remove them, dissolve a half ounce of cyanide of potassium in six ounces of water. The precise quantity of potassuim is not material, so long as enough is used to remove the specks, and not so much as to cause a scum on the plate. Wet the plate and pour on as much of the filtered solution as it will hold; heat moderately until the specks disappear; rinse with pure water.

NO. 1.

Van Loan's or Mayall's Sensitive.

Mix a fourth of an ounce of bromine with six ounces of nitro-muriatic acid, in a quart bottle, fill the bottle nearly full of water and let it stand a few days.

Amount used for a half sized coating box, is about a tea-spoonful to four ounces of water, and the addition of a few drops every morning. Coat to a deep yellow or orange over iodine, to a cherry red, over sensitive, and back one-third to one-half.

A successful impression produced by this combination is very fine, but it is so very volatile, that it requires an operator of much skill to use it. This compound is very similar to chloride of bromine.

NO. 2.

To one quart of pure water add a half ounce of chloride of iodine and sufficient bromine to dissolve the iodine, and a half ounce of nitric acid.

NO. 3.

Bisbee's Sensitive.

A half ounce of each of the preceeding (No. 1 and 2) to four or six ounces of water in a half size coating box. Coat the plate the same as in No. 1.

This compound works very quick aud produces splendid results. A small quantity should be added once or twice a week. The longer it is kept in the coating box without changing the better and quicker it works. We have taken fine likenesses of children, with it in two seconds, with a mederate light; by coating with iodine deep yellow, orange color with quick, and back one-sixth.

NO. 4.

A good sensitive is made by mixing a quart of lime-water with a quart of alum-water. Then thoroughly mixing an ounce of chloride of iodine with a half ounce of bromine and pouring it into the water, then adding a half ounce of nitric acid, and forty drops of sulphuric ether. For coating, one part of the compound and two of water. Coat over iodine to a deep yellow and to a deep red over sensitive, and back one-third to a half. It should be strengthened once a week.

This compound produces good pictures, and works very sure, but considerable slower than the preceding ones. A few drops of No. 1 may be be added to make it work quicker.

NO. 5.

Dry Sensitive.

Take equal parts of good, well slaked quick

lime, and magnesia, and mix them well together, then add bromine, a little at a time, till it is of a rich scarlet color.

For a half size coating box about two ounces is sufficient, but more may be added to keep up the strength. Coat to a deep yellow over iodine, to a cherry red over quick, and back one-half.

This sensitive works very uniformly, and we would recommend it to beginners, as being one that will work as sure as any other and is prepared with less trouble. Some of our best specimens were produced with it.

NO. 6.

Take a pint tincture bottle with a wide mouth, and fill it one-third full of the very best chloride of lime, and an equal amount of slaked quick-lime and mix them well. Then mix one ounce of chloride of iodine with two ounces of bromine and add it to the lime, a little at a time, giving it time to become diffused through the lime, and to let the heat subside which is produced by the combination; 10 or 12 hours should be occupied in mixing them. An ounce of the compound is sufficient for the coating box which will last a long time without renewing.

Coat with iodine to a light yellow, over quick to a light red, or merely give a percep-

tible change of color, and back over iodine as long as at first. This mixture gives a good picture, frequently having a purple tint.

NOTE.—There can be no absolute rules for using liquid sensitives, as the temperature of the room and other things vary at different times, and the coating must be varied to correspond to the circumstances. When the quick has been recently renewed, we coat a little lighter with it than after it has been used for several days. Also when the room is cold and the iodine coats slow, we give the last coating a longer time in proportion than when it coats rapidly.

Experience is the only true guide in this part of the manipulation.

CHLORIDE OF GOLD.

Made from coin or other gold, but it is best to procure pure gold from a refiner.

Take a five dollar gold piece and dissolve it in two and a half ounces of nitro-muriatic acid, in a porcelain evaporating dish, and evaporate slowly by a spirit lamp, until vapors of chlorine begin to rise, and the liquid assumes a red color, then discontinue the heat and stir it often with a glass rod until it is cold. Care should be taken not to heat it too hot, during the evaporation, as a temperature of 400° decomposes the chloride by expelling the chlorine.

This is the pure chloride of gold, and is of a ruby red color. But on exposure to the atmosphere it absorbs moisture very rapidly, and assumes a greenish appearance.

CHLORIDE OF GOLD AND COMMON SALT.

This is the article generally sold by dealers for chloride of gold. It is made by adding to the solution of gold in nitro-muriatic acid, a solution of as much, by weight, of common salt as there is of gold, and evaporating as before.

It chrystalizes in a bright yellow powder, and is supposed by inexperienced operators to be of a purer quality, because it has the color of the metal.

TO PURIFY GOLD.

Chloride of gold, made from common or any alloyed gold, is dissolved in water, and a solution of copperas added. A brown powder falls which must be washed in dilute muriatic-acid, and is pure gold in fine powder, which may be melted, or used in this state for making chloride of gold.

TO PREPARE THE GILDING SOLUTION.

Dissolve one bottle, or 15 grains, of pure chloride of gold in a pint of pure water. In another pint of water dissolve a half ounce of Hyposulphite of soda, and mix them by pouring the

gold into the soda solution a little at a time, and shaking it well. If the common yellow chloride is used, a fourth of an ounce of hyposulphite of soda is sufficient. Some operators add a tea-spoonfull of common salt, or chloride of potash. It should be filtered immediately before using.

HYPOSULPHITE OR WHITE SALTS OF GOLD.

The chloride of gold is dissolved, and mixed with hyposulphite of soda, in the usual way for making gilding, but with much less water. As soon as it becomes colorless, it is filtered and evaporated to dryness. The chrystals are again dissolved in an excess of water, and two or three grains of powdered burnt allum are added, after it is all dissolved it is again filtered and evaporated to dryness, being stirred gently with a glass rod, when it chrystalizes in very small needles, very white and clean.

To prepare it for use it is merely dissolved in pure water.

TO MAKE CHLORIDE OF SILVER.

Dissolve one ounce of silver in two ounces of nitric acid, diluted with an equal quantity of water. (It is more readily dissolved by the aid of heat.) Then add two ounces of muriatic acid and wash the precipitate in five or six waters, and evaporate to dryness.

OXIDE OF SILVER.

Is made the same way as the preceding, by substituting for the muriatic acid, a solution of caustic potassa, or lime water.

TO PURIFY SILVER.

Take chloride of silver and put twice its weight of carbonate of potassa into a clean hessian or blacklead crucible, heat it to redness and throw the chloride by successive portions into the fused alkali. Effervescence takes place, from the evolution of carbonic acid and oxygen gases Chloride of potassium is generated metaile silver subsides at the bottom.

SILVER SOLUTION FOR GALVANIZING.

In a half pint of water dissolve four ounces of cyanide of potassium, and one ounce of oxide or chloride of silver, which will dissolve in a few minutes. Then dilute the solution with one gallon of water, and filter for use.

SILVER SOLVENT.

Dissolue one part nitrate of potash, in ten parts, by weight, of strong sulphuric acid; heat nearly to the boiling point of water; When old plates are immersed, the silver is dissolved without the copper being acted upon. To recover the silver from the solution, add common salt and then precipitate the chloride thus formed by corbonate of soda.

MERCURY.

The principle mines from which it has been obtained, are in Spain, but it has been discovered in large quantities in California.

It is found in the native state and combined with sulphur, as in cinibar, the latter being most abundant. From this ore the metal is extracted by heating it with lime, or iron filings, by which means the mercury is volatilized and the sulphur retained.

It is distinguished from all other metals by being fluid at common temperatures. It has a tin white color, and strong metalic lustre. It boils at 662° F., and freezes or becomes solid at a temperature which is 39 or 40 degrees below zero, and in this state is malleable and may be cut with a knife.

Pure mercury is not tarnished by exposure to the air and moisture, at common tempera tures; but if it contain other metals, as it frequently is adulterated with lead, tin, and bismuth, which it dissolves; the amalgums of these metals oxidizes readily and produces a film upon its surface. It is separated from these impurities by distillation, which may be done on a small scale, in the following manner. Take a small cast iron cup, about the size of a small tea cup, and fit it closely in an aperture in a board, so that the top of the dish will be on a level with the board, then take a

large earthern bowl and place it over the iron cup, in an inverted position, making a grove in the board of the same size as the top of the bowl, and sufficiently deep to contain the mercury. Put the mercury into the iron cup, and the bowl being inverted over it, place under it a spirit lamp, and heat to 350° or 400°, or considerably hotter than boiling water. The vapor will adhere to the inner surfacc of the bowl, and form small globules of mercury which run down into the grove in the board. The bowl should be kept wet with a wet cloth, or the bottom may be filled with water to keep it cool.

About four ounces is sufficient for the bath, and it should frequently be filtered through a paper cone with a fine opening, to remove the dust and oxide. A covering of clean dry sand prevents oxidation; and in this way it needs filtering no oftener than once a month. The bath may be left uncovered during the day but should be covered during the night to keep out the dust.

ALCOHOL.

Alcohol does not exist in nature, but is the result of vinous fermentation.

From the fermented liquid, which, in the case of the grape juice, is wine; the alchohol is separated by distillation; and being more volatile

than water, it predominates in the first portions distilled. It is again rectified, and the portions distilled are colorless, and go by the name of spirits of wine, After another rectification, they are called rectified spirits of wine. They now contain alcohol with from 10 to 20 percent of water; which is removed by digesting the spirit with quick lime, and distilling, or by rectifying over chloride of calcium. And it is called pure or Absolute Alcohol; which is a colorless fluid of sp. gr. 0.795, and boils at 173.° It has a burning taste, and a pleasant fruity smell. It has never been frozen, hence its use as a substitute for mercury in thermometers in high northern or southern latitudes where the mercury would be congealed. It is very combustible, and produces, in burning, a very intense heat; and is much used for lamps, in chemical, and daguerreotype purposes.

PROTOXIDE OF HYDROGEN, OR WATER.

Composed of 8 parts of oxygen and one of hydrogen by weight, or one part of oxygen and two of hydrogen by volume. It is a well known transparent, colorless, inodorous, tasteless liquid. A powerful refractor of light, imperfect conductor of heat and electricity, very incompressible, its absolute diminution by a pressure of 15 pounds to a square inch, being only about 51 millionths of its volume: and when exposed

to the air, at common temperatures, is slowly changed to vapor. Its specific gravity is 1, being the unit, to which the specific gravity of all solids and liquids is referred, as a convenient term of comparison. One cubic foot weighs 1000 ounces, and is 815 times heavier than atmospheric air. It boils at 212° Fah., and cannot be heated above this point in an open vessel, as it is rapidly changed to steam, which keeps the temperature stationary.

It crystalizes or freezes at 32° Fah., and expands about one-eleventh of its volume, so that the sp. gr. of ice is only about 0.92. The expansion of water at the moment of freezing, is attributed to a new and peculiar arrangement of its particles, which during the formation of ice arrange themselves in ranks and lines, which cross each other, at angles of 60,° and 120,° and consequently occupy more space than when liquid.

Chemists state that the purest water that can be found as a natural product, is procured by melting freshly fallen snow, or by receiving rain in clean vessels, at a distance from houses. But within the last three years M. V. Meynac, a French chemist, has discovered that rain and snow water contains a minute portion of chloride of sodium or common salt, ammonia, and iodine. It also generally becomes impregnated with smoke from the atmosphere. Water free

from most of these impurities, may be obtained by melting ice procured from a running stream, as nearly all impurities are expelled in crystalizing.

All water which has once fallen on the ground, becomes impregnated more or less with earthy or saline matter, and cannot be entirely separated from them, except by distillation. Water thus obtained, and preserved in well stopped bottles, is absolutely pure. Distillation of water may be performed on a small scale, by means of a still, made by any tinner.

Recently boiled water has the property of absorbing a portion of all gases, which come in contact with its surface, and the absorption is promoted by brisk agitation.

CHAPTER IV.

GALVANIZING, AND MISCELLANEOUS RECIPES

GALVANISM AND THE BATTERY

The science of Galvanism owes its origin, to the experiments on animal irritability, made by Galvani, Professor of Anatomy, at Bologna, in the yer 1790. In the course of his investigations, he discovered the fact that muscular

contractions were excited in the leg of a frog recently killed, when two metals such as zinc and silver, one of which touches the crural nerve, and the other the muscles to which it is distributed, are brought in contact with each other. Galvani imagined that the phenomena were owing to electricity present in the muscles, and that the metals only served the purpose of a conductor.

The views of Galvani, had several opponents one of whom, the celebrated Volta, Professor of Natural Philosophy at Pavia, succeeded in pointing out their fallacy. Volta maintained that electric excitement is due solely to the metals, and that the muscular contractions are occasioned by the electricity thus developed, passing along the nerves and muscles of the animal. To the experiments of Volta, we are indebted for the first voltaic apparatus, which received the name of the *Voltaic Pile;* and to the same distinguished philosopher belongs the real merits of laying the foundation of the science of galvanism.

Galvanism is excited when to different metals are brought in contact and submitted to the action af an acid solution. The oxidation or chemical action is the primary cause of its development, and it is necessary that one should be more easily excited or oxidized than the other; and the greater the difference in

this, the more powerful is the current of galvanism: therefore one metal should be chosen, which is dissolved very sparingly or not at all in acid; and another which is dissolved very freely.

The instrument formed on this principle, for the production of an electrical current by chemical decomposition, is called a voltaic, or galvanic battery.

There are various kinds of these instruments, made of different kinds of metals, but Grove's Battery is considered the best, and is now used by all Telegraph companies. In this, which is the most powerful combination yet made, the metals used, are zinc and platina, the zinc in the form of a cylinder, supporting a porous cup of strong nitric acid, in which is suspended the platina. The zinc stands in a large tumbler of dilute sulphuric acid, one part of acid and 15 to 20 parts of water. The zinc should be amalgamated with mercury, which may be done by pouring a small quantity on it, after the acid solutiou has dissolved the oxide from its surface. To each of the metals is sodered a copper wire of any convenient length, and the extremities of these are called the poles or electrodes, the one connected with the platina being the positive, and the one connected with the zinc, the negative pole.

In the carbon battery of Cooper, the carbon,

in the various forms of charcoal, coke, anthracite and plumbago, is associated with zinc, instead of the platina in the preceding arrangement, the acids and zinc being used in the same way, While little inferior in energy, it is much less expensive than Grove's Battery.

A very active combination is formed by using iron instead of platina. But the iron must previously be brought into what is termed the passive state: in which condition it is not acted upon nitric acid alone. This is done by taking a piece of iron of any convenient size and heating one end, and dropping it, in a perpendicular position with the heated end downward, into nitric acid.

A battery composed of only two pieces of metal, is called a simple voltaic circle. The compound circle is formed by two or more simple batteries being connected, having the positive pole of one connected with the negative pole of the other: and by increasing the number, any desired amount of power may be obtained.

The chemical agency of the galvanic battery to which chemists are indebted for a most powerful instrument of analysis, was discovered by Charlile and Nicholson, soon after the invention was made known. The substance first decomposed by it was water. When two platina wires are connected with the opposite poles of

the battery and their free extremities are placed in the same cup of water, but without touching each-other; hydrogen gas is disengaged at the negative, and oxygen at the positive pole.

This important discovery led to experiments on other compounds, such as acids and salts; and it was found that all of them were decomposed without exception, one of their elements appearing at one pole of the battery, and the other at the opposite pole.

Electro-plating is based on this principle. Any kind of metal is reduced to a solution in a convenient vessel, and the metal to be plated, which is called the cathode, is made perfectly clean and bright, and connected with the negative pole of the battery and immersed in the solution; and to the positive pole is attached a piece of metal similar to that of the solution and also placed in it, and is called the anode. The salt of the metal is decomposed, the metalic particles adhering to the metal to be plated, and the solvent passing to the positive pole. This was known long before it was practiced for improving the daguerreotype.

The daguerreotype plate is silvered or galvanized in the following manner. The silver solution is prepared as already described, and the battery put in order, having a copper wire with one end attached to the platina, and the other end attached to a piece of silver which

is suspended in the silver solution. Another wire has one end attached to the zinc of the battery, and the other end to the plate which is immersed in the solution, it should remain from one to five minutes. It first assumes a blue appearance and gradually changes to white, as the silver accumulates on it surface.

In this process the cyanide of silver, of the solution, is decomposed and metalic silver is de posited on the plate on the negative pole, while the cyanogen passes to the positive pole, and acting an the silver anode, dissolves a portion of it which keeps up the strength of the solution.

After the plate is sufficiently coated, it is removed and rinsed in pure water and dried over a spirit lamp. The proper amount of silver on the plate is known by its color, which should be a pale blue almost white, but care should be taken that too much is not given, as the surface becomes crystalized and then it is almost impossible to remove it by buffing. If too light a coating is given, it might be buffed off, leaving a very bad surface to the plate, for the chemical coating. One coating of silver is generally sufficient for a small plate, but when a very fine surface is required, the plate should be galvanized twice; very lightly at first and then well buffed with a fine buff, and galvanizd in the usual way.

After the solution has been standing for some length of time, a scum is formed on its surface, this, as well as the dust that falls on the surface, may be removed by covering the surface with a piece of paper, and removing it very quickly, the scum adheres to the paper, and is taken off with it. When this scum is not removed, it adheres to the plate, in streaks, and gives it a very bad surface. In putting the plate into the solution this scum and dust should be blown aside, and the plate suddenly immersed.

If the plate receives the silver in spots, and appears clouded, and shows the marks of the buffs, it is evidence of their not being clean.

It is sometimes the case, particularly with new solutions of silver, that narrow white streaks appear from the edge to which the wire is attached, and running parallel to each other across the plate. This is owing to the current of electricity being too strong and may be remedied by diluting one of the acids, or pouring out a part of it.

After the silver solution has been used a long time, so that it coats a plate too slowly, a little more cyanide of potassium may be added. The silver suspended in the solution, should be only about one half or two thirds as long as the plate to be silvered; if it be longer it is apt to coat the lower edge of the plate too heavy.

TO PREPARE ROTTEN STONE.

Procure at any drug store, the best Derbyshire rotten stone, put two or three ounces into a porcelain mortar with sufficient water to make it into a thin paste, and grind it thoroughly with a pestle, then add more water and stir it well; let it stand a minute to allow the sand and gritty matter to settle; then pour off the turbid liquid into a deep vessel. After a sufficient quantity has been ground in this manner, the whole may be stirred up and left to settle a minute, and then poured off as before, into a clean dish; let stand several hours to settle, then pour off the water, and let it dry: when it is well dried, pulverize for use.

CALCINED ROTTEN STONE.

Is prepared as above, and then put into a crucible and heated to redness, or sufficiently to change its natural gray color to a light orange when it is cold; and then repeating the grinding and washing process.

ROUGE.

Place any quantity of the sulphate of iron (copperas) into a black lead crucible, and calcine at a red heat till the vapors of sulphur cease to rise, when it is cold dissolve it in water, and wash, as directed for rotten stone, several times to remove the sulphate of soda

which is produced; let it dry and heat it quite hot, to expel all dampness, before using.

VERY FINE ROUGE.

As the common sulphate of iron frequently contains foreign matter, a finer quality of rouge may be made by dissolving it in water and adding a solution of the same quantity of sal soda, washing, drying, and calcining the precipitate with a moderate heat, and then grinding and washing as in the first process.

BERZELIUS' ROUGE.

Mix forty-two parts of common salt with one hundred parts of the sulphate of iron, calcine in an iron crucible for two hours, at a white heat. Let it cool, and dissolve in water and wash as in the first process. The product is a beautiful powder, of minute crystals. A splendid powder for finishing, after rubbing the plate with rotten stone; as it will not stick into the plate like common rouge.

BLACK POLISH.

The finest quality of lamp-black, calcined for two hours, in a close Hessian crucible, at a red heat.

SEALING PAPER.

Four ounces gum arabic, two ounces izinglass or white glue, two ounces of honey or sugar-

house molasses. Dissolve them in a pint and a half of boiling water. A few drops of tincture of benzoin makes it more adhesive. Spread it on tea-paper with a large paint brush.

TO NEUTRALIZE IODINE OR BROMINE VAPORS.

Sprinkle the room with aqua-ammonia. The same article if smelled will neutralize these vapors in the nose or lungs.

If any of these chemicals get on the hands, wash first with alcohol, and then with hyposulphite of soda.

SOFT SEALING WAX FOR BOTTLES.

Melt together two parts of beeswax and one of rosin.

HARD SEALING WAX.

Black rosin or pitch 12 parts; beeswax one part; finely powdered ivory black three parts; melt together.

CLEANING GLASSES.

Rub them with alcohol and rotten stone on a piece of canton flannel, and dry off with a clean piece. Finish with a piece of buckskin and rouge; or with an old velvet buff.

TO COUNT SECONDS.

A small weight suspended with a string 39½ inches long will vibrate in true seconds.

BLACK STAIN FOR APPARATUS.

Two ounces of Shellac dissolved in a pint of alcohol, with lamp-black mixed for color. Apply with a sponge.

FILTER FOR WATER AND OTHER LIQUIDS.

Take an earthen bowl of a convenient size and drill a hole through the bottom three-fourths of an inch in diameter; press a clean sponge into the aperature; it may be set on a pitcher or other vessel.

TO GRIND A FOCUS GLASS.

Take two pieces of plate glass of the desired size and grind flour emery between them, with a little water; till the polish is taken off.

ACCELERATING BUFF.

The preparation for this buff is of recent discovery, and is thought by a few to be of great value, but we have only in a few instances seen favorable results arising from its use. Yet there is no doubt it will reduce the time for the exposure of the plate in the camera from one-fifth to one half the time required by the usual process, and may, perhaps, be used to advantage in preparing the plates for taking the likenesses of small children. In no other case than this last would we recommend it.

It requires great care to make one of these buffs, that will work with any degree of success; it is necessary to be provided with two newly covered buffs of the softest and best prepared buckskin. These should in all cases be free from rouge or any other polishing materials.

A little castile soap may be dissolved in alcohol, to about the consistency of thin paste —when it assumes a brown color. Of this solution, a very little may be applied on the surface of one of the buffs. This may be done with a small piece of sponge or cloth; care should be observed that you spread on but very little of this solution, and also evenly as possible; or mutton tallow may be used instead of the solution of soap. In order that the buff may be kept soft and moist, it will be found advisable to slightly saturate it with sweet oil.

One of these new buffs should be kept free from all substances other than the clean buck skin with which it is covered.

To use these the plate should be clean and buffed in the usual manner; then apply the accelerating buff until a bluish oily coating appears on the surface of the plate, then take the other new buff, and with it buff the plate to remove the coating thus formed, and coat the plate in the usual way.

The coating is more effectually removed by

adding a little common soda to the Hyposul phite wash.

One great difficulty in using this buff is to obtain buckskin that will not scratch the snrface of the plate.

TO CLEAN A BUFF.

Rub on the buff, a piece of soft clean chalk, shaving it often to prevent the grit from wearing off on the buff.

DAGUERREOTYPE PLATES.

These are made of copper plated with one fortieth of its thickness of silver, which is generally denoted by the number 40, stamped on one corner. Some plates, however, are made with only one sixtieth part silver.

A heavy piece of copper is made of the proper size and thickness, and another of silver of the same length and breadth, and one fortieth of the thickness of the copper. A thin edge of the copper, on one side, is raised to correspond with the thickness of the silver, so as to form a kind of dish sufficiently deep to hold the silver plate. Both pieces are made clean and bright, and placed together in an oven, and made perfectly level, the silver being on the upper side, and in the dish of the copper. Heat is applied, just sufficient to begin to melt the silver, and then discontinued and the plate allowed to cool, when they are found

to firmly adhere together. It then goes to the rolling mill and is rolled down to any desired thickness; polished, and cut into the proper sizes.

Most of the plates now used, are the French plates,-made in Paris; Scovill's made in Waterbury. Ct. Scovill's are generally considered the best plate, but are sold at a little higher price than the others.

We would recommend Scovill's when a galvanic battery is not used, as they are generally thicker than the French plates, but if they are galvanized, a French plate does very well.

CHAPTER V.

FHE AUTHOR'S MODE OF OPERATING.

POLISHING PLATES.

To clean a plate as it should be done to leave the best surface to receive the chemical coating, is one of the most important parts of the science; and a carelessness in this is the principle cause of nearly all the failures of inexperienced operators. When a person has learned to clean a plate well, he may consider that ne has learned at least one half of the

art. But this is not to be learned in a week, or a month, and we might say a year, for it is careful experience that makes perfect. We have now been engaged in the business eleven years, and find that we are still improving by practiee in this one thing. We have known operators who, when making failures, condemn their chemicals, mercury, rotten stone, and nearly everything except the right one, and when informed by experienced artists, would scarcely believe the true cause to be imperfectly prepared plates. If a plate is prepared as it should be, a good picture is sometimes obtained when it is not properly coated; but when the plate is not well cleaned it is impossible to obtain a fine impression. We give the process, which we believe to be the best, and by which we have obtained the best results.

Procure the best bleached canton fiannel, that which has a long heavy nap; lay two pieces together, with the nap inside, and cut it into pieces about two inches square and keep them in a covered box to protect them from the dust.

Then take an ounce of the best rotten stone and put it in a porcelain mortar, and sufficient alchohol to make it into a thin paste, and grind it well, let it stand a minute, and pour off into a clean four ounce vial.

To another vial of pure water, add about

three drops of chemically pure nitric acid, or sufficient to make it as sour as common vinegar. It is so seldom that pure nitric acid can be obtained, that we generally use the water alone.

Next, tie up in a piece of thin, soft chamois, or sheep skin, about an ounce of pulverized rouge, and beat it against some clean surface till the rouge works through the leather. Used in this way none passes through except the finest quality. Then in a piece of muslin tie up some well pulverized dry rotten stone, or as some artists use it, put it in a wide mouth vial with a piece of gause tied over it.

Take a piece of india rubber about two inches long and one and a half wide; stretch over this a square piece of the canton flannel, taking care never to touch that part which is to come in contact with the plate. Then having placed the plate in the vice, take on some of the paste from the mouth of the vial, proceed to rub the plate briskly with a circular motion for a minute or two. Care should be taken to keep the rotten stone constantly wet, to prevent scratching; it should not be too wet, as it will not polish so fast. The plate is then allowed to dry, and some dry rotten stone dusted on, also a drop or two of water is added and a new piece of flannel on the rubber, and the plate rubbed again about half as long

as at first, and then left to dry, and finished with a new piece of flannel dusted over with a small quantity of rouge, (Berzelius' rouge is best for the first) and continue rubbing with a circular motion till most of the marks of the rotten stone disappear and then, with the same piece, clean off all the rotten stone from the edges of the plate. Then take another piece of dry flannel and dust on fine rouge, and continue rubbing until a fine clear surface is produced. One sett of pieces of flannel will do for four or five plates. For a medium plate four or five minutes rubbing is sufficient, though an experienced workman will often do it in half that time.

Old plates that have been gilded should be rubbed with rotten stone and spirits of turpentine, on flannel, and dried off with a clean piece and heated over a spirit lamp. If the plate has not been rubbed sufficiently, the picture will reappear.

All plates should be heated in this manner as often as three impressions are taken on them. The object of this is to expel the mercury. Sometimes a speck or drop of mercury gets on the plate, which must be expelled by a high heat; but the best way is to keep the mercury where it belongs.

No good artist will depend on the buff to clean the plate, but the cleaning should be

done before the plate goes to the buff. The object of the buff is to remove the scratches and put on a fine polish. If an artist depends on his buff to clean the plate, it will soon be in a condition to produce failures constantly.

Some operators recommend breathing on the plate, to determine when it is clean; but this is a very injurious practice for it is more than probable that the breath does more harm than the impurities which are discovered by it.

BUFFING.

First use the buck skin buff, dusted over with rouge and black polish; continue the buffing till all the circular marks disappear; first across the plate, then lengthwise.

Rouge should be dusted on this buff, once or twice every day, and a little chalk rubbed on as often as once a week; shave the chalk clean, and rub it once or twice from end to end of the buff, and a little black polish, and brush them all into the surface together, with a coarse brush.

Next use the cotton velvet buff dusted over with black polish alone which gives a finer finish than rouge. When it is thoroughly buffed with this, which should be done very lightly, and a circular motion given it to finish, it is ready for galvanizing.

After it is galvanized, buff lightly with the

buck skin buff, and finish with the velvet and black polish; or when a very fine finish is desired, use a finishing buff of fine soft buckskin with black polish and chalk only on it. The last buffing should be done very lightly and across the plate, or at right angles with the perpendicular position of the plate as it stands for viewing the picture.

After the plate is removed from the vice, any particles of dust remaining on it may be removed by a clean camel's hair brush; or with the face downwards it may be lightly rapped against some hard substance. It is then ready for the coating.

CAUTIONS.—If the first buff glides over the plate without taking hold as though it were oily, and leaves a kind of scum or smear; it is proof that the plate was not sufficiently rubbed with flannel and rouge.

Care should be taken in handling the plate, that the fingers do not lap over the edges on the face of it: if this should happen the buffs should not be used until the marks of the fingers are entirely removed, or the plate repolished.

The buff is the most delicate part of the apparatus, and should be kept with the greatest care; for if these are not in good order, or are allowed to be used on plates not well cleaned, it is useless for any one to think of

obtaining fine proofs, or to work with success. We have seen several prescriptions for cleaning buffs, but the best way is to never allow them to become dirty, by using them on plates not well cleaned. They should be kept over a heater, or in a dry warm place.

COATING THE PLATE

The iodine coating box is charged by artists, in different ways: some place a piece of canton flannel over the iodine; or sometimes put the iodine alone into the box. A very good way is to mix iodine with slaked quick lime, in a glass bottle, and let it stand till the lime takes up the iodine and forms a red compound, which is what is called hydriodate of lime. The proportions depend on the temperature of the room, and must be regulated by the judgment of the operator.

We have always used the iodine wet with lime-water, and find it coats more evenly in hot weather, and produces better results than any other manner in which we ever used it. About half an ounce is placed in the coating box, and strong lime water poured on sufficient to cover the iodine, a portion of which is dissolved and a dark red liquid is formed. This will last for constant use for about six months, and will produce as fine white drapery, and we think, a little finer than dry iodine. Blue toned

pictures are generally the result of bad proportions of iodine and quick, in the coating, with the assistance of damp buffs, and impurities on the plate.

The sensitive box we charge with about an ounce each of quick stuff No. 1 and 2, to a gill of water, or with sufficient sensitive to make it coat in about half a minute. If it coat too quick, a little water may be added, if too slow, add a little more sensitive. Add a little once a week to keep up the strength.

Having the boxes charged as directed; coat with the iodine vapors, to a deep yellow, then over the sensitive to a bright red, and back over the iodine one-third to one-sixth as long as at first; or if the sensitive has been used a long time without being renewed, the coating may be continued with it, till the color is nearly purple, and a shorter time in proportion for the last coating over iodine. For dry quicks this variation is not made, but one uniform coating is necessary.

A deficiency of sensitive coating generally gives good dark drapery in the picture, but the lights are not so good, being more faint and of a blue tone. An excess of sensitive makes the dark drapery very black and not well delineated, while the lights are very brilliant and the shadows generally dotted with very small white specks of mercury.

There can be no positive rules given for coating plates, for a great deal is depending on experience of the operator: sometimes it is necessary to change the proportions and amount of the coating, as the temperature of the room changes. When the weather is very warm and the sensitive very strong, we sometimes coat with iodine to a light yellow, and then over the sensitive, sufficiently to merely change the color, and back over the iodine as long as at first.

We have known operators, when their pictures were not satisfactory, to think the fault was all in their sensitive box, and accordingly throw it out, and put in new, perhaps some other kind: but this is the worst possible practice, and we have never known an operator to excel who does this.

But we recommend it as decidedly the best way to take some good accelerator, and use it constantly, without changing that in the box for a new batch, but add a little as it is used, to keep up the strength, and continue to use the same kind, till he becomes a perfect master of it. For after all that can be said about sensitive compounds, there is less difference in them than many imagine. Almost any kind will produce fine pictures if the plate be well cleaned, and the quick used in its proper proportion for the iodine.

If this manner of using the chemicals be followed, and failures still continue, the operator may rest assured that the difficulty is not in the coating box, but in something else, probably in plates not perfectly clean.

SITTING.

The plate being polished and coated, it is placed in the dark frame or slide, and is ready for the camera. The position of the sitter should receive careful attention, but this being a matter of taste no definite rules can be given. It should be the object of the artist to obtain as natural and easy a position as possible, perfectly careless and free from all rigidness and constraint, But some persons sit in such a ridiculously constrained and awkward position, that it seems almost impossible to overcome it; but it would be unpardonable in the artist to make no effort to improve it. We generally sit a person so as to give considerable of a side view, with the face from the light, but turned a little more than the body, toward the camera, so as to give a slight side view of the face. A full face is sometimes preferable, and occasionally a profile view appears best.

It is not unfrequently the case that a person is accompanied by some half dozen friends or old ladies, to "fix them" in the seat; and the

likeness also will appear fixed, and of course will not please them. This should not be permitted when it can be avoided by persuasion; for we have never known an instance of this kind when the likeness was perfectly satisfactory. For how can it be expected that persons can give an artistic position, when it is more than probably that it is the first time they ever attempted to arrange a person's position, while sitting for a likeness. This is the artist's business, and being an every day business he ought to be competent for his task; but if he is not qualified for it; how can it be expected that one can do it, who probably has never so much as thought of it previous to that time?

We recollect on a certain occasion, a lady with her friends called at our gallery to sit for a likeness. They wished to obtain one similar in position to one taken in ——— which they had with them. We attempted to do this but was not allowed to have any thing to do with the arranging of the position of the sitter. The old ladies attended to this part of the operation; we took the impression but the attitude was not pleasing, we tried again with the same result, and as business happened to be dull at the time, we thought we would take it easy, and continue taking them till they were satisfied, and so we kept on till some

half dozen impression were taken with the same result as at first, although each was a good picture; we would occasionally attempt to give the right position but was not permitted by the numerous friends to do so, although they were loud in their applause of the artist who took the one they had—"He gave *such excellent* position." At the seventh or eighth trial they became discouraged and concluded to have the one copied which they had, and it was accordingly done, and they went away highly pleased with the copy, and said it was "just as good as the other;" but never thought that if they had allowed the artist to take the first one, instead of attempting to do it themselves, they might have been pleased at first, and saved themselves, and him, a great deal of trouble.

Having arranged the sitter, place the camera on the stand, near the wall next to the window, and about as high as the sitter's head, or if the person does not lean back much, the camera may be a little lower. Then proceed to adjust the focus; first, see that the eye is well delineated; this being right, see that each hair of the head, the ears and hands are shown clearly. Some operators look at the eye only, without regard to any thing else, and perhaps have a good focus on it, or perhaps on a point a short distance before the face, and a little

nearer the camera, but still leaving the eye distinct, but the ears and shoulders, which are a little more distant, entirely out of focus; giving the picture the appearance of being imbedded in the back ground, instead of standing out clearly from it.

MERCURIALIZING.

Place about four ounces of distilled mercury in the bath, and by a spirit lamp kept constantly burning under it, the heat is kept at about 75 or 80° for a half size bath, and about 90° for a whole size. At this temperature, if the mercury is kept clean, the picture is developed in about a minute and a half, or two minutes.

Some operators leave the plate in the holder or dark frame, and place both over the mercury, and then withdraw the slide. If this is done, the top edge of the bath should be lined with a narrow strip of canton flannel, stuck on with gumwater, to keep the vapors of the lamp from the picture; and the holder should frequently be wiped with a cloth, to remove the mercury which accumulates on it by the vapors. This mode has the advantage of exposing the plate to the air, less than any other method, but unless the holders are kept in a very dry warm place, the heat of the bath is very apt to expel damp-

ness from them which adheres to the plate and injures the picture.

What we consider a better way, is to take the plate out of the dark frame or holder and place it in the iron frame over the mercury; being careful to prevent much exposure to the atmosphere, the plate is soon warmed by the heat of the bath, and much quicker than when left in the dark frame; which facilitates the chemical combination. After it has been over the bath about the proper length of time, it may be examined by the light of a lamp, by raising the top of the picture a little from the frame with the thumb-nail. This should be done as quickly as possible, care being taken not to raise it too high, for if any dampness or cold air comes in contact with the plate at this time, it is very apt to produce a blue scum of mercury on the shadows, when any more mercury is given. It would be well for every operator to have some simple means to count the precise time which is required to develop the picture; this is done by using the two minute glass generally kept for sale by dealers.

GILDING.

To prepare the daguerreotype picture for gilding it is necessary first, to remove the chemical coating. This is done by making a solution of about two ounces of hyposulphite

of soda, in a pint of water; which should always be filtered before using. A convenient way of doing this, is to have two bottles and a large funnel with a sponge pressed into the neck of it; or what is better, some filtering paper folded in it. The solution in one bottle, the funnel is placed in the other and the picture held over it; when the solution is poured on the plate, it runs from it into the filter, and is always ready for use.

Some artists use the hyposulphite of gold and some prefer the chloride, but it is immaterial which is used, provided it is a good article. Gilding prepared for use should be filtered immediately before using; a good method is to fold a piece of filtering paper in the proper shape to fit in a small funnel, and pour the gilding liquid into the funnel and let it filter directly on the picture, then apply the heat of a spirit lamp, and it soon assumes a dark appearance; continue the heat till this dark shade disappears. The gilding may remain on the plate a minute or two longer and then it is rinsed in pure water and dried over a spirit lamp.

It is necessary to be careful and keep the sediment of the gilding liquid from the plate, as it causes a black speck wherever a particle falls on the picture, (see page 38.)

This part of the process requires considerable

care, for if a picture is gilded too much, by too strong gilding or too much heat, it has a cloudy appearance in spots, and frequently extends over the whole surface, but generally some part of the surface will scale off and spoil the picture before the whole plate assumes this appearance.

If the picture is not sufficiently gilded, it lacks that brilliant tone and finish, which it should have, besides making it very difficult to be colored without disturbing the surface. We always make it a rule to gild the plate as much as possible without giving that greasy or cloudy appearance.

COLORING.

Sometimes a picture is produced with such delicate perfection of lights and shadows, that it appears quite as well when it is left untouched with a brush; and probably far better, than to have it colored in bad taste, in a daubing manner. But if the colors are applied lightly, with a fine soft brush, in an artistic style, we consider it a great improvement.

Carmine is generally used by many artists, but we find this will fade, and therefore have almost entirely discontinued its use except for drapery; it may make a better color while it lasts, but as it is not permanent, we prefer indian red or common rouge, particularly on

a very brilliant white toned picture. This will adhere better than carmine, on pictures which lack mercury and have a smooth appearance.

The cheeks and lips should be most highly colored; the prominences of the forehead and chin may be colored a little, and sometimes the hands very lightly. The color should be gradually shaded from the more highly colored parts, so as to avoid that abruptness which is sometimes seen: after the coloring is completed, the loose particles are removed by lightly brushing with a soft camel's hair duster.

Chrome yellow and red in different proportions form any desirable tint of flesh color.

Prussian blue for drapery, adheres very readily. It may be pulverized by grinding it dry, between two pieces of glass made rough by grinding emery between them.

Oxide of bismuth, or a fine quality of carbonate of lead, called Silver white, is used for white.

Blue and yellow form green; blue and red form violet or purple.

Diamonds and stones in jewelry are represented by picking the plate with a needle.

We have seen gold from a gold saucer used with a wet brush, for coloring jewelry, but this is bad taste and should never be done except for "green ones" who cannot appreciate a fine picture and prefer something coarse. As

this preparation is not transparent, it covers the finely delineated representation of the jewelry, and shows only a yellow daub. The better way is to color it with a little dry chrome yellow, applied with a very small brush

THEORY OF THE PROCESS.

As others have already given many different theories, we shall say but little on the subject; for there is nothing positive known about the chemical change produced by light on the surface of the prepared plate, and we consider all theories on the subject as visionary. But we will give our theory and it may be taken for what it is worth.

It is well known that there are two changes or two different degrees of change produced on the chemically coated silver plate. The first is by a short exposure, and is that which makes it susceptible to the vapors of mercury to develop the image; but what this peculiar change is, no one yet has pretended to decide. The second is by a longer exposure, and is a kind of crystaline surface formed under the chemicals and immediately on the surface of the silver, producing a picture without the use of mercury.

Take a plate coated in the usual way to receive an impression, and place the camera so as to obtain the view of some object such

as a building, or landscape, in a strong sunlight; let the plate be exposed in the camera about an hour or perhaps longer. When it is removed a well delineated impression of the object will be found on it.

It is well known that some substances will not unite to form chemical compounds, except by the aid of light, heat, or electricity; such as hydrogen and chlorine; and it was for a long time supposed that they could not unite by being mixed in the dark; but it has been ascertained that they will as readily combine in perfect darkness, as in the light, provided the chlorine gas alone has previously been exposed to the direct rays of the sun. What the light imparts to it no one can determine; any more than the change produced on the daguerreotype plate, it may be the same principle. There is a peculiar property imparted to the chlorine which causes it to unite with hydrogen, and the same property may be imparted to the chloride of silver to cause it to unite with the mercury in producing the daguerreotype.

The chlorides of mercury are white substances, so is the chloride of silver. The iodide of silver is of a yellowish white; and it is not improbable that a compound of these substances is produced on the surface by the aid of light in forming the picture; as it is well known that the lights are a white substance on the

surface of the plate, which can be easily removed before it is gilded. Where a strong light falls on the plate there is more of this compound, or amalgum formed, than where the light has been less intense; hence the reason of the lights corresponding to lights and the half-tints to half-tints, &c.

The iodides and chlorides of silver and mercury are, the most of them insoluble in water; and therefore are not removed by washing with the hyposulphite wash.

The effects of the gilding in improving the picture by bleaching and making the lights more brilliant, appear to correspond with the same theory; for the bleaching properties of the gilding solution are imparted by the chlorides it contains; such as the chlorides of soda, potassa, ammonia, and gold. When these come in contact with the parts of the picture which have been solarized by too long exposure to light, there may be an additional quantity of chlorine imparted to these portions of the picture, thereby increasing the thickness of the amalgum on the surface; while the sulphur of the hyposulphite acts on the dark parts of the picture where the plate is not protected by the amalgum, forming sulphite of silver, thereby increasing their blackness. Hence the increased brilliancy of the gilded picture, when compared with its former condition.

Some philosophers have supposed the gold of the gilding solution formed a layer of gold over the surface like a thin gold leaf. But instead of this, a chemical union takes place with the surface of the plate and the ingredients of the solution, which hardens the surface and prevents its fading, and puts it in a condition to receive the colors without disturbing the surface.

CHAPTER VI.

CONVENIENT PROCESS FOR PROTOGRAPHS UPON PAPER AND GLASS.

BY J. E. MAYALL.

COLLODION.

Weigh 80 grains of soft clean cotton, such as the daguerreotypist uses, dry it very dry, pick out all the small specs and lay it on a piece of clean paper, weigh 9 oz. of dry pulverized nitrate of potassa, (saltpetre) put it into a porcelain mortar and pour into it 2½ fluid ounces of strong sulphuric acid, mix well together, and then put in the 80 grains of cotton, kneeding it well with the pestle and pressing through every fibre, the mixture of nitrate and sulphuric acid; it will smoke and give

off white fumes, and at the end of four minutes a slight indication of nitric oxide fumes, which may be easily distingnished by their red color; at this point the cotton must be plunged into water and washed until every vestige of acid is freed from it. This is best done by pulling the cotton to pieces with clean fingers; taste it and when perfectly free from sour taste, wash it at last in warm water and squeeze it as dry as possible between the folds of a clean towel, spread it out to dry, it will have a crisp feel like snow. This is

GUN COTTON.

II. Add the above gun cotton to one pint of rectified sulphuric either, perfectly free from pyroliganeous smell, which may be easily detected by rubbing a little on the back of the hand, and after the ether is evaporated if there be the slightest *pitchey smell* the ether is bad and wont do. The cotton will readily dissolve in the ether, with but little residue—and sometimes none at all. I find 2 oz. of rectified alcohol added to the ether increase the dissolving power, and does not interfere with any subsequent process; shake the bottle up two or three times and put in a cool place. This I call my stock bottle of collodion, and will keep for any length of time in a well stopped bottle—cotton blotting paper instead of

cotton answers equally well, and have no doubt but many things will yet be discovered equal in sensibility to either.

III. Take a 2 oz. stopped bottle and file a line at each ½ oz. to save time and trouble afterwards—pour one fluid oz. of the above collodion into it, and ½ oz. of ether and 5 grs. of crystalized iodide of ammonum, or iodide of potassium, use the glass pan scales to weigh it, and let there be no guessing. I prefer the former, shake up and the collodion is ready for use and will keep good about four days—this is for making negative pictures. For positives, I add 2 grs. of iodide of silver kept always ready for use in a bottle under alcohol —I make it by precipitating 30 grs. of silver from the nitrate by the aid of iodide of potassum—and well wash the precipitate before pouring the alcohol over it. To return then to the negative.

SILVER BATH.

IV. 30 grs. of nitrate of silver to the oz. of water; the bath should be made as thin as possible and either of glass or gutta percha, with a wooden foot to stand it in. Now let us suppose we have I doz. of glass cut to the size of the half plate (Dag.) almost any glass will do—flat window glass—but thin patent plate is the best; then in order to let a plate

of this gently down in the bath, we shall want a dipping rod, which is nothing more than a flat strip of glass with a small bit fastened at one end with marine glue, which bit will form a ledge sufficiently thick on whidh to rest the piece of glass, and by a little dextrous management, the operator will be able to poise his plate of glass on the dipping rod and plunge it into the bath, and take it out again, without the plate slipping away or tumbling—try this two or three times with water only.

Clean the glasses with nitric acid and water, then tripoli and water, then water simply—wipe them clean with a piece of old linen—then with a silk handkerchief, and shut them up in a box just like plates; free from dust. Now get the silver bath ready in the proportions above mentioned, (30 grs. nitrate silver 1 oz. distilled water,) also *to Develop* have ready in separate bottles

3 grs. pyrogallic acid 1 oz. water 30 dr's strong acetic acid	labelled No. 1.
50 grs. nitrate silver 1 oz. waters distilled	labelled No. 2.

Pour into an *oz.* measure 1 drm. of No. I and 3 drms. of water—pour into a *drop* measure 8 minums (drops) of No. 2—these preparations beforehand are indispensible, as there will be no time after the picture is taken.

V. Gently pour a quantity of the prepared collodion (III) upon a piece of the cleaned glass, which glass must be held flat in one hand by one of its corners, and by moving it very slowly and firmly the liquid will soon flow completely over the surface, the excess must be poured back into the bottle again, draw the mouth of the bottle along the edge of the glass—change the direction of the flow, to avoid lines and instantly plunge into the silver bath. One or two experiments on this point will soon familarize the operator with the difficulty—all depends on coolness—hurry scurry won't do at all—if the operator is not quick enough the film of collodion will be *too thick*, and will require more time in the camera—if too quick the film will be liable to break off in the bath—the desirable point is so to manipulate the collodion that it shall present a clear smooth surface as free from lines or specks as the glass itself, which perfection can only be attained by practice and care.

I now suppose the sitter is placed; the camera adjusted, and the developing solutions ready with a bottle of hpposulphite solution at hand [2 oz. to the pint] the time in the bath will be about one minute, don't disturb it for that time at least—take out the glass, place it in the plate holder, and this must be done by candle-light only—a green glass shade is the

best, to protect the sensitive film from even the weak light of a candle—take the impression just as the daguerreotype, say for strong light one second, for moderate light eight or ten seconds, for weak light 40—bring back into the dark chamber—put it on a gilding stand, and pour on solution No. 1 very quickly and evenly—blow the surface a little and put the 8 drops of the No. 2 in the No. 1 measure and pour the developing solution into this from the proof—then pour this mixture of the two on again as before, and presently the image will become strong, the lights and shades very vigorous—keep the surface gently agita ted by blowing, pour off—and then spread the solution of hyposulphite on very gently, and in four or five minutes the proof will be fixed, wash well with water, now in daylight—gently dry over a spirit lamp and when dry pour over it a varnish of copal very dilute in spirit, called spirit varnish—this will protect it from breaking up, it is finished. It is very probable it may be a positive, even now; when placed on a piece of black cloth but never mind that—it will be a strong negative when looked through and this is all we want. It may be printed in any of the usual ways directed by the writers on the subject.

TO MAKE POSITIVES ON GLASS.

The collodion should be somewhat more dilute, and, as I before stated, should have in addition to the iodide of ammonium, 2 grs. of iodide of silver.

THE DEVELOPING SOLUTION FOR POSITIVES.

15 grs. of protosulphate of iron,
1 oz. of water,
10 drops of strong acetic acid (try 15)
5 drops of strong nitric acid.

This solution is poured on, just as the other, and poured off again as the image is clearly developed; then fix with hyposulphite of soda; and now the curious change from a negative to a positive gradually takes place. Continue the fixing until the image is clear and the back ground entirely disappears; wash, and dry, and varnish as before directed. When dry, pour upon the picture a coach maker's black varnish that dries quickly. This throws up the picture, which is seen on the other side of the glass, and through it. Mount as in the Daguerreotype, and it is finished.

NOTES TO BE OBSERVED.

Should the excited collodion get too thick to flow evenly over the glass, dilute it with ether; it will be equally sensitive.

In strong summer light it is scarcely possible to work at all without stopping down the camera, say to one inch, if a three inch Vogt-

lander or HARRISON lens. I made out this curious fact last summer, when on a visit to friend Thompson in Paris. In too strong light the image has all the appearance of an underdone picture, and for a long time this baffled all our efforts. On my return to London I tried again, stopping down the lens to 1 inch, and succeeded just as well as ever. In America this fact will be worth observing.

Every time the drop and 1 oz. measures are used they should be washed out clean, and the positive developing solution and hyposulphite solution should be kept apart from the negative.

The holders for the cameras ought to have corners of glass for the plate to rest on, and all the ledge of the sides and ends cut away, that they may not produce stains.

Dr. Diamond has published his process of developing with the protonitrate of iron which I send you. I prefer the above, but at the same time sincerely thank the Doctor for his liberality in thus publishing all he knows, and he has certainly produced some of the finest proofs I have yet seen, by the positive process.

To the Doctor am I mainly indebted for exactitude in the manipulation as well as for his excellent method of making the gun cotton; and while acknowledging a debt to him, do not

let me omit my friend Mr. HORNE, nor that indefatigable cultivator of photography and improver of the collodion process, PETER W. FRY, Esq., whose enlightened encouragement and delightful photographic soirees have done much to advance this delightful recreation. I must not, as is quite usual in such matters, omit the original discoverer, Mr. ARCHER, whom I have not the pleasure of knowing personally.

The adept in manipulation will affect to smile at the detail here given, as quite unnecsary, but for such I have not written it. I feel conscieus that the aspiring student, wishful for success, will thank me for leaving nothing unsaid that can forward his progress. I subjoin a synopsis and an excellent formula for positives, and then, for the preseet, must say good bye.

Ever yours,

J. E. MAYALL.

LONDON, Dec. 21, 1852.

The editor of Humphrey's Journal.

SYNOPSIS.

Gun Cotton.

80 grs. cotton (dry,)
3 oz. nitrate of potassa,
2½ fluid oz. strong sulphuric acid-

Wix well, 4 minutes; wash till free from acid; dry, and it is finished.

Collodion.

80 grs. gun cotton,
1 pint of sulphuric ether
2 oz. alchohol,

Shake up, label, and kecp it cool.

Excited Collodion (Negative.)

1 oz. of the above cellodion,
5 grs. iodide of ammonium,
½ oz. ether.

Shake up; will be of slightly yellow color; will keep four to six days. Use 1 ounce at a time—*no more*, unless you want to fail.

Excited Collodion (Positive.)

1 oz. of collodion,
¾ " ether,
5 grs. iodide of potassium,
2 grs. iodide of silver.

Silver Bath.

30 grs· nitrate of silver,
1 oz. of distilled water.

This bath when not in use may be filtered and kept in a bottle from the light. It will take about 19 fluid ounces of the liquid for a bath.

No. 1.—*Pyrogallic Acid Soluiion for Negatives.*

3 grs. pyrogallic acid,
30 minims acetic acid,
1 oz. water.

One drachm of this, 3 drms. water in a measure, ready for use before the glass is prepared.

No. 2.—*Nitrate Solution for Negatives.*

50 grs. nitrate of silver,
1 oz. water.

Eight drops of this in a drop measure.

Hyposulphite Solution.

2 oz. hyposulphite of soda
1 pint water.

Varnish.

Any spirit varnish that will dry quickly.

Positive Developing Solution.

15 grs. protosulphate of iron,
1 oz. water,
10 drops strong acetic acid,
5 " nitric acid.

Will keep three weeks.

A weak solution of cyanide of silver poured upon the proof before fixing with hyposulphite, adds to the brilliancy.

Black Varnish.

Coachmaker's varnish that will dry quickly.

For Positive Printing.

1st. 3 grs. chloride of barium to 1 oz. water. Dip the papers and dry.

2d. Ammonio-nitrate of silver 40 grs. to the ounce of water. Dry quickly; place the negative faces to the prepared side of this paper; print in sunshine; wash and fix as directed by me for negatives (see *Humphrey's Journal*, p. 118, Vol. II.)

CHAPTER VII.

HELIOCHROMY, OR DAGUERREOTYPING IN COLORS.

Extract from a letter by Robert Hunt, detailing Niepce's process.

By far the most important investigation has been carried out by M. Niepce de Saint Victor.

The memoir is entitled, "Upon the relation existing between the colors of certain colored flames, with the Heliographic images colored by light."

When a plate of silver is plunged into a solution of sulphate of copper and chloride of sodium at the same time that it is rendered Electro-positive by means of the voltaic battery, the chloride formed becomes susceptible of coloration, when having been withdrawn from the bath, it receives the influence of light. This was the discovery of M. Edmond Becquerel: M. Saint Victor had been led to think

think tnat a relation existed between the color communicated by a body to a flame, and the color developed upon a plate of silver, which should have been chloridated with the body which colors this flame.

The bath in which the plate of silver was plunged, was formed of water saturated with chlorine, to which was added a chloride possessing the property of coloring flame.

It is well known that strontian gives a purple color to flames in general, and to that of alcohol in particular. If we prepare a plate of silver and pass it into water saturated with chlorine, to which is added some chloride of strontian, and when thus prepared we place upon it a colored design, of red and other colors and then expose it to the sunshine, after six or seven minutes, we shall perceive that the colors of the image are reproduced upon the plate, but the reds much more decidedly than the others. When we would produce successfully the other rays of the solar spectrum, we operate in the same manner as we have indicated for the red ray, employing for the orange the chloride of calcium, or that of uranium for the yellow, or hypochloride of soda, or the chlorides of sodium and potassium. If we plunge a plate of silver in the chloride liquid, or if we expose the plate to the paper we obtain all the colors by light, but the yellow

only with any degree of veracity. Very fine yellows have been obtained with a bath composed of water slightly acidulated with muriatic acid with a salt of copper.

The green rays are obtained with boracic acid or the chloride of nickel; also with all the salts of copper.

The blue rays are obtained with the double chloride of copper and ammonia. Indigo rays are obtained with the same substance.

The violet rays are obtained with the chloride of strontian and the sulphate of copper.

All the substances which give colored flames give also colored images by the light. If we take any of the substances which do not give color to flame, we do not obtain colored images by the light; we produce upon the plate a negative image, composed merely of black and white as in the ordinary photographs. Those substances which give white flames as the chloride of antimony, the chloride of lead, and the chloride zinc, yield no color by luminous action. All the colors of the picture have been produced by preparing a bath composed of the deutochloride of copper; and Niepce states that this salt thrown into burning alcohol, produces a variegated flame accordiug to the intensity of the fire; and it is nearly the same with all the salts of copper mixed with chlorine.

"If," says Niepce de Saint Victor, "we put a salt of copper in liquid chlorine, we obtain a very sensitive surface by a single immersion; but the result of the mixture is seldom good. I prefer taking the deutochloride of copper to which I add four pounds of water—this bath gives very good results. I prefer, however, a mixture of equal parts of chloride of copper and of chloride of iron, with three or four parts of water: the chloride of iron had as those of copper the property of being impressed on the plate of silver, and of producing many colors, but they are infinitely more feeble, and the yellow always predominates, and this agrees with the yellow color produced in flame by the chloride of iron."

If we form a bath composed of all substances which separately give a dominant color, we obtain very lively colors; but the great difficulty is the mixing in proper proportions, for it happens nearly always that some colors are found excluded by others. By care, however we ought to arrive at the reproduction of all colors. There exists many difficulties, more indeed than any of the ordinary processes of photography. We cannot always depend upon obtaining the same results with the same materials, owing principally to the difficulty of preserving the solution at a uniform strength. Liquid chlorine is necessary; the application of dry chlorine

will not produce the same result. The action of heat upon these prepared plates is in some respects, analogous to the effects of light. By warming a plate over a spirit lamp we produce successfully the following tints—brown red; a cerise red; scarlet; and red having a whitish tint.

Numerous experiments have been made by Saint Victor to produce the colors upon salts of silver or copper spread on a paper, but hitherto without success; a metallic plate of silver—the plated copper answered—must be employed.

Iodine and bromine, and their salts have been tried, but they will not produce a surface capable of developing colors. Chlorine, in the state of chlorates or chlorades, is the only substance which possesses the property of being colored by light, when chemically combined with metallic silver.

The mode of operating recommended is, to form a bath with one-fourth by weight of the chloride, and three-fourths of water. When the muriatic acid is used with a salt of copper we must add one-tenth of water. When the bath is composed of several substances it is essential to filter the solution carefully, so as to obtain very transparent solution, and it must be preserved in well stoppered bottle.

The quantity necessary to prepare two or

more plates should always be taken, because the bath is weakened considerably at each operation; it can, however, be rendered active by the addition of a few drops of muriatic acid.

The purer the silver employed the more perfect is the impression, and the more intense the colors.

The plate being very highly polished which is best effected by tripoli powder and ammonia is connected with the battery and then plunged in the bath, and kept there for some minutes; it is then taken from the bath, washed in a large quantity of water, and dried over a spirit lamp. The surface thus produced is a dull neutral tint, often almost black, and upon exposing it to the light the colors are produced by removing the blackness; the surface is, in fact *eaten out in colors*. The sensibility of the plate appears to be increased by the action of heat, and when brought by the spirit lamp to the cerise red color, it is in its most sensitive state. At present, however, the plates cannot be rendered very sensitive, two or three hours being required to produce a decided effect in the camera obscura. It is, however, already found that the fluoride of sodium will very much accelerate the operation.

The fixation of the colored image is, however, still a point of considerable difficulty, and although a certain degree of permanence has

been recovered, the colors fade out by exposure, and eventually pass away. A kind of lacquer appears to have been applied to the plates we have seen, and ordinary diffused light does not seem to produce much change upon them.

Such is an outline of the researches of M. Niepce de Saint Victor, as communicated by him, to the Academy of Science—he is still zealously occupied in the inquiry and we hope very shortly to be enabled to communicate some yet more important results. The problem is, however, solved; we can produce pictures by the agency of the solar beam in natural colors; that principle which gives to the exterior creation the charm of color, will so regulate the chemical agency of the actinic power with which it is associated, that on properly prepared surfaces, the images are painted in their native hues. The helichromes will we have no doubt, in a short time enable the artist to catch the ever-varying tints of nature, and preserve them as studies. This is certainly one of the greatest steps made in Photography.

ROBERT HUNT.

EXPERIMENTS BY JAMES CAMPBELL.

Having made a number of experiments on the above process, I will give the results in the form of brief conclusions derived from them. I should also add, that the results of those experiments only are given, which give the fairest prospect of future success, in producing colored pictures in a short time, and of fixing the impressions.

If the plate prepared by M. Niepces' process be exposed to the vapors of iodine or bromine, before it is placed in the camera, the process will be much accelerated, but the pictures will not be so highly colored.

Chloride of iodine or bromine act in the same manner, but rather quicker.

The compound bromine and hydrofluoric acid acts a little better.

Hydrofluoric acid accelerates the process, and does not appear to injure the red and blue parts of the picture.

Chlorochromic acid accelerates the picture, and does not injure the colors. The picture must be exposed to its vapor, however, but a few seconds.

If exposed too long, a chromate of silver is formed, which is not easily reduced by light.

The perfluoride of chrome acts very similarly to the above compound; the red and blue colors are the best.

The fluorides of potassium and sodium, applied in solution to the plate, accelerate the process very much, and do not injure the colors. There is probably here a double decomposition effected on the plate—fluoride of silver, and chlorate of potash or soda being formed.

I will remark here, that I have great faith in the capability as to the coloration of the fluoride of silver by light, and that I believe it susceptible of receiving colored impressions. As hydrofluoric acid does not attack the silver plate, it can only be formed indirectly, by double decomposition of the fluorides of potash or soda, by a salt of silver.

Now let us examine the action of light on the prepared plate. When the chloridated plate is exposed to light, the chloride is decomposed—chlorine being eliminated, and silver reduced on its surface in a metallic form. This reduction, however, does not take place unless the chloride is contaminated with organic matter, the oxygen of which is eliminated; and the free carbon, but more especially the nascent hydrogen thus produced, reduces the silver. That this reduction is owing in part to the organic matter, may be shown

by the fact, that if chloride of silver be washed with strong sulphuric acid, which readily destroys organic matter, it is not affected by light.

If the plate be exposed to nascent hydrogen while receiving the impression, the process is accelerated fully two-thirds, and the colors are preserved.

Sulphurous acid, like hydrogen, only unites with chlorine in sunlight; and the same effect may be produced with it, by passing its vapor in the camera. The pictures are, however, sometimes tinged yellow by its use.

Carburetted hydrogen is a powerful accelerator, both in its light and heavy forms, and does not injure the colors.

Electricity also hastens the action very much. The plate should be made strongly electro-positive while receiving the impression.

By using these gases at the same time that the plate was thus rendered electro-positive, I have produced colored impressions in from four to five minutes in sunlight.

These agents will also hasten the action of light on the iodized plate, and also on plates prepared with bromine, fluorine, etc.

I have not been able to permanently fix the picture, though they will keep a long time, if not exposed too often and too long to the light. I have some which have been kept six months, and they

are as good as when first taken. I keep them ordinarily in a covered box, and they are not exposed long to the light at any time.

I published communications detailing these facts, in the Scientific American, and in Humphrey's Journal, some time since, in order to give experimenters the benefit of my observations; but I have as yet seen nothing on the same subject published.

Mr. Hill has not published his process; and it is as yet impossible to say whether it is substantially the same as this, or not.

It is also, as yet, uncertain whether he will be able to perfect his process so as to render it practically useful. It is to be hoped, however, that he or some other experimenter may be able to do so. That the thing is possible, is certain; the coloration and beauty of M. Niepces' pictures can not be excelled, and they only need acceleration and fixing, to render them perfect.

JAS. CAMPBELL.