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[Updater’s note: In this version, the above page numbering convention has been replaced by “{##}” sequences placed in line with the surrounding text.]

AMERICAN HAND BOOK OF THE DAGUERREOTYPE

GIVING
THE MOST APPROVED AND CONVENIENT
METHODS FOR PREPARING THE CHEMICALS,
AND
THE COMBINATIONS USED IN THE ART.

CONTAINING THE
DAGUERREOTYPE, ELECTROTYPE,
AND VARIOUS OTHER PROCESSES
EMPLOYED IN TAKING
HELIOGRAPHIC IMPRESSIONS.

BY S. D. HUMPHREY

FIFTH EDITION

NEW YORK:
PUBLISHED BY S. D. HUMPHREY
37 LISPENARD STREET
1858

To J. GURNEY, WHOSE PROFESSIONAL SKILL,
SCIENTIFIC ACCURACY,
AND ENERGETIC PERSEVERANCE, HAVE
WON FOR HIM UNIVERSAL ESTEEM,

THIS WORK IS MOST RESPECTFULLY INSCRIBED.

PREFACE.

There is not an Amateur or practical Daguerreotypist, who has not felt the want of a manual—Hand Book, giving concise and reliable information for the processes, and preparations of the Agents employed in his practice.

Since portraits by the Daguerreotype are at this time believed to be more durable than any other style of “Sun-drawing,” the author has hit upon the present as being an appropriate time for the introduction of the Fifth Edition of this work. The earlier edition having a long since been wholly; exhausted, the one now before you is presented.

The endeavor has been to point out the readiest and most approved Methods of Operation, and condense in its pages; as much practical information as its limits will admit. An extended Preface is unnecessary, since the aim and scope of this work are sufficiently indicated by the title.

S. D. HUMPHREY NEW YORK, 1858.

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AMERICAN HAND-BOOK of THE DAGUERREOTYPE.

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Polishing the Daguerreotype Plate.—I shall endeavor to present to the reader the process I have found productive of good and satisfactory results, presenting the same in a clear and concise manner, so that any one, by following the various manipulations given, will be enabled to succeed. If there is any one part of the process in Daguerreotype in which operators fail more than all others, it is in not properly preparing the plate. It has truly been said that it would take a volume to describe all the methods that have been suggested for polishing the plate.

I shall confine myself to the following description, which has been successfully practised, also most generally adopted by our operators, and I believe equal, if not superior to any other method, yet at the same time it is not of so much importance what particular method is employed, so that it be thoroughly and skillfully carried out.

There is a general tendency with beginners to slight this operation; hence the necessity of adopting a system which precludes the possibility of doing so. During many years' study and practice in the art, I have tried numerous methods and substances for the better accomplishment of the end in view, and have finally settled upon the following, as being (so far as experience allows me to Judge) the modus operandi, best suited to all circumstances; under no condition would I approve of a method less rigorous or precise.

The operator being provided with a bottle of finely prepared rotten stone, cover the mouth of the bottle with a piece of thick paper, this perforated with a pin so that the rotten stone can be dusted on the plate. Fasten the plate on the holder, take the rotten stone (Becker's can always be depended

upon), and dust on lightly until the surface is freely covered; now drop on the plate's surface a few drops of an alcoholic solution.[1]

[1] This solution is composed of equal parts of alcohol and water, for the summer, and in winter three parts alcohol to one of water; a few drops of potassa solution may be added, and is known to have a decided effect upon the plate.

Take a patch of Canton flannel; in order to prevent the moisture from the hand it should have a thick, firm texture: with this rub the plate in circles across, then back covering one-half of the former row of circles in each crossing until you have gone over the plate and back to the point of beginning, occupying at least half a minute in the operation, for a small plate, and so in proportion for the other sizes.

Care should be observed to keep the patch wet with the alcoholic solution forming a paste on the surface of the plate; the motion of the hand should be brisk and free, not hurried, and the pressure about equal to that of a pound weight. When the cotton is disposed to adhere to the plate, and slip from under the finger, spread the fore and middle fingers a little apart, then pressing down, bring them together in such a manner as to form a fold in the cloth between them, by which means you will hold it perfectly secure.

Avoid wetting the fingers, and should they perspire, wipe them often, as the moisture penetrating the cotton and coming in contact with the plate, would cause streaks it would be difficult to remove. I will here remark that many operators use much more cotton flannel than there is need of. I have found in my experience that a single patch, about one and half inch square, will be better for cleaning a number of plates than a new piece for every plate. This is the case for the wet, and for the dryrubbing two or three pieces will be found to answer. Thus with four or five cloths a dozen plates may be prepared.

Some operators use prepared cotton, and think it more convenient than the flannel. This may be had prepared free from seeds and in a very perfect state, if wished.

In going over the plate, great care should be observed, in touching its surface as equally as possible. The greatest care should be taken neither to touch the plate with the fingers, nor that part of the cotton flannel which is to come in contact with its surface; take a clean piece of flannel by one corner, snap it smartly to free it from dust and loose fibres, lay it face-side upward, dust on a little fine rotten stone; with this, polish around, or across,

or in circles, lightly and briskly, passing gradually over the whole surface of the plate, as was done before with the wet. The plate should now exhibit a bright, clear, uniform surface, with a strong metallic lustre, perfectly free from any appearance of film; if not, the last polished should be continued until the effect is obtained, and when once obtained, the plate is ready for buffing.

Buffing the Plate.—There are a variety of ways and means employed in this part of the operation. Some choose wheels, and others prefer the ordinary hand-buff. I have been unable to detect any peculiar advantage in the use of the wheel except in the facility of the operation; no doubt, however, but there is a saving of time, particularly in the preparation of the larger plates. For general use, we have not seen a wheel better adapted for this purpose than the one patented by Messrs. Lewis.

It is generally well to use a hand-buff before placing the plate on the wheel; this is in order to prevent, as far as possible, the dust or other substance that may be on the surface of the plate from coming in contact with the cover of the wheel. I will here follow out the use of the hand-buffs (two are necessary) as they are mostly used.

In the morning, before using the buffs, brush both as clean as possible, in order to free them from dust; then with the blade of a pair of shears, held perpendicular, rub the buffs from end to end; then knock them both together in order to free them from all dust or other substances, occasionally exposing them to the sun or to the fire.

With one of the buffs (reserving the finest and softest for the last operation), powder its face with fine rouge and brush off slightly, leaving only the finest particles in it. Every operator should have two plate-holders; one for cleaning and one for buffing the plate; for when using only one, the rotten stone is liable to get on the buff and scratch the plate.

Rest the fingers of the left hand on the back of the buff, near the farther end, with about the same pressure as in cleaning, while with the right you bear on the handle to correspond, and give the buff a free, easy, horizontal motion, passing it very nearly the whole length over the plate each time. Continue this operation in such a manner that the plate will on all parts of its surface have received an equal amount of polish. This buff once well filled with polish, add but little after, say a small quantity once in two or three plates. The polish as well as the buffs must be kept perfectly dry.

The second buff should always be in the best order, and if this is the case, but little polish after the first need be used. Much depends upon the last finish of the surface of the plate, and as a fine impression is desired in the same ratio, the operator must exercise care and skill in this operation. Some buff the smaller plates on the hands, by resting them on the fingers in such a manner that the buff cannot touch them; some by holding the edges with thumb and little finger, with the remaining fingers under, or on the back; and others buff on the holder. When this last method is adopted, it requires the greatest caution to prevent the dust from getting on the buff. The holder should be wiped clean.

The plate frequently slips off or around, and the buff comes in contact with the bed of the holder. When, however, the operator is so unfortunate as to meet with this mishap, the utmost care must be observed in thoroughly cleaning the buff cover before further buffing. In this last buffing it may be continued as before, except without the application of polish powder to the last buff. Examine the surface occasionally, and buff more lightly towards the close of the operation, using at last the mere weight of the buff. This last buffing should occupy as long a time as the first.

The point to be aimed at is, the production of a surface of such exquisite polish as to be itself invisible, like the surface of a mirror. The secret of producing pictures discernible in any light, lies in this: the more dark, deep and mirror-like the surface of the plate, the more nearly do we approach to perfection.

In all cases, very light and long continued buffing is productive of the greater success, since by that means a more perfect polish can be obtained.

The question is often asked, why is it that the plates receive the coating so unevenly? I will answer by saying that it may arise from two causes: the first and most general cause is that those parts of the plate’s surface which will receive the heaviest coating have been more thoroughly polished, and the consequence is that it is more sensitive to the chemical operation; second, and might perhaps be considered a part of the first, the heat of the plate may not be equal in all its parts; this may arise from the heat caused by the friction in buffing. It is a well known fact, with which every observing practitioner is familiar, that a silver plate at a temperature of 45 deg. or less, exposed to the vapors of iodine, is less sensitive and takes a longer time to coat, than when it is at a temperature of 60 deg. or more.

Whenever a view is to be taken, or any impression which requires the plate to be turned on the side, it should be buffed in the other direction, so that the marks will always be horizontal, when the picture is in position. With the finest possible polish, the plate is ready for the coating box.

The question is often asked by operators, what is the state of the plate when polished and allowed to stand for a time before using? To meet this point we hare only to consider the silver and the power acting upon it. Pure atmosphere does not act upon silver; but we do not have this about in our operating rooms, as it is more or less charged with sulphurated hydrogen, which soon tarnishes the surface of the plate with a film of brown sulphurate. It is this that sometimes causes the specks which appear on finishing the impression, and are a great annoyance. Hence we see that the plate should be buffed just before receiving the vapor of iodine. Mr Hunt gives his opinion of the use of diluted nitric acid as the best solution for freeing, the surface of the plate; he says:

“Numerous experiments on plated copper, pure silver plates, and on silvered glass and paper, have convinced me that the first operation of polishing with nitric acid, etc., is essential to the production of the most sensitive surface. All who will take the trouble to examine the subject, will soon be convinced that the acid softens the silver, bringing it to a state in which it is extremely susceptible of being either oxydized or iodized, according as the circumstances may occur of its exposure to the atmosphere or the iodine.”

I cannot see the objection to this solution; not, however, in general use. Our operators do not find it of sufficient importance to the success of their pictures to accept it, the alcoholic solution being in its nature less objectionable.

I will say here, that a plate submitted to only an ordinary polish is found to contain numberless minute particles of the powder made use of. Should the same plate be buffed for a long time, the polish will nearly all disappear, leaving the cavities in the surface free for the action of agents employed in subsequent operation. For this reason, I find that great amount of polishing powder should not be applied to the last buff, and it is obvious that three buffs can be employed to adventure; the two last should not receive any polishing materials. I have examined a plate that was considered to possess a fine finish, and similar had produced good impressions; these same plates,

when subjected to a long and light buffing, would present a surface no finer in appearance to the naked eye; but upon exposure to the solar radiation, would produce a well-defined image in one fourth less time than the plate without the extra buffing.

Coating the Plate.—For this purpose our mechanics and artists have provided a simple apparatus called a coating-box, which is so arranged as to be perfectly tight, retaining the vapor of the iodine or accelerators, and at the same time allowing, by means of a slide, the exposure of the plate to these vapors. They can readily be obtained by application to any dealer, all of whom can furnish them.

The principal difficulty in coating the plate, is that of preserving the exact proportion between the quantity of iodine and bromine, or quick. It is here necessary to say, that hardly any two persons see alike the same degree of color, so as to be enabled to judge correctly the exact tint, i. e. what one might describe as light rose red, might appear to another as bright or cherry red; consequently, the only rule for the student in Daguerreotype, is to study what appears to him to be the particular tint or shade required to aid him to produce the desired result. Practise has proved that but a slight variation in the chemical coating, of the Daguerreotype plate will very materially affect the final result.

The operator will proportion the coating of iodine and bromine or accelerators according to the strength and composition of the latter.

Experience proves that the common impressions, iodized to a rather light yellow gold tint, and brought by the bromine to a very light, rose color, have their whites very intense, and their deep shades very black. It is also known that if you employ a thicker coating of iodine and apply upon it a proportionate tint of bromine, so as to obtain a deep rose tint, delineations will be less marked, and the image have a softer tone. This effect has been obvious to everyone who has practised the art. Thus I may observe that the light coatings produce strong contrast of light and shade, and that this contrast grows gradually less, until in the very heavy coating it almost wholly disappears. From this it will readily be perceived that the middle shades are the ones to be desired for representing the harmonious blending of the lights and shades.

Then, if we examine, with respect to strength, or depth of tone, and sharpness of impression, we see that the light coating, produces a very

sharp but shallow impression; while the other extreme gives a deep but very dull one. Here, then, are still better reasons for avoiding either extreme. The changes through which the plate passes in coating may be considered a yellow straw color or dark orange yellow, a rose color more or less dark in tint, or red violet, steel blue or indigo, and lastly green. After attaining this latter color, the plate resumes a light yellow tint, and continues to pass successively a second time, with very few exceptions, through all the shades above mentioned.

I will here present some excellent remarks upon this subject by Mr. Finley. This gentleman says:

“It is well known to all who have given much attention to the subject, that an excess of iodine gives the light portions of objects with peculiar strength and clearness, while the darker parts are retarded, as it were, and not brought out by that length of exposure which suffices for the former. Hence, statuary, monuments, and all objects of like character, were remarkably well delineated by the original process of Daguerre; the plate being coated with iodine alone. An excess of bromine, to a certain degree, has the opposite effect; the white portions of the impression appearing of a dull, leaden hue, while those which should be black, or dark, appear quite light. This being the case, I conclude there must be a point between the two extremes where light and dark objects will be in photogenic equilibrium. The great object, therefore, is to maintain, as nearly as possible, a perfect balance between the two elements entering into union to form the sensitive coating of the plate, in order that the lights and shades be truly and faithfully represented, and that all objects, whether light or dark, be made to appear so far conformable to nature, as is consistent with the difference in the photogenic energy of the different colored rays of light. It is this nicely-balanced combination which ensures, in the highest degree, a union of the essential qualities of a fine Daguerreotype, viz., clearness and strength, with softness and purity of tone.

“So far as I know, it is the universal practice of operators to judge of the proportion of iodine and bromine in coating the plate, by two standards of color the one fixed upon for the iodine, the other for the additional coating of bromine. Now I maintain that these alone form a very fallacious standard; first, because the color appears to the eye either lighter or darker, according as there is more or less light by which we inspect the coating; and

secondly, because if it occur that we are deceived in obtaining the exact tint for the first coating, we are worse misled in obtaining the second, for if the iodine coating be too light, then an undue proportion of bromine is used in order to bring it to the second standard, and vice versa."

The iodine box should be kept clean and dry. The plate immediately after the last buffing, should be placed over the iodine, and the coating will depend upon the character of the tone of the impression desired. Coating over dry iodine to an orange color, then over the accelerator, to a light rose, and back over iodine one sixth as long as first coating, will produce a fine, soft tone, and is the coating generally used for most accelerators. The plate iodized to a dark orange yellow, or tinged slightly with incipient rose color, coated over the accelerator to a deep rose red, then back over iodine one-tenth as long as at first coating, gives a clear, strong, bold, deep impression.

I will here state a singular fact, which is not generally known to the operator. If a plate, coated over the iodine to a rose red, and then exposed to strong dry quick or weak bromine water, so that a change of color can be seen, then recoated over the iodine twice as long as at first coating, it will be found far more sensitive when exposed to the light than when it has been recoated over the iodine one-fourth of the time of the first coating.

Probably the best accelerating combination is the American compound formerly known as "Gurney's American compound," or some of the combinations of bromide of lime. The first is thought to possess perhaps more uniformity in its action than any other combination I have ever used.

The plate once coated should be kept excluded from the light by means of the plate holder for the camera box.

I will notice one of the principal causes having a tendency to prevent the perfect uniformity of chemical action, between the iodine and silver; hydrogen, or the moisture in the atmosphere, makes a very perceptible barrier. This moisture may arise as the result of the cold, from a want of friction in the buffing of the plate, which, coming in contact with the warmer air, as a writer on this subject says:

"It is well known that as often as bodies, when cold, are exposed to a warmer air, the humidity contained in them is condensed. It is to this effect that we must attribute the difficulty experienced in operating in most cases." This is corroborated by the results experienced by our operators. So it is seen that the plate should be of a temperature above that of the atmosphere.

Mr. Gurney submits his plates to a gentle heat from a spirit lamp just before exposing them to the vapor of iodine. Experience has convinced me that a plate heated to about 80 deg. before being exposed to iodine will present a far better defined image than a plate at a temperature of 50 deg. I account for this by noticing that, at a higher temperature, the plate throws off any larger crystals that might otherwise be deposited, receiving only the finer, thus producing a more perfect chemical combination of iodide of silver. I would call the attention of the operator to this point, as presenting something of interest, and which may direct in a way of accelerating the future operations.

That the presence of a film of moisture over the plate is a preventive of uniform chemical action, may be readily understood from the fact that iodine is almost insoluble in water, requiring seven thousand parts of water to dissolve one of iodine, or one grain to a gallon of water. Yet its affinities for silver and other substances are so powerful as to prevent its existing in an insulated state, hence we can account for the frequent occurrence of a plate presenting parts of an image over its surface. It is quite evident that those parts of plate's surface covered with moisture are nothing like as sensitive to the iodine as those parts perfectly free.

Exposure of the plate in the Camera, and Position.—The time of exposure necessary to produce an image upon the Daguerreotype plate, can only be determined by experiment, and requires a liberality of judgment to be exercised on the part of the operator. The constant variation of the light renders it impossible to lay down any exact rule upon this point. Light is not alone to be considered; the amount of coating exercises a deviating influence, also the subjects to be represented are not equally photogenic, some requiring much longer time of exposure than others. This may be easily observed by exposing the plate at the same time to a plaster bust and a piece of black velvet, the first being a much stronger reflector of light than the latter: the time necessary to produce a well developed image of the velvet being about six times longer than that required to produce an equally defined image of plaster. The manner of judging correctly of the time is by the appearance of impression after it has been developed by the mercurial vapors. Should it present a deep blue or black appearance it is solarized or over-timed. This sometimes is to an extent, that a perfect negative is formed, the white being represented black, and the dark light.

An object requiring the particular care and attention of the operator is the proper focus. It is not unfrequently the complaint of sitters that their hands are represented as being magnified and greatly out of proportion with the general figure. This is the case also with the nose and eyes, but in a less degree. As this cannot be wholly remedied, it is desirous to come as near as possible, and in order to do this, it is necessary to present the figure in such a position as to bring it as nearly as possible upon the same plane by making all parts nearly at equal distance from the lenses. This must be done by the sitter inclining the head and bust formed to a natural, easy position, and placing the hands closely to the body, thus preserving a propel proportion, and giving a lively familiarity to the general impression. It is not an uncommon fault among our less experienced operators to give a front view of the face of nearly every individual, regardless of any particular form, and this is often insisted upon by the sitter,[2] who seems to think the truth of the picture exists principally in the eyes staring the beholder full in the face.

[2] I might here picture some curious scenes experienced by our operators Every one is familiar with a certain class of our community whose ideas of the importance of a free and easy position of the body are too closely confined with stays, attention to toilet, tightly fitting dress coats and the like, to admit of being represented as if nature had endowed them with least possible power of flexibility. To such we would suggest the following, to be well learned and retained in the mind while presenting themselves before the Daguerreotype camera:

“The experience of one who has often been Daguerreotyped, is, to let the operator have his own way.”

Nothing, in many instances, can be more out of place in a Daguerreotype portrait than this, for let a man with a thin, long, defeated-politician-face, be represented by a directly front view, we have, to all appearances, increased the width of the face to such an extent as to reveal it flat and broad, losing the characteristic point by which it would be the most readily recognized. The method we should adopt in taking the likeness of such an individual as above, would be to turn the face from the camera, so as to present the end of the nose and the prominence of the cheek bone equally distant from the lenses, and then focusing on the corner of the eye towards the nose, we cannot in many cases, fail to produce an image with the lips, chin, hair, eyes and forehead in the minutest possible definition.

It should be the study of every operator to notice the effect of the lights and shades while arranging the sitter, and at the same time be very particular to give ease in the position.

No matter how successful the chemical effect may have been, should the image appear stiff and monument-like, all is lost. “In the masterpiece, grace and elegance must be combined.”

I will here use the words of another, which are very true:

“So great is the difference in many faces, when inspected in opposite directions, that one of the two views, however accurately taken, would not communicate the likeness—it not being, the usually observed characteristic form. When the right view of the head is obtained, it is first necessary to consider the size of the plate it is to be taken on, so as to form an idea of the proportion the head should bear to it. The mind must arrange these points before we commence, or we shall find everything, too large or too small for the happy proportion of the picture, and the conveying of a just notion of the stature. The work will have to be done over, and time sacrificed, if this is not attended to. The adjustment of the head to the size of the plate (as seen from the margin of the mat), is not to be taught: everyone must bring himself, by scrutinizing practice, to mathematical accuracy; for something will be discovered in every face which can be surmounted only by experience.

“The eye nearest the camera, in a three-quarter-face, is placed in the middle of the breadth of the plate; the chin, in a person of middle stature, in the middle of the length, and higher according to the proportional height of the person.”

In regard to the proper elevation of the camera, it may be here stated that I have found it best in taking portraits where the hands are introduced, to place the camera at about equal height with the eyes of the sitter, in order to bring the face and hands equi-distant from the tube. It will be found, if the above be followed, that by attaching a string to the camera tube, and making a semi-circle, that the face and hands of the sitter will occupy a corresponding distance, and the consequence is that the impression will appear without the hands being magnified. It has been found that a person with a freckly face can have as fine, fair, and clear an impression as the most perfect complexion; this may be done by the subject rubbing the face until it is very red. The effect is to lessen the contrast, by giving the freckles

and skin the same color and the photogenic intensity of the red and yellow being nearly the same, an impression can be produced perfectly clear.

When a child is to be taken, and there are doubts of its keeping still, the operation may be accelerated by placing it nearer the window bringing the screen nearer, and placing a white muslin cloth over the head; this will enable you to work in one third of the usual time. Should the person move, or the plate become exposed to the light, it may be restored to its original sensitiveness by placing it over the quick, one or two seconds.

Developing the Daguerreotype.—After the plate has been submitted to the operation of the light, the image is still invisible. It requires to be exposed to the vapors of heated mercury. It is not absolutely necessary to apply artificial heat to the mercury to develop the image, for fair proofs have been produced by placing a plate over the bath at the ordinary temperature of the atmosphere. This plan, however, requires a long time and cannot be adopted in practice, even if it were advisable. The time more usually required in developing the image over the mercurial vapors, is about two minutes, and the temperature is raised to a point necessary to produce the desired effect in that time. This point varies as indicated by different scales, but for the ordinary scales it is not far from 90 deg. cen.

The mercury bath is accompanied with a centigrade thermometer, by which the heat is regulated. Those furnished by the manufacturers are not always correct, and it requires some experience to find the proper degree on the scale.

I would here remark that it is advisable, when placing the spirit lamp under the bath, to so arrange it that the position of applied heat should always be on the same point, viz., should the heat be directly under the bulb containing the thermometer it would raise the mercury in the tube to the point marked, and the temperature of that in the bath would be far below what it should be; hence it is (where time is followed for developing) that many failures occur. This is observed more readily in the large baths made of thick iron, particularly upon first heating. In practice I apply the heat as nearly as possible between the centre of the bottom of the bath and the bulb containing the mercury tube. It is advisable to keep the lamp lighted under the bath from the time of commencing in the morning to the close of business at night. By this means you have a uniformity of action, that cannot be otherwise obtained.

It is well known to the experienced Daguerreotypist, that different atmospheres have a decided effect upon the mercury in developing the Daguerreotype. It will require a greater degree of heat for one atmosphere than for another. Experience alone determines this little difference.

In summer, on cloudy and stormy days, mercurial vapors rise more readily and quickly than in the temperature of autumn or winter. From 60 degrees upwards towards the boiling point (660 deg.), the vapors of mercury rise in greater abundance and collect in larger globules on cold surfaces.

For various reasons I prefer a high temperature and short exposure. It accelerates the process. It renders the lights of the picture more strong and clear, while the deep shades are more intense. It gives a finer lustre to the drapery. The solarized portions also are very seldom blue, especially after gilding. If heated too high, however, the light parts become of a dead, chalky white, and the shadows are injured by numerous little globules of mercury deposited over them. Just the right quantity of mercury leaves the impression of a transparent, pearly white tone, which improves in the highest degree in gilding. To mercurialize with exactness is a nice point. If there is reason to suspect having timed rather short in the camera, reduce the time over mercury in a corresponding proportion. A dark impression will be ruined by the quantity of mercury which would only improve a light one.

If practicable, it is most expedient that the plate be submitted to the action of mercury immediately on coming from the camera. I have frequently, however, carried plates for miles in the plate-holders and after exposing in the camera, brought them back to expose to mercury, and obtained fair proofs; but for the reason before given, it is advisable to carry along the bath, and bring out the impression on the spot.

It is sometimes the practice of inexperienced operators to take the plate off the bath and examine the impression by solar light. This plan should be abandoned, as it is almost sure to produce a dense blue film over the shadows.

This I am led to believe is occasioned by the action of light on the yet sensitive portions of the plate, and made to appear only by subsequent exposure to mercury, being equivalent to solarization.

There has been little said by our professors upon the subject of the position of the plates while exposed to the mercurial vapour. Mr. Hunt, in referring to this subject, says: “Daguerre himself laid much stress upon the necessity of exposing the plate to the mercury at an angle of about 45 deg.. This, perhaps, is the most convenient position as it enables the operator to view the plate distinctly, and watch the development of the design; but beyond this, I am satisfied there exists no real necessity for angular position. Both horizontally and vertically, I have often produced equally effective Daguerreotypes.” I presume from the last sentence of Mr. Hunt, that he has confined his experiments to the smaller sized plates. Hence he may not have thought of the effect of the vertical exposure of a large plate.

In America this is a subject of no little importance. When an impression is to be developed upon a plate fifteen by seventeen inches, were we to use an angle of about 45 deg., it would be found to make a perceptible difference in the appearance of the image. By examining the wood tops of our baths as formerly made, it will be found that there is a great variation in the distance from the mercury to the different portions of the plate. By measuring one of these tops for the size plate above mentioned, I find the distance to the nearest point between the mercury and the plate, to be thirteen, and the middle point sixteen, and the furthest point twenty-one and a half inches: by this we see that one point of the plate is eight and a half inches further from the mercury than the nearest point; even this is not the variation there would necessarily be, were we to adopt the angle of 45 deg. as urged by Daguerre.

Among our principal professors, the bevel top will not be found in use where the large plates are used. Should any one feel desirous to test more minutely the effect produced by a bevel top bath, I would suggest to them to place a frame, so constructed as to hold three sixth size plates, and fit it to the top of the bath, and so arrange it with openings that the plates may be placed, one at the nearest point of the mercury, the second midway, and the third to the greatest distance, and by placing the plates over at one and the same time, the experimenter will be enabled to judge if there exists a difference in the developing. In speaking of the above, reference is had to baths to the ordinary heights used by operators.

We will now proceed to examine the effect produced by mercurial vapor upon the plate at different lengths of exposure. In some investigations

which I have made upon the appearance of the Daguerreotype impressions when developed over mercury at 90 deg. C. (194 deg. F.), the following was the result. Plates, coated and exposed to light in our usual manner of operating, produced on exposure of

1/2 minute, whole impression, deep blue.

1 minute, ashy and flat; no shadows; linen, deep blue.

1 1/2 minute, coarse and spongy; shadows, muddy; drapery, dirty reddish brown.

2 minutes, shallow or watery; shadows, yellowish; drapery, brown.

2 1/4 minutes, soft; face, scarcely white; shadows, neutral; drapery, fine dark brown linen somewhat blue.

2 1/2 minutes, clear and pearly; shadows, clear and positive, of a purple tint; drapery, jet black, with the dark shades slightly frosted with mercury.

2 3/4 to 3 minutes, hard and chalky; shadows, harsh; drapery, roughened, and misty with excess of mercury.

The foregoing results will be found general.

There are numerous opinions among our operators in regard to the quantity of mercury necessary for a bath. As regards this, I need only say, similar results occur when two pounds or two ounces are used, but the quantity generally employed is about a quarter of a pound. I am of the opinion that one ounce will answer as well as a larger quantity. I know of no better proof in favor of a small quantity than that presented in the following incident. Several years since, an operator (Mr. Senter, of Auburn, N.Y.) of my acquaintance, was requested to go several miles to take a Daguerreotype portrait of a deceased person. He packed up his apparatus and proceeded over a rough road for some distance to the house where he was to take the portrait, and arranging his apparatus, with all the expedition which the occasion required, after having everything in usual order (as was supposed), he proceeded and took some ten or twelve very superior impressions. They were fine, clear, and well developed. After taking the number ordered, he proceeded to repack his apparatus, and to his surprise, when he took up the bottle he carried the mercury in, he found it still filled, and none in the bath, except only such particles as had adhered to the sides, after dusting and being jolted for several miles over the rough road. From this it will be seen that a very little mercury will suffice to develop fine proofs. I saw some of

the impressions referred to above, and they were certainly well developed, and very superior specimens of our art.

Removing the Coating.—After the impression has been developed over the mercurial vapor, the next step is to remove the sensitive coating. For this purpose the following solution is used:

Put 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.

It is best that the washing be done immediately on the plate coming from the mercury bath. If allowed to stand long with the coating on, it assumes a very dark tint—as the operation of the light continues, though less active than while exposed in the camera, and destroys that brightness which would otherwise have been obtained. It is preferable to wash and gild a picture without it first being dried; yet when there are doubts of its giving satisfaction, there would sometimes be a saving by drying and getting the decision of the subject before gilding, as this last injures the plate for another impression. First, light your spirit-lamp, then with your plyers take the plate by the lower right-hand corner, holding it in such a manner that the plyers will form in a line with the upper left-hand corner; pour on, slowly, the hyposulphite solution, slightly agitating the plate, until all the coating is dissolved off; then rinse off with clean water, and if it is not to be gilded, dry by holding the plate perpendicular with the bottom left-hand corner lowest, and applying the blaze of the spirit-lamp to the back, at the same time blowing gently downward on the face of the plate.

The hyposulphite solution should be often filtered through a sponge, and it will answer for a great number of washings. Yet it is observed that the mercury collects in this solution in small globules; these often come in contact with the plate, causing white spots, which spoil the impression. They should be guarded against, and the solution renewed. Again, in order to prevent streaks or scum on the surface of the plate, it is necessary that the coating should be removed with a good degree of uniformity. I find in practice that the hyposulphite of soda in our market varies much as regards

strength, and consequently the rule to be adopted is to make a solution of sufficient strength to remove the coating in about ten seconds. I am aware that it may be said that this strong solution would have a tendency to injure the impression by destroying in a measure the sharpness of outline. To meet this, it need only to be said that the preventive is, to not let the solution rest on the surface of the plate for a longer time than is absolutely necessary, and then it should be drenched copiously with water; hence a chemical action upon the image is prevented and the general operation facilitated. This plan is adopted by our first operators with the greatest success.

If the operator should allow the hyposulphite solution to run over the plate unevenly, it is quite likely that white or blue streaks would result. These it is impossible to remove without injury to the impression. Some, in order to prevent this, breathe over the surface, thus moistening it and putting it in a condition to receive the solution with greater uniformity. The plate should be well washed with water before gilding.

Gilding, or Fixing the Image.—The next process to be given is that for fixing the image on the plate. This is done by precipitating a thin film of gold over the surface and is productive of the most brilliant effect when prepared immediately after the plate has been washed with water after the application of the hyposulphite solution, and before the plate has been allowed to dry. When, however, the plate has been dried and allowed to stand for any time, before gilding, the hyposulphite wash should be applied as at first, in order to destroy any chemical coating that may have been formed on exposure of the plate to the air. For gilding the larger plates, we have a gilding stand so constructed that the plate can be put on a perfect level. In practice, I prefer holding the plate with nippers, fastened at one corner. Hold the plate in the same manner as in removing the coating; pour on the gilding, newly filtered, until the surface is wholly covered, and with the blaze of the spirit lamp, at least three inches high, apply it to the back of the plate, moving it about, that the surface may be heated with as much uniformity as possible. Continuing this operation, the surface will generally become covered with small yellow bubbles which soon disappear, leaving the image clear and distinct.

It is advisable to make use of a lamp having a sufficiently strong flame to produce the effect in a few minutes. If after a first heating, it is found that the impression can admit of a greater degree of intensity, it might be heated

anew; but that is seldom necessary, and often by trying to do too, well, the operator, if he persists in heating certain parts of the plate, may find the liquid dry up just above the flame, and inevitably cause a stain; [3] or else the blacks are covered with a film, or even the coating of gold may suddenly exfoliate, when small particles are detached from the plate. The impression is then entirely spoiled, but the plate may be re-polished.

[3] This can be remedied, however, if it is immediately washed over with the same solution that is on the plate, so that the surface shall not become cool; continue for a short time to apply the lamp under, and agitate the plate slightly, and it will soon be free from all imperfections and give a fine clear tone.

It is not unfrequent that the surface assumes a dark, cloudy appearance. This is generally the best sign that the gilding will bring out the impression with the greatest degree of distinctness. Soon, the clouds gradually begin to disappear, and, “like a thing of life” stands forth the image, clothed with all the brilliancy and clearness that the combined efforts of nature and art can produce. When in the operator’s judgment the operation has arrived at the highest state of perfection, rinse suddenly, with an abundance of clean water, and dry as before described.

When an impression is dark, the gilding process may be longer continued; but when light, it should be gilded quickly, as lengthening the time tends to bleach the impression and make it too white. The cause of this appears to be, that with a moderate heat the chlorine is merely set free from the gold, and remaining in the solution, instead of being driven off, with its powerful bleaching, properties, it immediately acts upon the shades of the picture. A dark impression can thus, by a low heat, long-continued, be made quite light. To procure the best effect, then, heat suddenly with a large blaze, and judging it to be at the maximum, cool as suddenly as possible.

When the hyposulphite of gold is used instead of the chloride, a less heat should be employed.

Coloring Daguerreotypes.—Of all the so-called improvements in the Daguerreotype, the coloring is the least worthy of notice. Yet the operator is often, in fact most generally, called upon to hide an excellent specimen under paint. I can conceive of nothing more perfect in a Daguerreotype than a finely-developed image, with clearness of lights and shadows, possessing the lively tone resulting from good gilding. Such pictures, however, are not always had, and then color may perform the part of hiding the

imperfections. We present the following method as given in Willat's Manual:

"Daguerreotype portraits are now commonly met with beautifully colored; but the coloring is a process requiring great care and judgment, and many good pictures are spoiled in fruitless experiments. Several different methods of coloring have been proposed. The simplest mode appears to be that of using dry colors prepared in the following manner: A little of the color required, very finely ground, is thrown into a glass containing water, in which a few grains of gum arabic have been dissolved. After standing a few moments, the mixture may be passed through bibulous paper, and the residue perfectly dried for use. The principal colors used are Carmine, Chrome Yellow, Burnt Sienna, Ultramarine and White; boxes fitted with sets of colors properly prepared, may be obtained of the dealers, and include Carmine, White, Lilac, Sky Blue, Pink, Yellow, Flesh color, Orange, Brown, Purple, Light Green, Dark Green and Blue. With a few colors, however, all the rest may be made thus: Orange, by Yellow and Red; Purple, with Blue and Red; Green, Blue and Yellow; Brown, with Umber, Carmine and Lamp Black; Scarlet, Carmine and Light Red. While it is true that a little color may relieve the dark metallic look of some Daguerreotypes, it must not be concealed that the covering of the fine delicate outline and exquisite gradations of tone of a good picture with such a coating, is barbarous and unartistic.

"The prevaling taste is, however, decidedly for colored proofs, and the following directions will assist the amateur in ministering to this perverted taste, should he be so inclined. The coloring should commence with the face, and the flesh tint must be stippled on (not rubbed) with a small camel's-hair brush, beginning from the centre of the cheek, taking great care not to go over the outline of the face, and also not to have too much color in the brush; the eyes and eyebrows must not be touched with color. After the flesh color is applied, take a piece of very soft cotton and pass it very gently backwards and forwards over the face, so as to soften down the color, and then apply the carmine to give the required tint. For men, the darker tints should predominate, and for women the warmer. Very light hair may be improved by a slight tint of brown, or yellow and brown, according to the color. In coloring the drapery, the same care must be used. No rules can be laid down for all the different colors required, and the amateur had better obtain the assistance or advice of some one accustomed to the use of

colors. A little white with a dash of blue or a little silver, will improve white linen, lace, etc. The jewelry may be touched with gold or silver from the shells, moistened with distilled water, and laid on with a fine-pointed sable-hair brush.

“Brilliants may be represented by picking the plate with the point of a pin or knife.”

CHAPTER II.

MISCELLANEOUS.

Coloring Back Grounds—Transparent ditto—Gilding Dissolvent Solution for removing Specks—Solarized Impression—To Purify Water—Cleaning Mercury—Adhesive Paper—Black Stain for Apparatus—Sealing Wax for Bottles—Rouge—Rotten Stone—Potassa Solution—Hyposulphite Solution—Substitute for do.—Gilding Solution—Solution for increasing the Brilliancy of the Daguerreotype—Bleaching Solution;—Cold Gilding—Neutralizing Agents—Buff Dryer—Keeping Buffs in order—Cleaning Buckskins—Reflector for taking Views.

To Color Back-grounds—To obtain a properly colored back ground is a matter of no little importance to the Daguerreotype operator. I had nearly exhausted all patience, and tried the skill of painters to obtain a back-ground that would be suitable to my purpose; but all to no avail. At last I adopted the following method, and at a cost of coloring of twenty-five cents, can now produce a back-ground far more valuable than those which had cost five dollars before.

Take common earth paint, such as is used in painting roofs; mix this with water to about the consistency of cream; then to four quarts of this mixture add about one pint of glue water (common glue dissolved in water, also about as thick as cream). This last will cause the paint to adhere to the cloth, to which it is applied with a common white-wash brush. By applying the brush on the coating while it is wet, it may be so blended that not a line can be seen, and a perfectly smooth color of any shade can be obtained. The

shade of color I use is a light reddish-brown. Tripoli, rotten-stone, or any earthy matter, may be applied in the same manner.

Transparent or Invisible Back-ground.—I give this as originally published in my System of Photography, 1849:

“Take a large woollen blanket with long nap, the longer and rougher it is the finer will be the effect produced; stretch it on a frame of sufficient size, and suspend the frame at the centre of the upper end by a string fastened to a nail in the ceiling, from three to five feet back of the sitter. Having arranged this, fasten another string to the side of the frame, and while the operation is going on in the camera, swing the back-ground from right to left, continuing this during the whole time of sitting, and you have a clear “transparent” back-ground, which throws the image out in bold relief, and renders the surface of the plate invisible. If equalled at all it is only by atmospheric back-ground. I consider it to be the best ever known, and think it needs but to be tried to afford satisfactory proof that it is so. Although used by few before, since the first edition of this work at least two thirds of the operators have adopted its use; for any one can at once understand the principle and the effect which it produces.”

It may be added that a motion imparted to to any back-ground where softness is desired, produces an excellent effect.

Gilding Dissolvent.—To one quart of muriatic acid add as much oxide of iron (common iron rust) as it will dissolve in two days. This may be done by putting in the oxide in excess. It should be frequently shook, and when wanted for bottling it should be allowed to stand in order to settle. When this is done the solution may be poured off, and reduced by adding to it an equal quantity of water; then it is ready for use. This constitutes a gilding dissolvent now in our market.

Solution for Removing Specks.—There is probably no one cause of complaint so general as “what makes those black specks?” There are several causes which produce them, and probably the most general are dust, rouge, or a spray of moisture on the plate. It this be the case, there is no solution which can remove them, as they have prevented a chemical action with the silver, and their removal would only expose the surface of the plate which in itself would afford a contrast with the impression. Another and less dangerous source of these specks is organic matter contained in the solution employed in dissolving the chemicals, or the water in washing.

Much of the hyposulphite of soda in market contains a sulphuret, which, coming in contact with the silver surface, immediately causes oxidation. Such spots, as well also as most all others found on the plate after it has been exposed in the camera, can be removed by the following, solution: To one ounce of water add a piece of cyanide of potassium the size of a pea; filter the solution and apply by pouring it on the surface of the plate. In all cases the plate should first be wet with water. Apply a gentle heat, and soon the spots disappear, leaving the impression clear and free from all organic matter.

In the absence of cyanide of potassium, a solution of pure hyposulphite of soda will answer as a fair substitute.

To Redeem, a Solarized Impression.—The Daguerreotype plate, prepared in the ordinary manner, should be exposed in the camera a sufficient time to solarize the impression. Then, before it be exposed to the vapor of mercury, expose it for a very brief period to the vapor of either chlorine, bromine or iodine. Then expose over mercury, as usual. I have produced singularly interesting results by this process.

To Purify Water.—Filter the water well, and then add about three drops of nitric acid to the pint. This can be used as absolutely pure water, but I would recommend the use of distilled water as preferable.

Cleaning Mercury.—Make a small bag of chamois skin, pour in the mercury, and squeeze it through the leather. Repeat this several times, and filter by means of a funnel made of paper, with a very small aperture, through which it will escape and leave the particles of dust, or other substances, in the paper. A paper with a pinhole through it will answer as well, and it is less difficult to make.

Adhesive Paper.—Take gum arabic, four ounces, put it in a wide-mouthed bottle and pour on water about one-third above the gum. Add half ounce of isinglass, or fish glue, and a small piece of loaf sugar. Let all dissolve, and spread over French letter paper, with a brush or piece of sponge. If once spreading is not enough, perform the same operation a second time.

Black Stain for Apparatus.—Dissolve gum shellac in alcohol, or procure shellac varnish at the druggists', stir in lampblack, and apply with a sponge or bit of rag. This will adhere to metal, as well as wood, and is used for the inside of camera, tubes, etc.

Sealing Wax for Bottles.—Melt together six parts rosin and one beeswax, and add a small quantity of lampblack; or, if red is preferable, add red lead. Common white wax is best, as most chemicals act less upon it.

When bottles containing bromine are to be sealed, it is well to grease the stopper. This, however, only when the bottle is in frequent use, for if it were to be sent by any conveyance it would be likely to fly out.

Rouge.—The method employed by Lord Ross is probably unsurpassed in the production of rouge. He has given his process as follows:

"I prepare the peroxide of iron by precipitation with water of ammonia, from a pure dilute solution of sulphate of iron; the precipitate is washed, pressed in a screw press till nearly dry, and exposed to a heat which in the dark appears a dull, low red. The only points of importance are, that the sulphate of iron should be pure, that the water of ammonia should be decidedly in excess, and that the heat should not exceed that I have described. The color will be a bright crimson inclining to yellow. I have tried both potash and soda, pure, instead of water of ammonia, but after washing with some degree of care, a trace of the alkali still remained, and the peroxide was of an ochrey color, till overheated, and did not polish properly."

Care should be observed to apply rouge in a dry state to the surface of the plate.

I would remark, that so far as my experience has gone, I consider good rouge fully equal to any other polishing, material for the last or finishing polishing; consequently I shall not take up my space in enumerating any of the great variety that find few advocates.

Why Rouge is to be preferred.—"Because it burnishes better, and because it assists in fixing the layer of gold, rendering it less susceptible of being removed in scales when heated too much."

Rotten Stone.—"Purchase the best ground rotten stone of the druggist, put a few ounces at a time in a wedgewood or porcelain mortar, with plenty of clean rain water. This should have about forty drops of nitric acid to the quart. Grind well, and after letting the mortar stand two minutes, pour into a third. After remaining undisturbed eight minutes, finally pour off into a fourth to settle. Rinse back the sediment in the second and third, and grind over with a new batch. Repeat the operation till you have all in the fourth vessel. Let this stand several hours, and pour off the water very carefully.

Set the deposit in the sun, or by a stove to dry. When perfectly dry, pulverize, and it is ready for use. With a little trouble you will obtain in this way a much better article than can generally be bought of dealers. For the last washing, alcohol, or a mixture of alcohol and water, is preferable."

Potassa Solution.—The use of a solution of potassa in the preparation of the plate was suggested in the early history of the Daguerreotype. It was thought to possess some peculiar property for improving the tone of the impression. It is used for moistening the rotten stone in polishing the plate, and may be prepared by putting about an ounce and a half of alcohol in a close bottle, and add half a stick of caustic potash. This will soon become of a deep red color. For use, fill your small bottle, having a quill in the cork, with alcohol, and add a few drops of the above, or enough to change it to a bright orange or saffron color.

A Substitute for the Hyposulphite Solution.—M. DAGUERRE recommends the use of a solution of salt water for removing the coating off the plate. I found this of some service at one time during my travels. My hyposulphite bottle got broke and its contents lost, so as only to leave enough for preparing gilding. I resorted to the use of salt solution, and found it to answer well. Make a saturated solution of salt in water. First wash the plate with clear water; then immerse it in the saline solution, when it should be agitated, and the coating will soon disappear. Another process with a salt solution of half the strength of the above is very interesting and effectual. The plate having been dipped into cold water, is placed in a solution of common salt, of moderate strength; it lies without being acted upon at all; but if it be now touched on one corner with a piece of zinc, which has been scraped bright, the yellow coat of iodine moves off like a wave and disappears. It is a very pretty process. The zinc and silver forming together a voltaic pair, with the salt water intervening, oxidation of the zinc takes place, and the silver surface commences to evolve hydrogen gas; while this is in a nascent condition it decomposes the film of iodide of silver, giving rise to the production of hydriodic acid, which is very soluble in water, and hence instantly removed.

This process, therefore, differs from that with hyposulphite. The latter acts by dissolving the iodide of silver, the former by decomposing it. It is necessary not to leave the zinc in contact too long, or it deposits stains, and

in large plates the contact should be made at the four corners successively, to avoid this accident.

Gilding Solution.—To one pint of pure rain or distilled water add fifteen grains of pure chloride of gold, and to another pint add sixty grains of hyposulphite of soda. When dissolved, pour the gold solution into the hyposulphite by small quantities, shaking well after each addition. The soda solution must not be poured into the gold, as the gold would be immediately decomposed, and the solution turn black, and be unfit for use.

Some operators add muriate of potash and other substances, but these do not possess any advantage except in cases where it is necessary to bleach the solarized portions of the impression, and when such is the case, chloride of sodium (common salt) is probably as effective and is the most convenient. Add about a teaspoonful to two ounces of the gilding.

Solution, for Increasing the Brilliancy of the Daguerreotype.—This solution will have the effect to thoroughly cleanse the surface of the gilded plate and excite a powerful influence on the general character of the impression. To a solution of three ounces of water, in which is dissolved a quarter of an ounce of cyanide of potassium, add one teaspoonful of a solution containing six ounces of water and half an ounce of each pure carbonate of potash, alum, common salt, gallic acid, sulphate of copper, and purified borax. While the plate is wet, pour on a little, and heat it with a powerful blaze. The effect will be quickly produced, in from three to fifteen seconds. Rinse and dry, as in the gilding.

Bleaching Solution.—Make a saturated solution of muriate of ammonia (sal ammoniac) in pure water, and filter through paper. Reduce with an equal quantity of water when used. When the linen or any other portion of the impression is badly solarized, after removing the coating, rinse with water; then pour this upon the surface in the same manner as the gilding solution. If the solarization be very deep, apply the lamp beneath, and warm the plate a trifle. Now pour off, and, without rinsing, apply the gilding. The whole operation must be quickly performed, or the chlorine soon attacks the shades of the picture. When properly done, however, the solarized parts are restored to a clear, transparent white.

Electro, or Cold Gilding.—This process I have adopted, and it produces exceedingly beautiful impressions for the stereoscope, adding a great charm to the pleasing effect of that instrument. It also possesses a pretty and

curious effect on views. It is easy of trial, and may be used by dissolving one gramme of chloride of gold in half a litre of ordinary water, and thirty grammes of hyposulphite of soda in another half litre of similar water; then pour the solution of chloride of gold into that of soda, by little and little, agitating it exactly as in M. Fizeau's preparation, of which there is but a variation.

When you wish to use it, pour some into a plate, or any other vessel of the same kind, sufficient to cover the proof; then, after having added to it a drop of ammonia, immerse the plate in it as soon as you take it out of the mercury-box, after having wiped its back and edges, and agitate the mixture quickly from right to left, so as to dissolve rapidly the coating of iodide of silver as usual. As soon as the plate appears white, cease all rapid motion, but continue to give it a slight undulating one; for if it were allowed to remain still for only a few minutes, the proof would be clouded. By little and little, the surface of the plate takes a yellow tint, which darkens more and more, approaching to bistre. You stop therefore, at the color you wish; and when the proof has been washed and dried, in the manner previously explained, it will be found to be fixed, without any stain, with a limpid surface, and an extraordinary warm tone. If you were to augment the proportions of the ammonia or chloride of gold, the operation would progress much quicker, but then the middle of the proof would be always much clearer than towards the border. The mixture may be used several times without being renewed. It does not, however, give such a beautiful color to the impression as when it is newly prepared. By communicating to the vessel containing the solution a continual motion, the impression, when once immersed, will be fixed. During that time, and while attending to anything else, watch its color; and at the end of ten minutes or a quarter of an hour, take it out of the bath and dry it.

Agent for Neutralizing Bromine, Chlorine, and Iodine Vapors.—Aqua ammonia, sprinkled about the chemical or coating room, will soon neutralize all the vapor in the atmosphere of either chlorine, bromine, or iodine. No operator should be without, at least, a six-ounce bottle filled with ammonia. A little of its vapor about the camera-box has a decided and happy effect. Burnt coffee, pulverized, has also the property of destroying the vapors of the above chemicals, as also almost any other agent employed about the Daguerreotype room. Its deodorizing properties are such that if brought in contact with air filled with the odor of decomposing meat, it will

instantly destroy all disagreeable smell. It can easily be used in the Daguerreotype room by placing a little of the raw bean, finely pulverized, on an old plate, and roasting it over the spirit-lamp.

Buff Dryer.—There are various methods for keeping buffs dry and free from dust. Some place a sheet of iron against the wall at an angle sufficient to put a lamp between it and the wall, and then let the buff rest against the top of the sheet. By this method the buff is for its full length close to the heated iron, and at the same time exposed to the heated atmosphere and any dust that may be free. I would recommend some arrangement by which the buff would be inclosed. I have found the following to answer the purpose well, which is a box of sheet iron twenty inches long, eight wide and five high, with one end left open and the other closed; the cover is made of the same material, with the edges bent over to go on and off. There are several wires running through the centre of the sides, which it is necessary to cover with cloth or paper to absorb all the moisture that may be made by applying the heat, and the buffs are put in and taken out at the open end. In order that the heat may be as nearly uniform as possible, an iron bar one inch wide, eighteen inches long and one half inch thick, is so bent that the centre is one quarter inch from the bottom of the box, and that at least two inches of each end come in contact with the bottom; this being riveted on the bottom, and a lamp with a small blaze applied to the centre of the bar of iron. This will constitute one of the best and cheapest buff dryers in use. It may be suspended from the wall by placing wires around it, or it may stand upon legs. Perhaps a more convenient plan is to place it under the workbench in a similar position to a drawer. One precaution is necessary: when first heating the dryer, apply but a very gentle heat. This will prevent an accumulation of moisture, which would otherwise pass off in steam, coming in contact with the buff, thus causing a dampness. Another caution: never have the temperature of the air in the heater more than ten degrees above that which surrounds it.

When wheels are used, they should be encased in a sheet iron or wood case. All those made for our market are provided in this respect.

Keeping Buffs in Order.—This is one of the most important objects to arrest the attention of the operator. Every buff is more or less liable to get out of order by dust falling upon or coming in contact with the polishing powder employed in cleaning the plate. The edge of every plate should be thoroughly wiped and freed from any material that may adhere while cleaning. I have adopted the following method, which proves highly successful:

Rub the buff leather, holding the face down, with the sharp edge of a pair of shears or a piece of glass. This brings out any portion of the skin which may have become matted from any moisture, and also takes out any substance imbedded in it, and prevents it from scratching. Then, with a stiff brush, rub the buff well, and it will be found to work well. This same process employ on wheels and hand buffs every morning, or oftener, as occasion requires.

Preparing Buffs.—Two of these are necessary. That part of the stick to be covered should be about eighteen or twenty inches long, and three wide, and made crowning on the face from one end to the other, about one half inch. Before covering, these are to be padded with two or three thicknesses of Canton flannel. The buff should not be too hard, but padded with flannel, so that by drawing it over the plate, it may touch across the surface. The only proper material for buffs is prepared buckskin; and if prepared in a proper manner, this needs nothing but to be tacked upon the stick. There are several varieties of wheels employed; the one most generally adopted is Lewis' patent, which consists of several varieties of wheels. Any operator can make a suitable wheel on the same plan of a turning lathe.

To Clean Buckskins.—When the operator is compelled to purchase an unprepared buckskin, the following is a good process for cleaning it: There is always in the buckskin leather that is purchased, more or less of an oily matter, which is acquired in its preparation, sometimes even amounting, to a third of its weight. The following is the mode of ridding it of this noxious ingredient: Dissolve, in about six or seven quarts of filtered water, about five ounces of potash; when dissolved, wash with the solution an ordinary buckskin; when it has been well stirred in the liquid, the water becomes very soapy, owing to the combination of the potash with the oily matters

contained in the skin. Throw away this solution and use some fresh water without potash and rather tepid; change it several times until it remains quite limpid. Then gently stretch the skin to dry in an airy shaded place. When thoroughly dried, rub it well between the hands. It thus becomes very pliant and velvet-like.

Reflectors for Taking Views.—There have been excellent cameras introduced for taking views, but the time of exposure, which is increased in proportion to the focal length, is considered an objection; consequently many adhere to the old plan of using the speculum, or rather, substitute a mirror. I now have one which I have used for several years and find it equal to any article of the kind have ever tried. One is easily made by a tin man, at a trifling expense. Procure a piece of best plate looking-glass, two and a half by five inches for a quarter, or four by eight for a half-sized camera; put a piece of pasteboard of the same size on the back, to protect the silvering, and stick around the edge in the same manner as in putting up a picture. Take a sheet of tin for the large size, or a half sheet for the other; place the glass crosswise in the centre; bend the ends of the tin over the edge of the glass and turn them back so as to form a groove to hold the glass, and still allow it to slide out and in. These ends of the tin must be turned out flaring, that they may not reflect in the glass.

Have a tin band about an inch wide made to fit close on the end of the camera tube; place it on, and taking the tin containing the glass, bring it to an angle of forty-five degrees with the tube, extending nearly the whole length of the glass in front of the lenses; lap the loose ends of the tin on each side of the tin rim, and having your camera turned on the side to throw the view lengthwise, arrange the exact angle by examining the image on the ground-glass. When you have it exactly right, hold it while it is soldered fast to the band. Take out your glass and stain the tin black, to prevent reflection.

CHAPTER III.

CHEMICALS.

Bromine and its Compounds—Iodine and its Compounds—Chlorine and its compounds—Cyanide of Potassium—Hyposulphite of Soda—Hyposulphite of Gold—Nitric Acid—Nitro-Muriatic Acid—Hydrochloric Acid—Hydrofluoric Acid—Sulphuric Acid—Accelerating Substances—Liquid Sensitives—Dry Sensitives, etc., etc.

BROMINE.

An article so extensively used in the practice of the Daguerreotypic art as Bromine, is deserving of especial attention, and accordingly every person should endeavor to make himself familiar with its properties and applications.

History.—This element was discovered in 1826 by M. Balard, in the mother-liquor, or residue of the evaporation of sea-water. It is named from its offensive odor (bromos, bad odor). In nature it is found in sea-water combined with alkaline bases, and in the waters of many saline springs and inland seas. The salt springs of Ohio abound in the compounds of bromine, and it is found in the waters of the Dead Sea. The only use which has been made of bromine in the arts is in the practice of photography. It is also used in medicine In a chemical point of view it is very interesting, from its similarity in properties, and the parallelism of its compounds to chlorine and iodine.

Dr. D. Alter, of Freeport, Pa., is the only American manufacturer, and furnishes all of the “American Bromine.” Yet we understand much purporting to be of German manufacture is prepared from that made in Freeport. This is done by individuals in this city, who get well paid for the deception.

For the successful application of bromine as an accelerating agent, we are indebted to Mr. John Goddard of London, who at the time was associated with Mr. John Johnson, now a resident of this city.

Preparation.—The mother-liquor containing bromides is treated with a current of chlorine gas, which decomposes these salts, setting the bromine free, which at once colors the liquid to a reddish brown color. Ether is added and shaken with the liquid, until all the bromine is taken up by the ether, which acquires a fine red color and separates from the saline liquid.

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Solution of caustic potash is then added to the ethereal solution, forming bromide of potassium and bromate of potash. This solution is evaporated to dryness, and the salts being collected are heated in a glass retort with sulphuric acid and a little oxide of manganese. The bromine is distilled, and is condensed in a cooled receiver, into a red liquid.

Properties.—Bromine somewhat resembles chlorine in its odor, but is more offensive. At common temperatures it is a very volatile liquid, of a deep red color, and with a specific gravity of 3, being one of the heaviest fluids known. Sulphuric acid floats on its surface, and is used to prevent its escape. At zero it freezes into a brittle solid. A few drops in a large flask will fill the whole vessel when slightly warmed, with blood red vapors, which have a density of nearly 6.00, air being one. It is a non-conductor of electricity, and suffers no change of properties from heat, or any other of the imponderable agents. It dissolves slightly in water, forming a bleaching solution.

Chloride of Bromine.—This as an accelerating agent is by many considered superior {75} to the other Bromide combinations. It can be readily prepared by passing a current of chlorine through a vessel containing bromine. A mixture of two parts muriatic acid and one of black oxide of manganese, should be put into a flask having a bent tube to conduct the chlorine vapor into the bromine in another vessel. This last vessel should also be supplied with a bent tube for conducting the combined

vapors with a third vessel or receiver. On the application of the heat from a spirit lamp to the bottom of the flask, a current of chlorine gas will be disengaged, and pass into the bromine, when it readily combines, and gives off a vapor, which, when condensed in the third vessel, forms a volatile yellowish-red liquid. It is best, even at ordinary temperature, to place the receiver in an ice bath. For manner of using, see farther on, under head of Accelerators.

Bromides.—A bromide treated with oil of vitriol, disengages chlorohyadic acid; but vapors of bromine are constantly disengaged, at the same time imparting a brown color to the gas. If the bromide be treated with a mixture of sulphuric acid, and peroxide of manganese, bromide is only disengaged. A solution of a bromide gives, with of nitrate {76} silver, a light yellowish white precipitate of bromide of silver, which is insoluble in an excess of acid, and readily dissolves in ammonia. The precipitated bromide is colored by light like the chloride, but is immediately tinged brown, while the chloride assumes at first a violet hue. The bromides, in solution, are readily decomposed and chloride being set free, colors the liquid brown.

In the whole range of heliographic chemicals there is probably not another collection less understood and being so productive of interesting investigation as the bromides.

Bromide of Iodine.—M. de Valicours furnishes us with the best method for preparing this mixture:

“Into a bottle of the capacity of about two ounces, pour thirty or forty drops of bromine, the precise quantity not being of importance. Then add, grain by grain, as much iodine as the bromine will dissolve till quite saturated. This point is ascertained when some grains of the iodine remain undissolved. They may remain in the bottle, as they will not interfere with the success of the preparation.

“The bromide of iodine thus prepared, from its occupying so small a space, can very easily be carried, but in this state it is much too concentrated to be used. When it is to be employed, pour a small quantity, say fifteen drops, by means of a dropping-tube, into a bottle containing about half an ounce of filtered river water. It will easily be understood that the bromide of iodine can be used with a greater or less quantity of water

without altering the proportion which exists between the bromine and iodine."

This article forms a very good dry accelerator, and is by some persons thought superior to all others, as it works with great uniformity, and is less liable to scum the plate in coating at high temperatures, or when the thermometer indicates a heat above 60 deg.

Bromide of Potassium—Is prepared by mixing bromine and a solution of pure potass together, and evaporating to dryness; it crystallizes in small cubes, and dissolves readily in water. This agent is extensively employed in the paper and glass processes.

Bromide of Lime. This the principal accelerator used in the American practice, and is the best of all dry combinations at present employed. There are many reasons why the dry is advantageous; these are too familiar to repeat.

"The bromide of lime may be produced by allowing bromine vapor to act upon hydrate of lime for some hours. The most convenient method of doing this is to place some of the hydrate at the bottom of the flask, and then put some bromine into a glass capsule supported a little above the lime. As heat is developed during the combination, it is better to place the lower part of the flask in water at the temperature of about 50 deg. Fah.; the lime gradually assumes a beautiful scarlet color, and acquires an appearance very similar to that of the red iodide of mercury. The chloro-iodide of lime may be formed in the same manner; it has a deep brown color. Both these compounds, when the vapor arising from them is not too intense, have an odor analogous to that of bleaching powder, and quite distinguishable from chlorine, bromine, or iodine alone."

Farther on, I have given, in connection with accelerators, a process I adopt, which is far less tedious and equally reliable.

Bromide of Silver—May be formed by pouring an alkaline bromide into a solution of nitrate of silver, in the shape of a white, slightly yellowish precipitate, which is insoluble in water and nitric acid, but readily dissolves in ammonia and the alkaline hyposulphites. Chlorine easily decomposes bromide of silver, and transforms it into chloride.

M. Biot has expressed his opinion, that it is not possible to find any substance more sensitive to light than the bromide of silver. This is true to a

certain extent, but in combination with deoxidizing agents, other preparations have a decided superiority over the pure bromide of silver.

Bromide of Gold—Is readily prepared by adding a little bromide to the brown gold of the assayers, and allowing it to remain some time under water, or assisting its action by a gentle heat. It forms a salt of a bright crimson color, but in its general properties is precisely similar to the chloride used in gilding.

Bromide of Magnesia—Is prepared in the same manner as bromide of lime.

This mixture is particularly adapted for hot climates, and is used in this country by some few who regard its use as a valuable secret.

Bromide of Starch.—This preparation is much used, but not alone. It is combined with lime by putting about one part in measure of starch to four of lime. It is prepared by adding bromine to finely pulverized starch, in the same manner as bromide of lime. (See Accelerators.)

Experiments with Bromine.—Place in a very flaring wine glass a few drops (say ten) of bromine, then place a small piece of phosphorus about one-twentieth of an inch in diameter. Place the latter on the end of a stick from five to ten feet in length. So place it that the phosphorus can be dropped into the glass, and in an instant combustion giving a loud report will be the result.

b. Expose a daguerreotype plate to the vapor of bromine, it assumes a leaden-grey color, which, blackens by light very readily. Exposing this to mercury will not produce any decided action upon the lights. Immerse it in the solution of the muriate of soda, and the parts unacted upon by light becomes a jet black, while the parts on which the light has acted will be dissolved off, leaving a clean coating of silver. This will be a most decided black picture on a white ground.

c. Expose an impressioned plate, that has been sufficient time in the camera to become solarized, to the vapors of bromine, and the impression will be fully developed and exhibit no signs of solarization. The exposure over the bromine most be very brief. Chlorine or iodine will produce the same result. The latter is preferable.

Again, should the impressioned plate be exposed too long over the vapor of bromine, the impression would be rendered wholly insensitive to the

mercurial vapor. Hence this method is resorted to for restoring the sensibility of the plate when there is reason to believe that the impression would not be a desirable one; as, for example, if a likeness of a child be wanted, and it had moved before the plate had been sufficiently long exposed in the camera, the plate may be restored to its original sensitiveness by re-coating over bromine, as above, thus saving the time and labor of re-preparing the plate for the chemicals.

d. If by accident (we would not advise a trial to any extent of this), you should inhale a quantity of the vapor of bromine, immediately inhale the vapor of aqua ammonia, as this neutralizes the dangerous effect of the bromine vapor. Every operator should be provided with a bottle of ammonia, as a little sprinkled about the chemical room soon disinfects it of all iodine or bromine vapor, and also tends to facilitate the operation in the camera.

IODINE.

History of Iodine.—This is one of the simple chemical bodies which was discovered in 1812 by M. Courtois, of Paris, a manufacturer of saltpetre, who found it in the mother-water of that salt. Its properties were first studied into by M. Gay Lussac. It partakes much of the nature of chlorine and bromine. Its affinity for other substances is so powerful as to prevent it from existing in an isolated state. It occurs combined with potassium and sodium in many mineral waters, such as the brine spring of Ashby-de-la-Zouche, and other strongly saline springs. This combination exists sparingly in sea-water, abundantly in many species of fucus or sea-weed, and in the kelp made from them. It is an ingredient in the Salt Licks, saline, and brine springs of this country, especially of those in the valley of the Mississippi. It is sparingly found in fresh-water plants, as well also in coal, and in combination with numerous other bodies.

Fermented liquors contain iodine; wine, cider, and perry are more iodureted than the average of fresh waters. Milk is richer in iodine than wine; independently of the soil, with which it varies, the proportion of iodine in milk is in the inverse ratio of the abundance of that secretion. Eggs (not the shell) contain much iodine. A fowl’s egg weighing 50 gr. contains

more iodine than a quart of cow’s milk. Iodine exists in arable land. It is abundant in sulphur, iron, and manganese ores, and sulphuret of mercury: but rare in gypsum, chalk, calcareous and silicious earths. Any attempt to extract iodine economically should be made with the plants of the ferro-iodureted fresh waters. Most of the bodies regarded by the therapeutists as pectoral and anti-scrofulous are rich in iodine.

It is probably to the application of this body that we owe the discovery of the daguerreotype. There is no record of the precise date when Daguerre commenced experimenting with iodine, but by the published correspondence between him and M. Neipce, his partner, it was previous to 1833. There is no doubt, however, that the first successful application was made in 1838, as the discovery was reported to the world early in January, 1839.

Preparation.—Iodine is mostly prepared from kelp, or the half vitrified ashes of seaweed, prepared by the inhabitants of the western islands, and the northern shores of Scotland and Ireland. It is treated with water, which washes out all the soluble salts, and the filtered solution is evaporated until nearly all the carbonate of soda and other saline matters have crystallized out. The remaining liquor, which contains the iodine, is mixed with successive portions of sulphuric acid in a leaden retort, and after standing some days to allow the sulphureted hydrogen, etc., to escape, peroxide of manganese is added, and the whole gently heated. Iodine distills over in a purple vapor, and is condensed in a receiver, or in a series of two-necked globes.

Properties.—Iodine is solid at the ordinary temperature, presenting the appearance of dark-grey or purple spangles, possessing a high degree of metallic lustre. It somewhat resembles plumbago, with which it is sometimes diluted, particularly when it is fine. Operators should endeavor to secure the larger crystals. It melts at 224.6 deg., forming a brown or nearly black liquid. It boils at about 356 deg., and emits a very deep violet colored vapor. It gives off a very appreciable vapor, sufficient for all purposes of forming the iodide of silver on the daguerreotype plate, at a temperature of 45 deg. or even lower. Iodine crystallizes readily. Every operator has found upon the side of the jar in his coating-box, perfectly regular crystals, deposited there by sublimation.

Water dissolves but a small proportion of iodine, requiring 7000 parts of water to dissolve one of iodine, {85} or one grain to the gallon of water. Alcohol and ether dissolve it freely, as does a solution of nitrate or hydrochlorate of ammonia and of iodides.

The density of solid iodine is 4.95; that of its vapor 8.716. It greatly resembles chlorine and bromine in its combinations, but its affinities are weaker. It does not destroy the majority of organic substances, and vegetable colors generally resist its action. It combines with several organic substances, imparting to them peculiar colors. It colors the skin brown, but the stain soon disappears.

Chloride of Iodine—Is formed by passing chlorine into a bottle containing some iodine. This can be readily done by pouring one ounce and a half of muriatic acid upon a quarter of an ounce of powdered black oxide of manganese, and heat it gradually in a flask, to which is adapted a bent glass tube. This tube must connect with the bottle containing the iodine, and the yellowish-green gas disengaged will readily combine with the iodine, forming a deep red liquid, and the operation is complete. The use of chloride of iodine will be referred to in connection with the Accelerators.

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Iodides.—The iodide treated with the oil of vitriol, instantly produces a considerable deposit of iodine; and if the mixture be heated, intense violent vapors are disengaged. The reaction is due to the decomposition of oil of vitriol by iodohydric acid, water and sulphurous acid being formed, and iodine set free. The iodides in solution are decomposed by chlorine, iodine being precipitated, the smallest quantity of which in solution is instantly detected by its imparting to starch an intensely blue color.

Iodide of Potassium.[4]—This compound is easily made in the following manner: Subject to a moderate heat a mixture of 100 parts of iodine, 75 of carbonate of potash, 30 of iron filings, and 120 parts of water. This mass must be thoroughly dried and then heated to redness; the resulting reddish powder is to be washed with water, and the solution obtained filtered, and evaporated to dryness. It is found that 100 parts of iodine yield 135 parts of very white, but slightly alkaline, iodide of potassium.

[4] I shall present the preparation of only a few iodides, and such as are more intimately connected with the Daguerreotype.

Experiment.—On projecting dry pulverized iodide of potassium into fused anhydrous phosphoric acid, a violent disengagement of iodine takes place, attended by a transient ignition; fused hydrate of phosphoric acid liberates iodine abundantly from iodide of potassium; this reaction is accompanied by the phenomenon of flame and formation of a considerable quantity of hydriodic acid.

Iodide of Mercury.—For the preparation of iodide of mercury, Dublanc recommends to cover 100 grms. of mercury with 1 kilogrm. of alcohol, to add 124 grms. of iodine gradually in portions of ten grms., and agitating between each fresh addition, until the alcohol becomes colorless again. After the addition of the last 4 grms. the alcohol remains colored, the whole of the mercury having become converted into iodide. The resulting preparation is washed with alcohol; it is crystalline and of a hyacinth color.

Iodide of Silver.—This compound is formed upon every plate upon which a Daguerreotype is produced. The vapor of iodine coming in contact with the silver surface, forms an iodide which is peculiarly sensitive to light.

The various colors produced are owing to the thickness of the coating, and the maximum sensibility of the coating, as generally adopted, is when it assumes a deep yellow, or slightly tinged with rose color.

This compound is largely employed in most photographic processes on paper, and may be easily prepared by the following formula: By adding iodide of potassium to a solution of nitrate of silver, a yellowish-white precipitate of iodide of silver is obtained, which is insoluble in water, slightly soluble in nitric acid, and soluble in a small degree in ammonia, which properties seem easily to distinguish it from the chloride and bromide of silver. Chlorine decomposes it and sets the iodine free, and chlorohydric acid converts it into a chloride. It fuses below a red heat. Although the effect of light on the iodide is less rapid than on the chloride, the former sooner turning black, assuming a brown tinge; but when in connection with gallic acid and the ferrocyanate of potash, it forms two of the most sensitive processes on paper.

Iodide of silver dissolves easily in a solution of iodide of potassium, and the liquid deposits in evaporation crystals of a double iodide.

Iodide of Gold.—If a solution of potassium be added to a solution of chloride of gold, a precipitate of iodide of gold takes place, soluble in an

excess of the precipitate. A little free potash should be added to combine with any iodide that may chance to be set free by the chloride of gold.

Iodide of Lime is prepared by adding iodine to hydrate of lime (which will be referred to farther on) until the mixture assumes a light yellow shade, when wanted for combinations with accelerators, or to a dark brown when employed for the first coating. This latter mixture has been sold in our market under the name of “Iodide of Brome.”

Iodide of Bromine.—(See page 76.)

Experiments with Iodine.—Place a plate which has been exposed in the camera over the vapor of iodine for a very brief period, and it will present the appearance of the impression having been solarized.

b. Upon a Daguerreotype plate, from which an impression has been effaced by rubbing or otherwise, the picture may be made to reappear by merely coating it over with iodine.

c. Place in a vessel a little water, into which put the smallest possible quantity of free iodine and add a little starch, and the liquid will instantly assume a blue color. Advantage is taken of this fact in the laboratory to detect the presence of iodine in liquids. The starch should be dissolved in boiling water and allowed to cool. There are numerous other interesting experiments that can be performed by the aid of iodine, but it is unnecessary here to consume more space.

CHLORINE.

History.—The Swedish chemist, Scheele, in 1774, while examining the action of hydrochloric acid on peroxide of manganese, first noticed this element. He called it dephlogisticated muriatic acid. It was afterwards, by the French nomenclaturists, termed oxygenated muriatic acid, conceiving it to be a compound of oxygen and muriatic acid. This view of its notice was corrected by Sir H. Davy (in 1809), who gave it the present name. In 1840-41, this gas vas employed for accelerating the operation of light upon the iodized Daguerreotype plate. John Goddard, Wolcott & Johnson, Claudet, Draper, Morse and others, were among the first made acquainted with its use. Count Rumford, Ritter, Scheele, Seebert and others, experimented with

chlorine in regard to its effect when exposed to the action of light in combination with silver. In 1845, M. Edward Becquerel announced that he had “been successful in obtaining, by the agency of solar radiations, distinct impressions, of the colors of nature.”

On the 4th of March, 1851, Neipce, St. Victor, a former partner of DAGUERRE, announced that he had produced “all the colors by using a bath of bichloride of copper, and that a similar phenomenon occurs with all salts of copper, mixed with chlorine.”

Preparation.—This is easily accomplished by putting about two parts of hydrochloric (muriatic) acid on one of powdered black oxide of manganese, and heating it gradually in a flask or retort, to which may be adapted a bent glass tube. A yellowish-green gas is disengaged, which being conducted through the glass tube to the bottom of a bottle, can readily be collected, being much heavier than the air, displaces it completely and the bottle is filled (which can be seen by the green color); a greased stopper is tightly fitted to it, and another bottle may be substituted.

In all experiments with chlorine, care should be taken not to inhale the gas!

Properties.—Chlorine is a greenish-yellow gas (whence its name, from chloros, green), with a powerful and suffocating odor, and is wholly irrespirable. Even when much diluted with air, it produces the most annoying irritation of the throat, with stricture of the chest and a severe cough, which continues for hours, with the discharge of much thick mucus. The attempt to breathe the undiluted gas would be fatal; yet, in a very small quantity, and dissolved in water, it is used with benefit by patients suffering under pulmonary consumption.

Under a pressure of about four atmospheres, it becomes a limpid fluid of a fine yellow color, which does not freeze at zero, and is not a conductor of electricity. It immediately returns to the gaseous state with effervescence on removing the pressure.

Water recently boiled will absorb, if cold, about twice its bulk of chlorine gas, acquiring its color and characteristic properties. The moist gas, exposed to a cold of 32 deg., yields beautiful yellow crystals, which are a definite compound of one equivalent of chlorine and ten of water. If these crystals are hermetically sealed up in a glass tube, they will, on melting, exert such a pressure as to liquefy a portion of the gas, which is distinctly seen as a

yellow fluid, not miscible with the water which is present. Chlorine is one of the heaviest of the gases, its density being 2.47, and 100 cubic inches weighing 76.5 grains.

Chlorine Water.—This combination, which is used in conducting M. Neipce's process, can be readily prepared by conducting the gas into a bottle containing distilled water. One part water dissolves two parts of chlorine.

Chlorides.—The metallic chlorides are nearly all soluble in water; that of silver and protochloride of mercury being the only exceptions. A metallic chloride, treated with oil of vitriol, disengages chlorohydric acid. Heated with a mixture of peroxide of manganese and sulphuric acid, chlorine is given off, which is easily recognized by its odor and other physical properties.

The chlorides dissolve in water; give with nitrate of silver, a white precipitate, even in highly diluted solutions, becoming violet colored and finally black when exposed to the light. The rapidity of the change of color is proportioned to the intensity of the light. It is insoluble in nitric acid, but readily soluble in ammonia; it fuses without decomposition, forming, when cold, a tough, horny mass, and is reduced by hydrogen and by fusion with carbonate of soda, or with resin.

Chloride of Bromine. (See page 74.)

Chloride of Iodine. (See page 85.)

Chloride of potassium.—or (Muriate of Potassa).—Dissolve half an ounce of carbonate of potassa in water, and neutralize with muriatic acid. Upon concentrating the solutions, cubic crystals will be obtained, having a taste similar to common salt. They consist of potassium and chloride, and when dissolved in water they may be regarded as muriate of potassa.

Chloride of Lime.—Mix half an ounce of slacked lime (hydrate of lime) with six ounces of water, and conduct into this milk of lime, with frequent agitation, as much chlorine gas as will evolve from two ounces of muriatic acid and half an ounce of black oxide of manganese. The liquid clarifies by standing; may be regarded as a solution of chloride of lime, and must be protected from the air and light. It may also be made without putting in the water with the hydrate of lime, by merely passing the chlorine into the hydrate of lime. This last is by some used in preparations for accelerating

the operation of taking Daguerreotypes, but when used for this purpose it is in small quantities.

Chloride of Calcium.—To one part of water add two parts of muriatic acid, and add pieces of common chalk until effervescence ceases; then filter through cotton cloth and evaporate it by placing it in all earthen or porcelain dish, over a slow fire, to the consistency of a syrup. When cooling, large prismatic crystals of chloride of calcium are formed. These must be quickly dried by pressing between folds of blotting paper and kept carefully excluded from the air, as it readily attracts hydrogen. For most daguerreotype purposes, the syrup may be at once evaporated to dryness. This is frequently placed in the iodine coating box for the purpose of keeping the atmosphere dry. It is so easily made that every operator can provide himself with it in a short time, and at little expense.

Chloride of Gold.—Is prepared by dissolving gold in aqua regia, a composition of one part of nitric to two parts of muriatic acid. Gold foil is the best for our purposes; coin, however, answers, in most cases, for the daguerreotype operator, as the alloy, being so slight is not noticed in the gilding process. When the latter is used, it will facilitate the operation to beat it out, forming a thin sheet, and then cutting in small strips. Where purity is required, foil is better. The gold is placed in three or four times its own weight of the above acids. For this purpose, an evaporating dish is best (a common saucer will do); a moderate heat may be applied to favor the action. The mixture should be stirred often with a glass rod; care should be observed not to apply too much heat, for at a temperature of about 300 deg. the chlorine would be expelled and leave a metallic precipitate, which would require re-dissolving. Acid may at any time be added if necessary to dissolve the gold, but it is advisable to add as little excess as possible, as it would require more time to evaporate. After all the gold has dissolved, and the liquid assumes a deep red color, the solution should be allowed to cool, being stirred nearly all the time. This salt is of a reddish-brown color. It is rarely we find in our market good chloride of gold, as common, salt is used for the bulk; and when the bottles are labelled “15 grains,” “20 grains,” nine-tenths do not in reality contain exceeding five grains of chloride of gold. The salt is mixed with the above solution when it is cooling, and gives bright yellow crystals, which some of our uninformed operators conceive to be the best quality.

Chloride of Silver.—(Oxide of Silver.)—Take any quantity of silver coin or other silver, roll or hammer it thin; cut in small pieces. This in order to save time. Put the silver in a glass or earthen vessel (Florence flask is best); pour in nitric acid and water, about three parts of the former to one of the latter. The operation of cutting up the silver may be facilitated by applying a gentle heat. This blue solution consists of oxide of silver and oxide of copper, both combined with nitric acid. Should the operator wish a pure solution of silver, which, however, is not always used, he may obtain it in the following manner:

To separate the two metals contained in the above solution from each other, put some bright copper coins into the solution and set it aside in a warm place for three or four days, occasionally giving it a circular motion. The separated laminae are pure silver, which is to be digested with ammonia until it ceases to be colored blue. The silver, after being washed and dried, is again dissolved in nitric acid, and the liquid, diluted with water, is kept as solution, of silver.

Either of the above solutions (the one of oxide of silver and copper, and the pure silver solution) may be prepared for use by putting them in a bottle, with a quantity of water, and adding common fine salt, you obtain a white curdy precipitate of chloride of silver. No matter how much salt is used, provided enough be added to throw down all the chloride of silver. This solution should be well agitated and then allowed to stand for a few minutes; thus the white precipitate is in the bottom of the bottle. When the water has become clear, pour it off with care, leaving the sediment behind, then add a fresh quantity of clean water, shake, let settle, and pour off as before. Repeat the same for several times, and the excess of salt will disappear, leaving the white precipitate, which may be drained of the water and dried in the dark, and kept free from light and air.

CYANIDE OF POTASSIUM.

Cyanide of Potassium.—This important article is worthy the undivided attention of every Daguerreotypist. I here give Mr. Smee’s process for its preparation. This is from that author’s work entitled, “Electro Metallurgy,” American edition:

“The cyanide of potassium, so often alluded to while treating of the metallo-cyanides, may be formed in several ways. It may be obtained by heating to a dull redness the yellow ferrocyanate of potash, in a covered vessel, filtering and rapidly evaporating it. The objection to this method, however, is that without great care the whole of the ferrocyanate is not decomposed, a circumstance which much reduces its value for electro-metallurgy. By boiling, however, the ignited residue with spirits of wine this difficulty is said to be overcome, as the ferrocyanate is absolutely insoluble in that menstruum, while the cyanuret, at that heat, freely dissolves, and is as easily re-deposited on cooling.

“There is, however, a much better process by which this salt may be formed, viz. by simply transmitting hydrocyanic acid through potassium. Although the modes of making this acid are very numerous, there is but one which is likely to be employed on a very large scale, and that is its formation from the yellow ferrocyanate by means of sulphuric acid. This process is performed as follows: any given weight of the yellow salt is taken and dissolved in about five times its weight of water; this is placed in a retort, or some such analogous vessel, to which is then added a quantity of strong sulphuric acid, twice the weight of the salt, and diluted with three or four times its quantity of water. A pipe is carried from the neck of the retort to the receiving bottle, which should be kept as cool as possible.

“For small operations, those invaluable vessels, Florence flasks, answer well: a bent tube being connected at one end to its month, the other passing into the second vessel; heat should be cautiously applied by means of an Argand lamp, a little vessel of sand being placed under the flask, which helps the acid to decompose the salt. Prussic acid is then generated and passes through the tube to the recipient vessel, which is to be charged with liquor potassae.

“When the potash is saturated, the operation is completed. The Germans recommend a strong, alcoholic solution of potassa to be used in the second vessel, for in this case, the hydrocyanic or prussic acid combines with the potassa, forming a hydrocyanate of potassa, or, the water being abstracted, the cyanuret of potassium, which spontaneously precipitates, on the saturation of the fluid, the cyanuret, being insoluble in strong alcohol. The ferrocyanate of potash may be considered as containing three equivalents of hydrocyanic acid, two of potash and one of iron; but, unfortunately, we can

only obtain half the acid from the salt, owing to the formation of a compound during its decomposition which resists the action of the acid. The decomposition of this salt taking 2 equivalents or 426 grains (to avoid fractions) would afford 3 equivalents or 81 grains of hydrocyanic, or prussic acid, capable of forming 198 grains of cyanuret of potassium, while in the retort there would remain 384 grains or 3 equivalents of bisulphate of potash, and 1 equivalent or 174 grains of a peculiar compound, said to contain 3 equivalents of cyanogen, 1 of potassium, and one of iron (Pereira). It is manifest that, but for this later compound, we might double the quantity of hydrocyanic acid from the yellow salt."

The decomposition just described is the one usually received; but too much reliance must not be placed on its accuracy, for the analysis of the several compounds is too difficult for the results to be fully admitted. The residue left in the retort speedily turns to one of the blues, identical with, or allied to, Prussian blue. This is at best a disagreeable process to conduct, for the hydrocyanic acid formed adheres so strongly to the glass, that, instead of being freely given off, bubbles are evolved suddenly with such explosive violence as occasionally to crack the vessel. This may be remedied as far as possible by the insertion of plenty of waste pieces of platinum—if platinized, so much the better, as that facilitates the escape of the gas. The heat should be applied to every part of the vessel, and the flame should not be allowed to play upon one single part alone. Large commercial operations are performed in green glass or stone-ware retorts.

"Now for one word of advice to the tyro: Remember that you are working with prussic acid; therefore, never conduct the process in a room, the fumes being quite as poisonous as the solution of the acid itself; moreover, have always a bottle of ammonia or chlorine by your side, that should you have chanced to inhale more than is pleasant, it will be instantly at hand to counteract any bad effects. It is stated by Pereira, that a little sulphuric acid or hydroferrocyanic acid passes to the outer vessel, but probably the amount would be of no consequence for electro-metallurgy, otherwise, it might be as well to use a Woulfe's apparatus, and discard the salt formed in the first vessel. To the large manufacturer it may be worth considering whether some other metallo-cyanuret, formed in a similar manner to the ferrocyanuret, might not be more advantageously employed, because the residue of the process last described contains a large quantity of cyanogen which the acid is unable to set free.

“There are other modes of procuring prussic acid, besides the one which has been so tediously described; but these are found to be more expensive. The only one which I shall now notice is the process by which it is obtained from bicyanide of mercury. The bicyanide of mercury itself is formed when peroxide of mercury is digested with Prussian blue, the peroxide of mercury abstracting the whole of the cyanogen from the blue, and leaving the oxides of iron at the bottom of the vessel. The solution may be evaporated to dryness, and one part of the salt dissolved in six of water; one part of muriatic acid, sp. gr. 1.15, is then added, and the solution distilled, when the whole of the hydrocyanic acid passes over, and by being conducted into a solution of potassa, as in the former process, forms cyanuret of potassium. This process, though easier than the first described, is rather given as a resource under peculiar circumstances than as one to be adopted by the large manufacturer. The expense is the only objection, but in a small quantity this cannot be a consideration.

“In giving this very rough outline of the general mode of forming salts, the minutiae necessary for chemical work have altogether been avoided, and those parts alone are entered upon which are more immediately necessary for the electro metallurgist to know and practice for himself. This will account for the long description of the cyanuret of potassium, while the preparation of the equally important and even more used acids, the sulphuric, muriatic, etc., commonly found in commerce, are altogether neglected.

“In using solutions of cyanide of potassium, the workman should not immerse his arms into them, otherwise it occasionally happens that the solution produces very troublesome eruptions over the skin.”

HYPOSULPHITE OF SODA.

Hyposulphite of Soda.—This salt forms one of the important chemicals for the Daguerreotype operator. Its application to this art is of an interesting nature. It is used to dissolve the sensitive salt of silver which remains unchanged during the exposure in the camera. It has the property of readily dissolving the chloride, bromide and iodide of silver. It should be pure and free from sulphuret of sodium; should this last be present, it will cause

brown spots of sulphurated silver upon the Daguerreotype impression. This annoyance is a great source of complaint from many operators, and ever will be, so long as it is prepared by men who have no reputation to lose, and whose eyes are blinded by the “Almighty Dollar.”

A good article may be prepared as follows:

“Mix one pound of finely pulverized carbonate of soda with ten ounces of flowers of sulphur, and heat the mixture slowly in a porcelain dish till the sulphur melts. Stir the fused mass, so as to expose all its parts freely to the atmosphere, whereby it passes from the state of a sulphuret, by the absorption of atmospheric oxygen, into that of a sulphite, with the phenomenon of very slight incandescence. Dissolve in water, filter the solution, and boil it immediately along with flowers of sulphur. The filtered concentrated saline liquid will afford, on cooling, a large quantity of pure and beautiful crystals of hyposulphite of soda.”

Hyposulphite of Gold.—This compound salt is by a few considered preferable to the chloride of gold, but our experience has induced us to use the latter, believing we are enabled to produce a more brilliant and warm-toned impression with it. When the hyposulphite of gold is used in gilding, it requires less heat and a longer application, as there is some danger of producing a glossy scum over some parts of the surface of the plate. I prepare this salt as follows:

Dissolve one part chloride of gold and four parts hyposulphite of soda in equal quantities of distilled water: pour the gold into the hyposulphite solution, in the same manner as in mixing the gilding solution; let it stand until it becomes limpid; filter and evaporate to dryness. Re-dissolve and add a few grains of burnt alum.

After standing a few hours, filter and evaporate again. If not sufficiently pure, repeat the crystallization until it is so. For gilding, dissolve in water and use in the same manner as the common gilding solution.

N.B.—The four following mixtures were employed in Neipce’s process in his earliest experiments:

Aqueous Solution of Bichloride of Mercury.—Eight grains of bichloride of mercury in 10,000 grains of distilled water.

Solution of Cyanide of Mercury.—A flask of distilled water is saturated with cyanide of mercury, and a certain quantity is decanted, which is diluted

with an equal quantity of distilled water.

Acidulated White Oil of Petroleum.—This oil is acidulated by mixing with it one tenth of pure nitric acid, leaving it for at least 48 hours, occasionally agitating the flask. The oil, which is acidulated, and which then powerfully reddens litmus paper, is decanted. It is also a little colored, but remains very limpid.

Solution of Chloride of Gold and Platinum.—In order not to multiply the solutions, take the ordinary chloride of gold, used for fixing the impressions, and which is composed of 1 gramme of chloride of gold and 50 grains of hyposulphate of soda, to a quart of distilled water.

With respect to chloride of platinum, 4 grains must be dissolved in 3 quarts of distilled water; these two solutions are mixed in equal quantities.

Acids.—I shall not go into the preparations of the various acids employed in the Daguerreotype. This would be useless to the operator, as there are few, if any, that it would be advisable to prepare. It is only necessary for the experimenter to be made acquainted with their properties, and this in order to prevent any haphazard experiments, which are too common among operators. Any person who may be desirous to try an experiment, should first study the agents he wishes to employ. By so doing much time and money will be saved; while the searcher after new discoveries would rarely become vexed on account of his own ignorance, or be obliged to avail himself of the experience of others in any department of science.

Nitric Acid—Exists in combination with the bases, potash, soda, lime, magnesia, in both the mineral and vegetable kingdoms, and is never found insoluble. It has the same constituents as common air, but in different proportions. The strongest nitric acid contains in every pound, two and a quarter ounces of water. Pure nitric acid is colorless, with a specific gravity of 1.5, and boiling at 248 deg.. It is a most powerful oxidizing agent, and is decomposed with more or less rapidity, by almost all the metals, to which it yields a portion of its oxygen.

The nitric acid of commerce, is generally the article used by the Daguerreotypist. This usually contains some chlorine and sulphuric acid. It is obtained by the distillation of saltpetre with sulphuric acid. It is employed in the Daguerreotype process for dissolving silver, preparing chloride or oxide, nitrate of silver, [the former used in galvanizing,] and in combination

with muriatic acid for preparing chloride of gold, used in gilding. It is also used by some for preparing the plate.

Acidulated Solution.—This solution is used for cleaning the surface of the Daguerreotype plate. It has the property of softening the silver, and bringing it to a state in which it is very susceptible of being either oxidized or iodized, hence it contributes to increase the sensibility of the plate. The proportions are to one drop of acid add from 15 to 20 drops of water, or make the solution about like sharp vinegar to the taste.

Nitro-Muriatic Acid.—Aqua Regia is a compound menstruum invented by the alchemists for dissolving gold. It is composed of colorless nitric acid (aqua-fortis) and ordinary muriatic acid; the mixture is yellow, and acquires the power of dissolving gold and platinum. These materials are not properly oxidized; it nearly causes their combination with chlorine, which is in the Muriatic acid.

Hydrochloric Acid (Muriatic Acid).—This acid forms a valuable addition to the chemicals employed by the practical Daguerreotypist. This acid is formed by acting upon common salt (which is chloride of sodium) by concentrated sulphuric acid. The water of the acid is decomposed, and its hydrogen combines with the chloride of the salt to form muriatic acid, and this unites with the sulphuric acid to form sulphate of soda; 60 parts of common salt and 49 parts of concentrated sulphuric acid, afford, by this mutual action, 37 parts of muriatic acid and 72 parts of sulphate of soda. The muriatic acid of commerce has usually a yellowish tinge, but when chemically pure it is colorless. The former is commonly contaminated with sulphurous acid, sulphuric acid, chlorine, iron, and sometimes with arsenic.

Muriatic acid, from the fact of the presence of the chlorine, is used in the Daguerreotype process for dissolving gold, and in combination with various accelerators. Its presence can be detected by ammonia. A strip of paper dipped in this and waved to and fro will emit a thick white smoke if the acid vapor be in the atmosphere. The ammonia neutralizes the acid fumes. By reversing the experiment we can determine whether vapor of ammonia be in the air, and also deprive these suffocating and dangerous gases of their injurious properties, and remove them from the air. Every Daguerreotype operator should be furnished with, at least, a six ounce bottle of aqua ammonia. Its operation is very nearly the same on bromine and iodine vapor.

Hydrofluoric Acid (Fluorohydric Acid).—This acid is used to form some of the most volatile and sensitive compounds employed in the Daguerreotype. It is one of the most dangerous bodies to experiment with: it is volatile and corrosive, giving off dense white fumes in the air. It combines with water with great heat. At 32 deg. it condenses into a colorless fluid, with a density 1.069. It is obtained from decomposition of fluorspar by strong sulphuric acid. It readily dissolves the silica in glass, and consequently cannot be kept in a vessel of that material. It is prepared and kept in lead. It is employed in accelerators on account of its fluorine.

One small drop on the tongue of a dog causes death. The operator who wishes to use it should pour some of the liquid for which he intends it into a graduate, or other vessel, and then add the desired quantity of acid. If by accident any of the spray should fall upon the skin, it should at once be copiously drenched with water.

Sulphuric Acid.—There are two sorts of this acid: one is an oily, fuming liquid; this is made in Nordhausen, in Saxony, and is commonly called “Nordhausen sulphuric acid,” or oil of vitriol. The other which is the kind used in connection with the Daguerreotype, is common sulphuric acid. It is somewhat thinner, and when undiluted is not fuming. This acid may be obtained in a solid and dry state, called anhydrous sulphuric acid.

The common sulphuric acid is made by burning sulphur, which forms sulphurous acid. To convert this into sulphuric acid and gain more oxygen, nitric acid, which is rich in that body, is added. It forms a limpid, colorless fluid, of a specific gravity of 1.8. It boils at 620 deg.; it freezes at 15 deg. It is acrid and caustic, and intensely acid in all its characters, even when largely diluted.

Its attraction for basis is such that it separates or expels all other acids, more or less perfectly, from their combinations. Its affinity for water is such that it rapidly absorbs it from the atmosphere, and when mixed with water much heat is evolved. It acts energetically upon animal and vegetable substances, and is a poisonous, dangerous substance to get on the skin. It is a powerful oxidizing agent; hence its use in the galvanic battery, for which purpose it is mostly used by the Daguerreotypist. The fumes of this being so much more offensive than nitric acid, the latter is sometimes used. It is also employed in some of the more sensitive accelerators.

ACCELERATING SUBSTANCES.

Remarks on the Accelerating substances Used in the Daguerreotype.—I have now arrived at a point in this work, where the eye of the Daguerreotype public will intently search for something new. This search will prove in vain, at least so far as regards those who have enjoyed and embraced the opportunities for studying the principles of our art. Every experienced operator has in a degree become familiar with the mechanical uses of all the agents employed, while I fear but few understand the properties, and laws governing those properties, which are so indispensable to produce an image impressed upon the silver surface.

There are three substances which form the bases for producing a Daguerreotype; silver, iodine and bromine. Each forms a separate body which is indispensable to the operators success as the art is now practiced in America. With these three, compounds of great variety are formed.

The silver surface is first thoroughly cleaned and freed from all organic matter, then exposed to vapor of iodine, producing an iodide of silver. The plate upon which is this salt, is again exposed to the vapor of bromine, forming a bromo-iodide of silver, a salt also.

As most of the various accelerators are compounds of bromine, with either chlorine or fluorine combination, they partake somewhat of the nature of these latter, giving results which can be detected by the experienced operator. Thus muriatic acid is added for its chlorine, which can generally be detected by the impression produced, being of a light, soft, mellow tone, and in most cases presenting a brilliant black to that colored drapery. Those who wish to experiment with agents for accelerating substances, should first study to well understand their peculiar nature and properties; as well, also, to endeavor to find out what will be the probable changes they undergo in combination as an accelerator. This should be done before making the experiments. From the foregoing it will be seen that numerous compounds are formed from the same basis, and, consequently, it would be a waste of time and a useless appropriation to devote more of our space than is necessary to give the principal and most reliable combination.

In America, the words “Quick” and “Quick Stuff,” are more generally used for and instead of the more proper names, “Sensitives,” or

“Accelerators,” etc. As it has by use become common, I frequently use it in this work.

Liquid Accelerator, No. 1.—This mixture was used by me in 1849, and is given as it appeared in my “System of Photography,” published at the above date:

Take pure rain or distilled water, one quart, filter through paper into a ground stopper bottle, and add, for warm weather, one and a half ounce chloride of iodine; or for cold, one ounce; then add one ounce bromine, and shake well. Now with care not to allow the vapor to escape, add drop by drop, thirty drops of aqua ammonia, shaking well at each drop. Care must be taken not to add more at a time, as it evokes too much heat. This mixed, in equal proportions with John Roach’s quick, forms an excellent chemical combination. For this purpose, take one and a half ounce of each, to which add ten ounces water, for warm weather, or from six to seven for cold. Pour the whole into a large box, and it will work from two to four months. I am now using (1849) one charged as above which has been in constant use for three months, and works uniformly well. The above is right for half or full size boxes, but half of it would be sufficient for a quarter size box.

Coat to the first shade of rose over iodine, change to a deep rosy red over quick, and black about one tenth the first.

I would not now recommend the addition of “John Roach’s quick,” as I believe equally good results can be produced without it. This liquid is now used by many, and is very good for taking views.

Lime Water Quick.—This mixture is more used at present than all the other liquids ever introduced. It produced the most uniform results, giving the fine soft tone so characteristic in pictures produces from accelerators containing chlorine. To one quart of lime water (this can be had of any druggist) add one and a half ounce of pulverized alum. This should be shook at intervals for twenty—four hours; then add one ounce of chloride of iodine and three fourths ounce of bromine.

Lime Water.—This is easily prepared by putting lime into water, say a piece of quick-lime about the size of an egg into one quart of water. This should be shook occasionally for two or three days and allowed to settle, when the water can be poured off and used.

Use.—To one part of quick add six parts of water; coat to a light yellow over the iodine, to a rose color over the quick, and recoat about one tenth.

The above coating may be increased or diminished, it matters not, so that there is not too much, and the proper proportions are preserved. Some add to the above a small quantity of magnesia, say about a teaspoonful to the quart of liquid.

Liquid Accelerator, No. 2.—The following was for a long time used by one of the first houses in the United States, and probably was one of the first liquids ever used. It produces a fine-toned picture, but is not considered as sure as the lime water quick:

Take rain water one quart, add pulverized alum until it is a little sour to the taste, and a small piece, say one half inch square, of magnesia. Filter through paper, and add chloride of iodine one half ounce, bromine sufficient to take it up, which is a little less than half an ounce.

Charge with one of quick to six of water; coat over iodine to a soft yellow, nearly, but not quite, bordering on a rose; over quick to a dark purple, or steel, and back one sixth to one tenth.

Wolcott's American Mixture.—Van Loan Quick.—This mixture was first formed and used by T. Wolcott & Johnson and gained great celebrity for its productions. I have now a bottle hermetically sealed that contains about a half ounce of this mixture prepared in 1841 by John Johnson, now a resident of this city, and the former partner of Mr. Wolcott. The preparation of this mixture, as furnished by Mr. Johnson himself, is given as follows:

"One part of bromine, eight parts of nitric acid, sixteen parts of muriatic acid, water one hundred parts. This mixture should be allowed to stand for several days; it improves by age.

"Use.—A few drops say, 6 to 12, of this mixture, should be put into about 6 or 8 ounces of water; it will require frequent replenishing by the addition of a few more drops. The plate should be coated over the dry iodine to a red just bordering on a slate, and then exposed to the mixture only sufficiently long to change the color. If this is not done in less than six seconds it is not strong enough. Re-coat over the iodine full one fourth as long as first coating."

This exceedingly volatile compound is difficult to control from its instability; it is but little used. The impressions successfully produced by this mixture are very brilliant, and possess a pleasing peculiarity.

DRY SENSITIVES.

Hydrate of Lime.—The operation by which water is combined with lime is called slaking. Take a piece of quick lime, common lime used in mortar, and immerse it in warm water for about fifteen seconds; then place it in an iron or tin vessel. It will soon begin to swell, evolving a great deal of heat and emitting steam, and soon falls into a fine powder, hydrate of lime. This should be well stirred and allowed to cool, and then bottled in order to prevent it from giving off the hydrate and recovering the carbonic acid from the atmosphere. The last is detrimental to its use with bromine, and is one cause of the complaint that "it will not take bromine." The hydrate of lime should, not be dried over a heat, as has been supposed by many, for in that case the hydrogen is expelled and it returns to a carbonate. It is advisable to cool it in a damp place like a ground cellar. Much of the lime in our market will not, except it be quite damp, combine with the bromine. This is owing to impurities. Nothing is equal to oyster-shell lime, which I use altogether.

Bromide of Lime.—In preparing large quantities of this, we adopt the following method: Fill a four-quart bottle about two-thirds full of hydrate of lime; pour into this about one or two ounces of bromine; then shake well, add more of the bromine, shake well and let it stand for a few hours, adding sufficient bromine to give it a fine red color. It is better when kept in the large bottles, as it forms a more perfect combination: in other words it improves by age.

Use.—Coat over the iodine to a rose red and then over this mixture to a purple or slate; recoat over the first about one fourth as long as first coating.

Gurneys American Compound.—Of this compound there are two combinations, one for use, when the temperature of the atmosphere is above 65 or 70 deg., and the other at a lower temperature. The first is called No. 1, the second No. 2.

No. 1 is prepared by placing hydrate of lime in a bottle, say to three quarts of the hydrate of lime, add one ounce of pulverized burnt alum, and as much chloride of lime as can be put on a quarter of a dollar, and from 15 to 30 grains of dry pulverized iodine, or enough to change the color of the hydrate of lime, to the slightest possible tinge of yellow. There had better be less than carry the color to a deeper shade. The object of using the iodine is to form a compound with bromine that is not so volatile as the bromine

itself. No matter how little iodine is combined with the bromine, the vapors possess their relative proportion; hence, only enough iodine to prevent "flaring," or as it is often termed a "scum-coating," is used. The iodine should be thoroughly combined with the lime, which will take about one or two days. Should add bromine the same as in bromide of lime, until the compound assumes a light red color.

No. 2 is prepared in the same manner as No. 1, except the addition of the iodine, which is omitted.

Use.—No. 1. Coat over the iodine to a bright yellow color, then over the compound, No. 1, to red color, recoat over iodine, about one sixth as long, as the time occupied in first coating.

No. 2. Coat over iodine same as above, except recoat over the iodine about one fourth to one half as long as first coating.

Dry Quick, No. 1.—Bromide of Lime and Starch.—The following compound forms an excellent accelerator, and is used by many. It is claimed for this preparation, that it will hold the bromine longer than others where starch is not employed. As regards this claim we do not think it can be substantiated. Our experience in practice has led us to the conclusion that there is no great difference as respects durability, but there is some little difference as regards the tone of the impressions produced by its use.

To one quart of hydrate of lime add one quart of finely pulverized starch. To this mixture add bromine, until it assumes a deep yellow or pink color.

Starch may be added to any of the dry mixtures.

Use.—Coat over the iodine to a deep yellow, then over this quick to a red color, recoat about one sixth of the time of first coating.

I will here again remark, that the exact color of the coating is not essentially provided a proper proportion is preserved.

I have never seen it stated, though it be a fact worthy of note, that a proportionate time for coating over the iodine and accelerator, will not answer. For example: if a plate exposed to the vapor of iodine be perfectly coated in sixteen seconds, and then exposed to an accelerator, (not having iodine in its combination) receives its coating in four seconds, it will be found that a proper proportionate coating cannot be preserved by adopting, a proportion of time, but on the contrary, the time will diminish; for exposure over the accelerator, as in the above example, if it be desired to

coat the plate with twice as much iodine as in the above example, the time would be, over iodine thirty-two seconds, and over the accelerator (to possess a proper proportion) from six to seven seconds. Hence it is that many inexperienced operators, when wishing to vary their usual manner of coating, fail in producing a favorable result. They coat calculating a proportion of time when they should not.

Dry Quick, No. 2.—Bromide of Lime and Magnesia.—To one quart of hydrate of lime add one quart of magnesia, and mix them well together; add bromine same as in preparing bromide of lime; coat the same as over dry quick No. 1. This combination produces very uniform results, and is worked with much success by beginners.

Chloro-Bromide of Lime.—To the bromide of lime add chloride of bromine until the mixture becomes a pale yellow color, resembling sulphur. It should be shook well, and enough of the chloride of bromine added to bring the compound to a deep blood red color.

Use.—Coat over the iodine to a pink color, and then over the above to a red, or just changing the color. It should be remembered that accelerators containing chlorine do not admit of a great change of color of coating on the plate.

Iodide of Starch.—This mixture can be employed for coating over in warm weather, and prevent the flashing resulting at high temperatures. It may be used the same as the iodide alone.

To six ounces of finely pulverized starch, add one fourth ounce of dry iodine.

Use.—Same as the dry iodine alone.

The same combination may be made with lime, magnesia and other substances.

Concentrated Solution of Iodine for First Coating.—It may appear strange to some of our old operators that an aqueous solution of iodine can be used for coating the plate and forming the iodide of silver. It has long been a cry among most operators that it is impossible to succeed when the iodine box contains dampness. Now this is a great mistake, and we will here state that in all cases where dampness appears upon a properly prepared Daguerreotype plate, it is the result of a different temperature of the metal from the air which surrounds it. Mr. Senter, of Auburn, was the first of our

operators who used a solution of iodine for coating the plate, and we several years since saw his results, which would rival the production of any other operator. A concentrated solution of iodine is prepared by putting into a common bottle two thimblesful of hyposulphite of soda and a rather larger quantity of iodine, so that there may be more than sufficient. Add to it about 40 ounces of common water (heated to 60 or 70 degrees), by little and little, moving, the bottle to warm it, for fear of breaking. After shaking it a short time, the water is rapidly and strongly colored. The solution should be poured into a bottle with a ground stopper, and when cool used for iodizing.

A solution of sufficient strength can be made by moistening or just covering the iodine with water.

Chloride of Iodine as an Accelerator.—This is probably one of the best accelerators that can be used for coating the plate for taking views; it works too slow, however, to meet the wants of the operating room, yet its use was formerly, for a long time, adhered to by some of our best professors. In producing views with this, we are successful in obtaining well-developed impressions, with a depth of tone and richness of appearance not to be met with in the productions of any other substances. I give its use as furnished me by an old and experienced operator, and published in Humphrey's Journal, vol. i. p. 180:

"As the process of using chloride of iodine may be of interest to some of our subscribers, I take pleasure in giving the following manipulation. To one ounce of chloride of iodine add two ounces of water; place this mixture in a coating-box, the same as quick stuff; coat the plate with dry iodine to a light yellow, or lemon color; then bring the coating to a deep pink over the chloride. The plate must be recoated over the dry iodine."

This combination has been very successfully used in one of our most extensive establishments in this city, and the superiority of the pictures produced by it was considered as an equivalent for the additional time required to bring out the impressions.

Chlorine as an Accelerator.—I shall here refer to but a single experiment in which I employed chlorine gas for coating the plate. I was provided with a retort, the neck of which was fitted to the jar of my coating-box, through a hole drilled for its reception. This was fitted perfectly tight in my coating-box. I placed some pure undiluted bromine water and the agents necessary for producing chlorine gas (in small quantity) in the retort. The result was

that my first experiment produced an impression completely solarized in all its parts by an exposure of four seconds of time, which would have required an exposure of twenty seconds to produce a perfectly developed impression by the usual process.

Another trial immediately produced one of the finest toned impressions I ever saw, perfectly developed in one second of time.

My next two or three experiments proved total failures. I was unable to produce even a sign of an impression. By accident my retort was broken, and not being in a locality convenient to obtain another, my experiments were necessarily suspended.

My attention was not called to this subject again for several years, when I noticed an account of some similar experiments by F. A. P. Barnard and Dr. W. H. Harrington, the latter of whom is now of the firm of Dobyns & Harrington, of New Orleans.

From reading this article, I found my own difficulties explained. Too much of the chlorine gas was present in my coating jar. I would like to see some of our enterprising operators investigate this combination.

It is a singular fact, that the vapors of bromine and chlorine combining upon the iodide of silver, produce a more sensitive coating than when the two are combined in solution, as in chloride of bromine solution. Those having Humphrey’s Journal at hand, can refer to vol. i. p. 142.

To use Bromine Water or other Accelerators in Hot Weather.—An excellent plan for using bromine water is as follows:

Fill a two-ounce bottle quarter full of it, and then fill the bottle with fine sand, which serves to preserve a low temperature; then place the bottle in a porous cup, same as used in the battery; fill this also with sand, and close the end with plaster of Paris. Place this in a coating-box, and it will be found to act with great uniformity and be quite permanent.

Bromide of Lime, another accelerator, can be used in the same manner, except it is, only necessary, when a solid sensitive is used, to mix it with the sand without placing it in a bottle. This method is employed with great success by a few, who have regarded it as a secret worth keeping.

A Combination, requiring the Use of only One Coating-box.—It is often wondered by beginners, why some solution requiring only one coating cannot be employed. This can be done, but the results are not so satisfactory

as when two or more are employed. Such an accelerator may be produced by adding alcoholic solution of iodine to a solution of chlorate of potash, until the latter will take up no more of the former, and to each ounce, by measure of this solution, ten drops of a saturated solution of bromide in water are added. The solution of chlorate of potash is made by diluting, one part of a saturated solution of the salt with ten parts of water. The use of the chlorate is simply as a solvent of iodine.

Fats as Accelerators.—The use of fats, oils, or greasy substances, has been one of the most emphatic prohibitions about the Daguerreotype plate. Yet it has been proved that its presence in a small quantity upon the silver surface has the effect of reducing the time of exposure in the camera from two-thirds to three-fourths. An application may be made as follows: Pour sweet oil, or rub beef or mutton fat, on a common buff, which is free from all polishing powders. With this, buff a well-cleaned plate, and it will leave a scum, which should be mostly removed by using another buff, which should be clean. Coat the plate in the usual manner, and the result will be a great reduction in the time of exposure in the camera. The impression produced upon a plate so prepared presents, when coming from the vapor of mercury, a grey, scummy appearance, which, on the application of heat in gilding, does not improve; hence its use is not generally adopted.

We have instituted some investigations upon this subject, and in the present volume, we shall not refer to it further. Those wishing to learn more fully the effect of light upon organic substances will find Robert Hunt’s “Researches on Light” an invaluable work.

CHAPTER IV.

LIGHT AND OPTICS.

Light—Optics—Solar Spectrum—Decomposition of Light—Light, Heat, and Actinism—Blue Paper and Color for the Walls of the Operating Room—Proportions of Light, Heat, and Actinism composing a Sunbeam—Refraction—Reflection—Lenses—Copying Spherical Aberration—Chromatic Aberration.

It is advisable that persons engaging in the Daguerreotype art should have at least a little knowledge of the general principles of light and optics. It is not the author's design here to give a full treatise on these subjects, but he only briefly refers to the matter, giving a few facts.

It has been well observed by an able writer, that it is impossible to trace the path of a sunbeam through our atmosphere without feeling a desire to know its nature, by what power it traverses the immensity of space, and the various modifications it undergoes at the surfaces and interior of terrestrial substances.

Light is white and colorless, as long as it does not come in contact with matter. When in apposition with any body, it suffers variable degrees of decomposition, resulting in color, as by reflection, dispersion, refraction, and unequal absorption.

To Sir I. Newton the world is indebted for proving the compound nature of a ray of white light emitted from the sun. The object of this work is not to engage in an extended theory upon the subject of light, but to recur only to some points of more particular interest to the photographic operator.

The decomposition of a beam of light can be noticed by exposing it to a prism. If, in a dark room, a beam of light be admitted through a small hole

in a shutter, it will form a white round spot upon the place where it falls. If a triangular prism of glass be placed on the inside of the dark room, so that the beam of light falls upon it, it no longer has the same direction, nor does it form a round spot, but an oblong painted image of seven colors—red, orange, yellow, green, blue, indigo, and violet. This is called the solar spectrum, and will be readily understood by reference to the accompanying diagram, Fig. 1.

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To those who are unacquainted with the theory of light (and for their benefit this chapter is given), it may be a matter of wonder how a beam of light can be divided.

[Illustration: Fig. 1]

This can be understood when I say, that white light is a bundle of colored rays united together, and when so incorporated, they are colorless; but in passing through the prism the bond of union is severed, and the colored rays come out singly and separately, because each ray has a certain amount of refracting (bending) power, peculiar to itself. These rays always hold the same relation to each other, as may be seen by comparing every spectrum or rainbow; there is never any confusion or misplacement.

There are various other means of decomposing {134} white light besides the prism, of which one of the principal and most interesting to the Daguerreotypist is by reflection from colored bodies. If a beam of white light falls upon a white surface, it is reflected without change; but if it falls upon a red surface, only the red ray is reflected: so also with yellow and other colors. The ray which is reflected corresponds with the color of the object. It is this reflected decomposed light which prevents the beautifully-colored image we see upon the ground glass in our cameras.

[Illustration: Fig. 2]

A sunbeam may be capable of three divisions—LIGHT, HEAT, and ACTINISM; the last causes all the chemical changes, and is the acting power upon surfaces prepared to receive the photographic image. The accompanying illustration, Fig. 2, will readily bring to the mind of the

reader the relation of these one to another, and their intensities in the different parts of a decomposed sunbeam.

The various points of the solar spectrum are represented in the order in which they occur between A, and B, this exhibits the limits of the Newtonian spectrum, corresponding with Fig. 1. Sir John Herschel and Seebeck have shown that there exists, beyond the violet, a faint violet light, or rather a lavender to b, to which gradually becomes colorless; similarly, red light exists beyond the assigned limits of the red ray to a. The greatest amount of actinic power is shown at E opposite the violet; hence this color “exerts” the greatest amount of influence in the formation of the photographic image.

(Blue paper and blue color have been somewhat extensively used by our Daguerreotype operators in their operating rooms and skylights, in order to facilitate the operation in the camera. I fancy, however, that this plan cannot be productive of as much good as thought by some, from the fact, that the light falling upon the subject, and then reflected into the camera, is, coming through colorless glass, not affected by such rays as may be reflected from the walls of the operating room; and even if it were so, I conceive that it would be injurious, by destroying the harmony of shadows which might otherwise occur.) The greatest amount of white light is at C; the yellow contains less of the chemical power than any other portion of the solar spectrum. It has been found that the most intense heat is at the extreme red, b.

Artificial lights differ in their color; the white light of burning charcoal, which is the principal light from candles, oil and gas, contains three rays—red, yellow, and blue. The dazzling light emitted from lime intensely heated, known as the Drummond light, gives the colors of the prism almost as bright as the solar spectrum.

If we expose a prepared Daguerreotype plate or sensitive paper to the solar spectrum, it will be observed that the luminous power (the yellow) occupies but a small space compared with the influence of heat and chemical power. R. Hunt, in his Researches on Light, has presented the following remarks upon the accompanying illustration:

[Illustration: Fig. 3]

“If the linear measure, or the diameter of a circle which shall include the luminous rays, is 25, that of the calorific spectrum will be 42.10, and of the chemical spectrum 55.10. Such a series of circles may well be used to represent a beam from the sun, which may be regarded as an atom of Light, surrounded with an invisible atmosphere of Heat, and another still more extended, which possesses the remarkable property of producing chemical and molecular change.

A ray of light, in passing obliquely through any medium of uniform density, does not change its course; but if it should pass into a denser body, it would turn from a straight line, pursue a less oblique direction, and in a line nearer to a perpendicular to the surface of that body. Water exerts a stronger refracting power than air; and if a ray of light fall upon a body of this fluid its course is changed, as may be seen by reference to Fig. 4.

[Illustration: Fig. 4]

It is observed that it proceeds in a less oblique direction (towards the dotted line), and, on passing on through, leaves the liquid, proceeding in a line parallel to that at which it entered. It should be observed that at the surface of bodies the refractive power is exerted, and that the light proceeds in a straight line until leaving the body. The refraction is more or less, and in all cases in proportion as the rays fall more or less obliquely on the refracting surface. It is this law of optics which has given rise to the lenses in our camera tubes, by which means we are enabled to secure a well-delineated representation of any object we choose to picture.

When a ray of light passes from one medium to another, and through that into the first again, if the two refractions be equal, and in opposite directions, no sensible effect will be produced.

The reader may readily comprehend the phenomena of refraction, by means of light passing through lenses of different curves, by reference to the following diagrams:—

[Illustration: Fig. 5, 6, 7]

Fig 5 represents a double-convex lens, Fig. 6 a double-concave, and Fig. 7 a concavo-convex or meniscus. By these it is seen that a double-convex

lens tends to condense the rays of light to a focus, a double-concave to scatter them, and a concavo-convex combines both powers.

If parallel rays of light fall upon a double-convex lens, D D, Fig. 8, they will be refracted (excepting such as pass directly through the centre) to a point termed the principal focus.

[Illustration: Fig. 8]

The lines A B C represent parallel rays which pass through the lens, D D, and meet at F; this point being the principal focus, its distance from the lens is called the focal length. Those rays of light which are traversing a parallel course, when they enter the lens are brought to a focus nearer the lens than others. Hence the difficulty the operator sometimes experiences by not being able to "obtain a focus," when he wishes to secure a picture of some very distant objects; he does not get his ground glass near enough to the lenses. Again, the rays from an object near by may be termed diverging rays. This will be better comprehended by reference to Fig. 9, where it will be seen that the dotted lines, representing parallel rays, meet nearer the lenses than those from the point A. The closer the object is to the lenses, the greater will be the divergence. This rule is applicable to copying. Did we wish to copy a 1/6 size Daguerreotype on a 1/16 size plate, we should place it in such a position to the lenses at A that the focus would be at F, where the image would be represented at about the proper size. Now, if we should wish to copy the 1/6 size picture, and produce another of exactly the same dimensions, we have only to bring it nearer to the lenses, so that the lens D E shall be equi-distant from the picture and the focus, i. e. from A to B. The reason of this is, that the distance of the picture from the lens, in the last copy, is less than the other, and the divergence has increased, throwing, the focus further from the lens."

[Illustration: Fig. 9]

These remarks have been introduced here as being important for those who may not understand the principles of enlarging or reducing pictures in copying.

I would remark that the points F and A, in Fig. 9, are termed "conjugate foci."

If we hold a double-convex lens opposite any object, we find that an inverted image of that object will be formed on a paper held behind it. To illustrate this more clearly, I will refer to the following woodcut:

[Illustration: Fig. 10]

“If A B C is an object placed before a convex lens, L L, every point of it will send forth rays in all directions; but, for the sake of simplicity, suppose only three points to give out rays, one at the top, one at the middle, and one at the bottom; the whole of the rays then that proceed from the point A, and fall on the lens L L, will be refracted and form an image somewhere on the line A G E, which is drawn direct through the centre of the lens; consequently the focus E, produced by the convergence of the rays proceding from A, must form an image of A, only in a different relative position; the middle point of C being in a direct line with the axis of the lens, will have its image formed on the axis F, and the rays proceeding from the point B will form an image at D; so that by imagining luminous objects to be made up of all infinite number of radiating points and the rays from each individual point, although falling on the whole surface of the lens, to converge again and form a focus or representation of that point from which the rays first emerged, it will be very easy to comprehend how images are formed, and the cause of those images being reversed.

“It must also be evident, that in the two triangles A G B and D G E, that E D, the length of the image, must be to A B, the length of the object, as G D, the distance of the image, is to G B, the distance of the object from the lens.

It will be observed that in the last cut the image produced by the lens is curved. Now, it would be impossible to produce a well-defined image from the centre to the edge upon a plain surface; the outer edges would be misty, indistinct, or crayon-like. The centre of the image might be represented clear and sharp on the ground glass, yet this would be far from the case in regard to the outer portions. This is called spherical aberration, and to it is due the want of distinctness which is frequently noticed around the edges of pictures taken in the camera. To secure a camera with a flat, sharp, field, should be the object of every operator; and, in a measure, this constitutes the great difference in cameras manufactured in this country.

Spherical aberration is overcome by proper care in the formation of the lens: “It can be shown upon mathematical data that a lens similar to that given in the following diagram—one surface of which is a section of an ellipse, and the other of a circle struck from the furthest of the two foci of that ellipse—produces no aberration.

“At the earliest period of the employment of the camera obscura, a double-convex lens was used to produce the image; but this form was soon abandoned, on account of the spherical aberration so caused. Lenses for the photographic camera are now always ground of a concavo-convex form, or meniscus, which corresponds more nearly to the accompanying diagram.”

[Illustration: Fig. 11]

Chromatic Aberration is another difficulty that opticians have to contend with in the manufacturing of lenses. It will be remembered, that in a former page (133) a beam of light is decomposed by passing through a glass prism giving seven distinct colors—red, orange, yellow, green, blue, indigo and violet.

Now, as has been said before, the dissimilar rays having an unequal degree of refrangibility, it will be impossible to obtain a focus by the light passing through a double-convex lens without its being fringed with color. Its effect will be readily understood by reference to the accompanying cut.

[Illustration: Fig. 8]

If L L be a double convex-lens, and R R R parallel rays of white light, composed of the seven colored rays, each having a different index of refraction, they cannot be refracted to one and the same point; the red rays, being the least refrangible, will be bent to r, and the violet rays, being the most refrangible, to v: the distance v r constitutes the chromatic aberration, and the circle, of which the diameter is a l, the place or point of mean refraction, and is called the circle of least aberration. If the rays of the sun are refracted by means of a lens, and the image received on a screen placed between C and o, so as to cut the cone L a l L, a luminous circle will be formed on the paper, only surrounded by a red border, because it is produced by a section of the cone L a l L, of which the external rays L a L l, are red; if the screen be moved to the other side of o, the luminous circle

will be bordered with violet, because it will be a section of the cone M a M l, of which the exterior rays are violet. To avoid the influence of spherical aberration, and to render the phenomena of coloration more evident, let an opaque disc be placed over the central portion of the lens, so as to allow the rays only to pass which are at the edge of the glass; a violet image of the sun will then be seen at v, red at r, and, finally, images of all the colors of the spectrum in the intermediate space; consequently, the general image will not only be confused, but clothed with prismatic colors."

To overcome the difficulty arising from the chromatic aberration, the optician has only to employ a combination of lenses of opposite focal length, and cut from glass possessing different refrangible powers, so that the rays of light passing through the one are strongly refracted, and in the other are bent asunder again, reproducing white light.

To the photographer one of the most important features, requiring his particular attention, is, that he be provided with a good lens. By the remarks given in the preceding pages, he will be enabled, in a measure, to judge of some of the difficulties to which he is occasionally subjected. We have in this country but two or three individuals who are giving their attention to the manufacture of lenses, and their construction is such, that they are quite free from the spherical or chromatic aberration.

CHAPTER V.

To make Plates for the Daguerreotype—Determining the Time of Exposure in the Camera—Instantaneous Process for Producing Daguerreotype—Galvanizing the Daguerreotype Plate—Silvering Solution—Daguerreotype without Mercury—Management of Chemicals—Hints and Cautions—Electrotyping—Crayon Daguerreotypes—Illuminated Daguerreotypes—Natural Colors in Heliography—Multiplying Daguerreotypes on one Plate—Deposit in Gilding—Practical Hints on the Daguerreotype.

TO MAKE PLATES FOR THE DAGUERREOTYPE.

I do not give the method employed by our regular plate manufacturers; this is not important, as the operator could not possibly profit by it from the fact of the great expense of manufacturing. The following will be found practical:

Procure a well planished copper plate of the required size, and well polish it, first with pumice stone and water, then with snake stone, jewelers' rouge. Plates can be purchased in a high state of preparation from the engravers. Having prepared the copper-plate, well rub it with salt and water, and then with the silvering powder. No kind answers better than that used by clock-makers to silver their dial-plates. It is composed of one part of well washed chloride of silver, five parts of cream of tartar, and four parts of table salt. This powder must be kept in a dark vessel, and in a dry place. For a plate six inches by five, as much of this composition as can be taken up on a shilling is sufficient. It is to be laid in the centre of the copper, and

the figures being wetted, to be quickly rubbed over every part of the plate, adding occasionally a little damp salt. The copper being covered with the silvering is to be speedily well washed in water, in which a little soda is dissolved, and as soon as the surface is of a fine silvery whiteness, it is to be dried with a very clean warm cloth. In this state the plates may be kept for use. The first process is to expose the plate to the heat of a spirit flame, until the silvered surface becomes of a well-defined golden-yellow color; then, when the plate is cold, take a piece of cotton, dipped in very dilute nitric acid, and rub lightly over it until the white hue is restored, and dry it with very soft clean cloths. A weak solution of the hydriodate of potash, in which a small portion of iodine is dissolved, is now passed over the plate with a wide camel's hair brush. The silver is thus converted, over its surface, into an ioduret of silver; and in this state it is exposed to light, which blackens it. When dry, it is to be again polished, either with dilute acid or a solution of carbonate of soda, and afterwards with dry cotton, and the smallest possible portion of prepared chalk: by this means a surface of the highest polish is produced. The rationale of this process is, in the first place, the heat applied dries off any adhering acid, and effects more perfect union between the copper and silver, so as to enable it to bear the subsequent processes. The first yellow surface appears to be an oxide of silver with, possibly, a minute quantity of copper in combination, which being removed leaves a surface chemically pure.

Another Method.—The best and simplest mode with which we are acquainted is to divide an earthenware vessel with a diaphragm: one side should be filled with a very dilute solution of sulphuric acid, and the other with either a solution of ferroprussiate of potash, or muriate of soda, saturated with chloride of silver. The copper plate, varnished on one side, is united, by means of a copper wire, with a plate of zinc. The zinc plate being immersed in the acid, and the copper in the salt, a weak electric current is generated, which precipitates the silver in a very uniform manner over the entire surface.

Another Method.—A piece of brass or of polished copper, brass is preferred, is perfectly planished and its surface made perfectly clean. A solution of nitrate of silver, so weak that the silver is precipitated slowly, and a brownish color, on the brass, is laid uniformly over it, "at least three times," with a camel's hair pencil. After each application of the nitrate, the plate should be rubbed gently in one direction, with moistened bitartrate of

potassa, applied with buff. This coat of silver receives a fine polish from peroxide of iron and buff. Proofs are said to have been taken on it, comparable with those obtained on French plates.

M. SOLIEL'S PROCESS FOR DETERMINING THE TIME OF EXPOSURE IN THE CAMERA.

M. Soliel has proposed the use of the chloride of silver to determine the time required to produce a good impression on the iodated plate in the camera. His method is to fix at the bottom of a tube, blackened within, a piece of card, on which chloride of silver, mixed with gum or dextrine, is spread. The tube thus disposed is turned from the side of the object of which we wish to take the image, and the time that the chloride of silver takes to become of a greyish slate color will be the time required for the light of the camera to produce a good effect on the iodated silver.

INSTANTANEOUS PROCESS FOR PROCURING DAGUERREOTYPES.

The following method of producing Daguerreotypes has by some been named as above. Most experienced operators have been long acquainted with the effect of the vapor of ammonia upon the chemically coated plate. I will here insert Mr. W. H. Hewett's plan of proceeding. This gentleman, in referring to it (published in 1845), says:

"This improvement consists in using the vapor of ammonia, as an object to accelerate the action of light upon the plate. The effect is produced upon a simple iodized plate, but still more upon a plate prepared in the ordinary way, with both iodine and bromine. By this means, the author obtained impressions instantaneously in the sunshine, and in five to ten seconds in a moderate light; and he hopes to be able to take moving objects. It can be applied by exposing the prepared plate over a surface of water, to which a

few drops of ammonia have been added (sufficient to make it smell of ammonia); or the vapor can be introduced into the camera during the action. In fact, the presence of ammonia, in the operating-room, appears to have a good effect, as it also neutralizes the vapors of iodine and bromine that may be floating about, and which are so detrimental to the influences of light upon the plate."

GALVANIZING THE DAGUERREOTYPE PLATE.

In consideration of the importance of galvanized plates, I shall endeavor to give as plain and concise a manner of manipulation as possible. For some time it was a question among the operators generally, as to the beneficial result of electrotyping, the Daguerreotype plate, but for a few years past our first operators have found it a fact, that a well electro-silvered surface is the best for producing a portrait by the Daguerreotype.

From my own experiments, I have found that a plate, by being galvanized, can be rendered more sensitive to the operation of the light in proportion of one to five, viz.: if a plate as furnished by the market, be cleaned, polished, coated and exposed in the camera, if the required time to freely develop an impression be ten seconds, a similar plate prepared in like manner and galvanized, will produce an equally well-defined image in eight seconds. In connection with this subject, there is one fact worthy of notice; a plate with a very heavy coating of pure silver, will not produce an equally developed image, as a plate with a thinner coating, hence the thin coating, providing it entirely covers the surface, is the best, and is the one most to be desired. The experiment is plain and simple. Let the slate receive a heavy or thick coating by the electrotype, then polish, coat, expose in the usual manner, and the result will be a flat, ashy, indistinct impression; when, on the other hand, the thin coating will produce a bright, clear and distinct image, with all the details delineated.

The style of battery best for the purpose has been, and now is, a question of dispute among operators; some preferring the Daniell battery to Smee's. Some claim the superiority of the first from its uniformity of action; others, of the latter, for its strength. I consider either good, and for the inexperienced would prefer the Daniell. This is more simple in its

construction, while it has certainty in action. The more skillful electrotyper would prefer Smee's, and this is the one most generally in use. I would remark that the plan of galvanizing plates should be followed by every operator, and when once thoroughly tested, no one will abandon it.

SILVERING SOLUTION.

To any desired quantity of chloride of silver in water add, little by little, cyanide of potassium, shaking well at each addition, until all the cyanide is dissolved. Continue this operation, and add the cyanide, until all the precipitate is taken up and held in solution.

This solution is now ready for the plate-cup. Enough water may be added to cover any sized plate when held perpendicular in the cup. The strength of the solution may be kept up by occasionally adding the chloride of silver and cyanide of potassium. There should alway be a very little excess of the cyanide.

The plate should be well cleaned and buffed, and the solution well stirred before it is immersed. Care should be observed to keep the solution clean, and allow no particle of dust to come in contact with the surface of the plate. The plate is now to be attached to the pole of the battery.

After remaining a short time, it assumes a blue color; take it out, rinse freely with pure water, then dry with a spirit lamp, and it is ready for buffing. Buff and coat in the usual manner. Some operators are in the practice of immersing the plate in the solution and buffing twice. This additional silvering is no improvement wherever there has been a proper first coating.

Sometimes the operator is troubled with streaks or scum on the plate. This may arise from three causes, all of which experience must teach the experimenter to avoid; first, too great an excess of cyanide in the solution; second, a lack of silver; third, the current too strong. Another annoyance arises from the solution being dirty and the dirt collecting on the surface. When this is the case, the dirt is sure to come in contact with the surface of the plate as it is plunged into the solution, and the result is a scum that it is difficult to dispose of. This can be prevented only by frequent filtering. One

thing should always be borne in mind in electrotyping Daguerreotype plates —that in order to secure a perfectly coated surface, the plate should be perfectly cleaned. In this point, many who have tried the electrotype process have failed, attributing their ill success to other than the proper cause.

DAGUERREOTYPES WITHOUT MERCURY.

The following process possesses some interest, and is worthy a trial from operators. M. Natterer, of Vienna, discovered a process for obtaining proofs on iodized plates with the chloride of sulphur, without the use of mercury. A plate of silver is iodized in the usual manner, and then placed on the top of a vessel six or eight inches high, having at the bottom, in a small cup, a few drops of chloride of sulphur; it should remain exposed to the action of the vapor until the sombre yellow color is changed to a red, after which it is brought to a focus in the camera, where it is exposed to the light in the camera, for about the time necessary to produce an ordinary daguerreotype. The plate is then taken out and examined in the camera by the light of a candle. It often occurs that no trace of the image is as yet perceptible, but if the plate is heated by placing over a spirit lamp the unprepared side, or if left for some time in the dark, or, lastly, if exposed only a few seconds to a weak, dimmed light, the positive picture then appears with all its shades. Of these three modes of bringing out the image, the second is superior to the others.

MANAGEMENT OF CHEMICALS.

It is necessary, first of all, to know that you have a chemical which is capable of producing good results when in skillful hands. For this reason it is best to prepare your own quick, after some formula which is known to be good. Those quick-stuffs which contain chloride of iodine are noted for their depth of tone while they probably operate with less uniformity than those which are destitute of it. For operating under ordinary circumstances, especially with an inferior light, probably no accelerator is more quick and

sure than Wolcott's. It also produces a very fine, white pleasing picture, though lacking that depth of impression so much to be desired. The dry quick operates with surety, and its use is simple and easy, producing an impression much like Wolcott's. For those having a good and permanent light, however, we would recommend a chemical giving more body to the impression.

There is a class of accelerators called sensitives, claiming to work in from three to ten seconds, which, however, will be found very little, if any, more sensitive than this. We frequently work it with the ordinary coating in twelve and fifteen seconds. The manner in which the sensitives are worked is by coating very light. In this way, a flat, shallow picture is obtained in a few seconds; and the same can be done with any of the more volatile quicks.

It is a fact not generally known, that a plate coated in a light chemical room is more sensitive than when coated in darkness. By admitting a free, uniform light, and exposing the plate to it a few seconds after coating, then timing short in the camera, a very light, clear impression is obtained. The time in the camera is reduced in proportion to the previous action of light. The shades, of course, are destroyed, and the tone injured; still, for taking children, we have succeeded better by this method than by the use of "sensitives." The discovery of this principle was accidental, while operating where the direct ray s of the sun, entering the window just before sunset, fell on the curtain of our dark room, rendering it very light within.

The selection of iodine is not unimportant. Reject, at once, that which has anything like a dull, black, greasy appearance; and select that which is in beautiful large crystalline scales, of a purple color, and brilliant steel lustre.

Solarization, and general blueness of all the light parts of the picture, were formerly great obstacles to success, though now scarcely thought of by first-class artists. Beginners in the art, however, are still apt to meet with this difficulty. It is occasioned by dampness in the iodine box, which causes the plate to become coated with a hydro-iodide of silver, instead of the iodide. The remedy is in drying your iodine. If in summer, you can open your box and set it in sunshine a few minutes; or if in winter, set it under a stove a short time. The true method, however, is to dry it by means of the chloride of calcium. It has such a remarkable affinity for water, that a small

fragment placed in the open air, even in the dryest weather, soon becomes dissolved.

Take one or two ounces of this chemical, heat it in the drying bath, or in a hot stove, to perfect dryness; place it in a small glass toy dish, or large watch crystal, and set it in the centre of your iodine box. Take this out and heat to dryness every morning. Adopt this process, and with your mercury at a high temperature, you will never be troubled with blue pictures.

Young operators are apt to impute all want of success in operating to their chemicals, even though the cause is quite as likely to be elsewhere. Failure is quite likely to occur from dampness in the buffs, or in the polish; it is therefore necessary to be constantly on the guard in this quarter. With a view to this, always scrape your buffs with a dull knife, or with one blade of your shears, the first thing in the morning, and after brushing them thoroughly, dry them, either in the sun, by a stove, or in the buff-dryer. It is equally important that the polish and the brush should be kept dry.

Want of success may arise from vapors of iodine or bromine in the camera box, mercury bath, or even in the buffs. It is incredible how small a quantity of these vapors will affect the effect of light when coming in contact with the plate, after or during the exposure in the camera. It is therefore necessary to be cautious not to mix chemicals, nor open your boxes or bottles in your room, but take them out to do it. Never hurry the operation through from lack of confidence in the result. The fact of anything being out of order, forms no excuse for slighting the process. If unsuccessful, do not pursue the same course every trial, but vary with a view to detect the cause of the difficulty.

In case of a long series of failures, institute a regular course of investigation, after this manner, commencing where the trouble is most likely to occur:

1. Are the plates well cleaned?

2. Is the iodine dry? If the impressions come out blue, you may rest assured it is not. Take out the iodine, wipe and dry the box, and dry the calcium.

3. Is the quick battery of the right strength? If dry, it must change the plate in from six to fifteen seconds. If any of the chloride of iodine class, it may vary from five seconds to a minute. Begin by coating light, and increase on each trial, observing the effect. If the light side of the picture

seems loth to come out, and shows no contrast with the dark side, it is to be inferred that your battery is too strong, and must be reduced with water or set out in the open air for a few minutes, with the lid off. If working an old battery, never renew very strong, or it will work dark and heavy. A battery, to work well, should be gradually losing strength, but never gaining. An old battery, however, may be quickened up and made to work well for some time, by adding five of six drops of sulphuric acid, repeating the quantity as often as necessary, providing always that acid be not used in manufacturing the quick.

4. Have the plates lost their sensitiveness by being many times exposed to mercury? Clean and burn them; but if French plates, burn light, or you spoil them.

5. Are the buff s dry and clean? Examine the plate critically after buffing to detect any appearance of scum or film on the surface. If so, the longer you buff the more it shows. Scrape and dry the buffs thoroughly.

6. Is the mercury free from scum and dirt? If not, filter. Is it also far enough from the coating boxes? Should be at least three feet, and kept covered.

7. Is the mercury sufficiently heated? This is important. Long exposure, however, will answer the same purpose.

8. Are your lenses clean, and in proper place?

9. Are the tablets in focus with the ground-glass? If you can attribute the failure to none of these, mix a new box of some other kind of quick, say the dry, for instance. If you fail in the same manner here, take time, wash your buffs, overhaul all the chemicals, and start anew. Do not be discouraged.

There is no day so dark but that the sun will shine again. We will close with this brief summary of advice:

Clean your plates. Keep everything dry. Keep the mercury hot. Follow these instructions carefully, and you must succeed.

HINTS AND CAUTIONS.

First of all, cleanliness should be observed. When there is dust or dirt about your room, particularly about the work-bench, failures will be frequent; for the smallest particles of rotten-stone, when allowed to come in contact with the buffs, will produce scratches on the surface of the plate, which very much injures the operation, and often causes failures.

Dust flying about the room is injurious, if allowed to fall on the plate, either before or after it has been coated, as it causes black spots which cannot be removed.

The polished plate should not be allowed to come in contact with a strong current of air, for it tends to oxidize the surface. Breathing on the surface should also be avoided, for the same reason.

The plate should, in all cases, be buffed immediately before using, and not allowed to stand any length of time. It should be held with the polished face downward.

It is always best that the plate should be of the same temperature of the atmosphere in the room.

Keep the camera and mercury-bath perfectly free from the vapors of iodine and bromine; for the presence of the slightest degree of either of the above will injure the impression in no small degree. As a preventive, let the camera be exposed to the sun or fire for a few minutes in the morning.

Filter your mercury often, to keep the surface free from film and dust.

The hyposulphite solution should be filtered through sponge every time it is used.

The direct rays of light must not enter the camera in conjunction with those reflected from the object; or the picture will be veiled, and the color of the plate changed to a thick green.

If the plate be iodized only to a light-yellow, the result might be of a bluish or grey tinge: and this is generally the case, when the quick is new and strong, and there is an excess of it on the plate, and yet not enough to form the bromide iodide of silver; in which case it would wholly spoil the impression.

Your iodine will be found to operate more successfully, when the time required for coating the plate does not fall short of fifteen seconds, or exceed one minute.

Too quick coating can be avoided by using less iodine in your box. In the summer months, when the weather is 80 deg. and over, one quarter of an ounce, or even less, will work to advantage.

ELECTROTYPING.

I am indebted to Mr. J. H. Fitzgibbons for the following process, which he employed in producing the excellent specimens he exhibited at the Crystal Palace:

“I shall endeavor to lay down in as comprehensive a manner as possible the method by which I have been enabled to produce the most satisfactory results. I use a Smee’s battery (another kind will do). After filling the cell, of common size, nearly full with water; add about quarter of an ounce of sulphuric acid. Mix this well, and let it stand for about three hours, or until the action of the battery becomes weak, when it is in order to work with a very uniform action. Put one pound of sulphate of copper in one quart of water; stir it until the sulphate of copper is all dissolved, and then add one half ounce of sulphuric acid and a quarter of an ounce of nitric acid. This solution, well mixed, should be filtered, and it is ready for use. It is very important that the solution should be kept clean, clear, and free from all foreign substance. The above quantity of this solution will be found sufficient for electrotyping a dozen of the sixth-size plates. When it is required to be strengthened, it is only necessary to add a little of the sulphate of copper.

“With the battery prepared as above, and the solution of sulphate of copper in a vessel of proper dimensions to receive your plate, connect the galvanic current, and immerse the impressioned plate, letting it remain until a thin film of copper has been formed, then the battery can be strengthened, and the impression will be of sufficient thickness to be removed in from eight to twelve hours. An old Daguerreotype plate attached to the opposite pole of the battery (copper side towards the face of the plate to be electrotyped), will answer the same purpose as the silver-plate.

“The great difficulty in taking an electrotype impression, and preserving the original, has been attributed to the battery being too powerful. I am led

to believe from practice that the principal difficulty has been in the Daguerreotype plate itself, for if we use an impression that has been taken but a few days, and taken in the usual way, we will find it difficult to succeed without spoiling both the copy and original, and so also with an old impression.

“I have found the most certain method to be as follows:—Coat the Daguerreotype plate as usual, except use less of the accelerators, the proportion of iodine coating being greater, of course the time of exposure in the camera will be lengthened. Mercurialize it at about a temperature requiring to develop the image, from six to eight minutes, at least. Gilding the Daguerreotype has much to do towards producing a good electrotype copy. This should be done by applying a little heat, and gilding very slowly, giving a coating of gold with the greatest possible uniformity. By this method, I have been enabled to produce any number of proofs. I have produced a dozen from one impression, and it remains as perfect as when first taken.

“By a little judgment and care the operator will be enabled to produce the electrotype copy of the Daguerreotype plate without any difficulty. The electrotype copy should be immediately put under a glass and sealed in the same manner as the ordinary Daguerreotype.”

CRAYON DAGUERREOTYPES.

This process is patented in the United States, by J. A. Whipple, of Boston, and of course no honorable person will use it for his own benefit without purchasing a right.

A white back-ground is generally employed, the object being to blur the lower portion of the plate, leaving the head of the subject in relief. Every Daguerreotypist is familiar with the fact that a motion of any body between the camera and the sitter will cause a “blur.” Cut a piece of thin paper and scallop it, making a semicircle. This is kept straight by means of a wire frame, and it is to be moved in front of the lower part of the body of the sitter during the time of exposure of the plate in the camera. Develop over mercury as usual, and the result will be a crayon Daguerreotype.

Another method is to have a wheel with a hole cut through it of a diameter of about 12 inches. This hole is so cut as to leave teeth resembling those of a large saw. This wheel is so arranged that it can be turned around, which should be done during the time of exposure in the camera. It must be placed between the camera and the sitter, and at such a distance from the camera as to allow such proportion of the body of the sitter be seen upon the ground-glass as is desired. It will be readily seen that by turning this wheel during the operation will produce the same result as the paper being moved in the other method. The teeth make the “blur.” The side of the wheel towards the camera may be black, by which means the result will be a dark instead of a light border.

ILLUMINATED DAGUERREOTYPES.

This process is also patented, and the remarks on the preceding subject will apply in this case. The plate is prepared and exposed as in the usual method of the Daguerreotype. A white back-ground is employed. Let the head of the sitter come in the middle of the plate, and before exposing it to the vapors of mercury, put a small mat or diaphragm, having a small hole through it, over or directly on the surface of the plate. This diaphragm should be bevelled, and the bevel should be towards the surface of the plate; this, in order to prevent too sharp a line on the impression. It will be readily seen that if an impressioned plate so covered is placed over the mercury, it will be developed on such portions only as are exposed. The principle is so familiar that further explanations are unnecessary.

NATURAL COLORS IN HELIOGRAPHY.

This subject is worthy the attention of every operator. The following process is so plain and easy of trial that any Daguerreotypist can try it. This is as given by Mr. James Campbell, and was published in Humphrey’s Journal of the Daguerreotype and Photographic Arts, vol. 5, page 11. Mr.

Campbell has done much to further the process announced by M. Neipce, and his experiments have proved highly successful.

The following is submitted as worthy of trial:

“The proper preparation of the chloridated plate, to enable it to receive colored impressions is an object of the first importance to those wishing to experiment on it, and consequently requires particular notice. The plate may be prepared by making it the positive pole of a battery, and letting it at the same time be immersed in chlorine water. The negative pole should be a slip of platinum. All the colors may be produced from a plate so prepared if the chlorine and water are in the right proportions; but generally one color or the other predominates, according to the amount of chlorine in the liquid. By adding the chlorides of strontian, uranium, potassium, sodium, iron, or copper to the liquid, various effects may be produced, and these bodies will be found to produce the same color on the plate that their flame gives to alcohol.

“The honor of this discovery is due to M. Neipce. Copper gives a variegated flame; hence many colors may be impressed on a plate prepared with a solution of its chloride.

“M. Neipce recommends a solution of the mixed chlorides of copper and iron, and it is with these, that I have been most successful. As the chlorides of copper and iron are not much used in the arts, they are not generally found for sale in the shops; and it may be well to furnish those not much versed in chemistry with an easy method of preparing them.

“They may be made directly from either metal by dissolving it in hydrochloric acid; but they may be formed by a cheaper method, and by which also the acid fumes are avoided.

“Sulphate of iron or copper, or both together, may be dissolved in water and then neutralized with common crude potash, or its carbonate or bicarbonate—known commonly as pearl ash and saleratus. If either of the latter be used, there will be formed sulphate of potash and a carbonate of the metal used, and there will also be a considerable effervescence of carbonic acid, which will, if care is not taken, cause the mixture to run over the vessel. After the copper or iron salt is neutralized, which is known by its ceasing to effervesce, the carbonate of the metal will settle slowly, and will at first nearly fill the vessel. The supernatant fluid, which is sulphate of potash in solution, may now be carefully poured off, and its place filled

with water; this operation should be repeated several times until the water which passes off is tasteless. The carbonate of the metal rapidly changes to an oxide by contact with the air, and it will generally be found, when it is sufficiently washed, that it is at least half oxide. On adding hydrochloric acid cautiously to the mixture, a chloric of the metal will be formed, and carbonic acid will be evolved from the remaining carbonate. The chloride formed is soluble; but as there are two chlorides of these metals, and we wish to produce the one which contains the most chlorine, it is best to add the acid cautiously until the solution is decidedly acid. After filtering the solution, it is fit for use; and it should be preserved in well-stoppered bottles. The water used should be rain or distilled water.

"About one part of the mixed chlorides should be used to three or four of water.

"The battery may be either Smee's, Daniell's, or Grove's; if of either of the former, it should be of two series; if of the latter, one cup is sufficient.

"The plate on being immersed in the liquid, almost instantly takes a violet color. It should be allowed to remain from two to five minutes, according to the strength of the battery, and until it becomes nearly black. It should now be carefully washed, and afterwards heated over a spirit lamp until it takes a cherry-red color, and it is then ready for exposure in the camera. Before speaking of exposing the plate, it may be well to speak of some difficulties which the inexperienced operator may find in preparing it. If the battery is not in good order, and a sufficient current is not passed through the solution, the plate will become coated—and apparently almost as well as when the battery is working well—but on exposure it will give a negative picture, and but little colored; while if the battery is in good order, the impression is invariably positive.

"Sometimes on heating the plate after washing, the surface is covered with spots or assumes a variegated appearance. This indicates that the solution is impure, or that the plate have not been thoroughly washed and are still contaminated with the soluble chlorides which are contained in the solution.

"From the fact that the plate if prepared with positive electricity gives a positive picture, while it prepared otherwise it gives a negative, it is evident that electricity plays an important part in this process. The same is true to some extent with the compounds formed with iodine, bromine, and fluorine.

“On heating the plate, the brown coating of chloride melts into a translucent enamel, and the heat should be withdrawn when a cherry-red color is produced. It the heat is continued longer, the plate assumes a lighter color, and becomes less sensitive; and the enamel will finally scale off. To produce a picture by the ordinary process of M. Neipce, unaccelerated, it should be exposed for from three to five hours to sunlight in the camera, though pictures may be procured by contact, in from fifteen to thirty minutes.”

MULTIPLYING DAGUERREOTYPES ON ONE PLATE.

I have produced some interesting specimens of the Daguerreotypic art, by exposing in the camera only a portion of the sensitive plate to the action of light. When on the exposed portion an image is formed, then taking the tablet into the dark room, change ends and expose the sensitive portion, and produce another image, developing as usual. This plan is adapted for taking likenesses for lockets. Two images can be presented as sitting side by side, by covering half the plate with black paper, and exposing as before. In this manner we have been enabled to surprise persons by exhibiting their portrait on the same plate with a stranger’s. Daguerreotypists must be cautious in practicing this, as it might not be agreeable to the parties whose likenesses are together, by the above process. It is impossible to produce an impression without a line being seen where the edge of the paper prevented the operation of the light.

I have recently seen a fine specimen produced by another plan, which far exceeds the above, there being no line, or any peculiarity denoting two exposures. The specimen referred to, was a gentleman represented on one plate by two full length portraits. This was produced by using a black velvet for the background. The plate was exposed sufficient time to produce one impression, and then the gentleman assumed another position, and is repeated as looking at himself. From the fact that the time required to develop black velvet being so much longer than that for producing a portrait, we are enabled to produce the above interesting results.

DEPOSIT IN GILDING.

Regarding specks from bad water, I would remark that gilding should be made only with distilled water. Thus made, it produces very little deposit, even by long keeping. It therefore preserves its original strength, and works with great uniformity.

Every grain of deposit contains at least 7-10 its weight of gold, easily discoverable by the blowpipe. Such gilding is continually deteriorating, which with good chloride and distilled water may be prevented. Distilled water should also be used for the hyposulphite. and for cleaning plates. Any good, clear water may be afterwards used for washing off, with equally good results. I am very rarely troubled with specs, and deem this as the main reason.

With a portable still attached to a cooking stove, I obtain half a gallon of water per hour, and with very little trouble. A small tin retort or still connected with a Leibig's condenser, would not add much to the "traps" of the travelling operator, and save him many a disreputable specimen.—T. J. BAILEY.—Humphrey's Journal.

PRACTICAL HINTS ON THE DAGUERREOTYPE.

The following is from Humphrey's Journal, vol. 5, and from the pen of Dr. WM. HARRINGTON, one of the most able writers upon the subject of the Daguerreotype in this country:

THE CAUSE OF THE DIFFICULTY THAT SOMETIMES OCCURS TO PREVENT THE

PRODUCTION OF A CLEAR IMPRESSION UPON A DAGUERREOTYPE PLATE.

Beyond all doubt this is traceable to dampness. Truly this is not a new thought; but where does this dampness come from? How does it originate, and where is it located? Generally it has been referred to a point entirely remote from its real location.

This dampness exists particularly upon the surface of the plate; is obviously derived immediately from the atmosphere; and is owing to a certain relative temperature of the plate with the hygrometric condition of the atmosphere.

Whenever this relation exists between the plate and atmosphere, a precipitation of moisture takes place upon the surface of the plate, which render all efforts at polishing impracticable. This interference is not confined to the buffing operation alone, but sometimes is discoverable even in the ordinary process of scouring. Every one at all experienced in this art will remember that it is not always an easy matter for him, by scouring, to bring his plate to the desired lustre. All his efforts become unavailing; the more he rubs, the duller the surface of his plate appears; and although he renews his cotton repeatedly, still he is obliged to content himself with an unsatisfactory finish.

This relative condition is not confined to any particular season of the year, nor to any certain thermometric temperature; but may occur in summer as well as in winter; the weather being warm or cold, wet or dry, clear or cloudy, raining or shining. Under any of these circumstances, if the relation of the plate and atmosphere be such as to invite upon the plate a precipitation of humidity from the atmosphere, the prospect of producing a clear impression is quite problematical.

It is reasonable to expect this occurrence from the fact that metal is a good radiator, and radiation reduces the temperature of a metallic body below that of the atmosphere. Consequently, if this relative condition happens, the result will be as I have stated.

Bodies may be colder than the atmosphere and yet derive no moisture from it; while at the same time the driest atmosphere is not devoid of moisture, but will part with it under certain conditions.

Assuming for granted that this relative condition between the plate and atmosphere, disposing the former to receive the humidity of the latter, constitutes the great obstacle the operator has to contend with in producing, a clear proof upon the plate, the remedy naturally suggests itself, and is very simple. It consists in merely heating the plate above the temperature of the atmosphere, previous to polishing, and retaining that temperature during the operation. Various measures might be devised to effect the desired object; one of which consists of a sheet-iron box, heated from the inside by a spirit-lamp, upon the top of which are to be kept the plates ready to undergo the process of being polished; the blocks of the swing or any other vice; or the iron bed belonging to Lewis's vice.

In cold weather, when it is necessary to keep a fire in the preparation room, all of the above may be so arranged in the vicinity of the fire as to receive the requisite degree of heat for the purpose specified.

This part of the subject, however, is left entirely for the ingenuity of the operator. No matter by hat means he accomplishes the object; all that is required is to heat the plate above the temperature of the atmosphere and retain that heat during the process of polishing.

Since the adoption of this method, in connection with my partner, T. J. Dobyns, even in this humid climate of ours, when everything in the room is dripping with moisture, it has been attended with invariable success.

CHOICE OF PLATES, ETC.

In the great catalogue of complaints made by operators, none is more common than that alleged against the quality of plates in general use. Although the greatest diversity of opinion exists upon this subject, nevertheless the plates of every manufactory share in this universal condemnation.

To be sure it cannot be denied but that this necessary article of utility in the photographic art has undergone a sad deterioration in quality owing to the increasing demand and great reduction in price—the plates of the present day being by no means so heavily coated with silver as formerly—but the complaint alluded to is not predicated so much upon the thinness of

silver as upon a mysterious something which has conferred upon the plates the epithet of not good.

That this complaint is in a great measure groundless appears evident from the fact that while, with the same brand of plates one operator can work successfully, another encounters the greatest difficulty; while one is able to produce beautifully clear and altogether satisfactory results, the other labors under the troublesome annoyance of innumerable specks, large dark insensitive patches and brown map-like portions, together with divers other blemishes, sufficient to prevent him from obtaining anything like a tolerable impression.

From this wide difference in the results of the two operators using identically the same article, it is but reasonable to conclude that the complaint is founded in error; while the inference is no more than just, that the fault may be traced to a want of practical skill on the part of the complaining operator himself; rather than to the inferior quality of the plates.

The question, then, whether the plates are unfit for use, or whether those who pronounce them so understand how to use them, appears to be satisfactorily answered. It therefore becomes a matter worthy of investigation, to ascertain what superior judgment and skill one operator possesses over another which enable him to work successfully a quality of plate, pronounced by the other entirely useless.

Suppose we make a critical examination of one of the repudiated plates. From its external appearance we have little hesitation in pronouncing it to be French; indeed, this presumption is strongly corroborated by the fact that it is ornamented upon one of its corners with a brand to designate the manufactory from which it emanated.

Upon close inspection we cannot fail to notice a striking peculiarity upon the surface; the roughness is very remarkable; the planishing hammer has left amazingly visible indications of its busy work. One would suppose the manufacturer intended the surface of the plate to represent the undulations of the sea, instead of that smooth and level character so strongly recommended by M. Daguerre.

Such a plate necessarily requires at the hand of the operator considerable labor before the surface is in a proper condition to receive a suitable polish from the buffer. The least reflection in the world should teach any one that

so long as the undulatory character continues upon the surface of the plate, it is in a very imperfect condition for buffing, because the buffer cannot touch every point equally; the elevated portions alone receiving a high degree of polish while the depressed portion, from their roughness acting as nuclei, gather dust, rouge, and other foreign bodies, so detrimental to sensitiveness. The secret of the superior judgment and skill of one operator over another, is intimately connected with this point: his success depends very much upon the first process of cleaning the plate.

Let us examine the manipulation of the complaining operator. He takes one of these plates and gives it a careful scouring with rotten-stone and alcohol or any other liquid preferred for this part of the operation—that is, he gives it what he terms a careful scouring—very gently indeed because, from the frequent trials he is in the habit of making in the camera, he fears he will rub the silver entirely away before he succeeds in obtaining a good impression. The dark patches, specks, and granular appearance resulting entirely from the unevenness of the surface of the plate, look like copper to him, and he is surprised that he should have rubbed away the silver so soon, particularly by such delicate handling.

The judgment and experience of the successful operator, however, teach him that scouring injures a plate less than buffing. He knows that unless the hammer marks be obliterated, he cannot by the buffer produce a surface of uniform polish and sensitiveness, without which a fair proof is extremely doubtful; he knows that the time employed in the preliminary operation of cleaning the plate properly is economy.

There is a style of French plates in the market, denominated heavy, which are truly excellent, if properly managed. Much patience, however, is required to remove the marks of the hammer; but with tripoli and alcohol the surface is readily cut down, and the plate is then susceptible of a beautiful black lustre by polishing with the buffer. The complaining operator could not succeed by his own method with one of the plates; he would encounter all manner of clouds and other unaccountable phenomena; he would imagine this plate entirely worn out before it was half cleaned, and soon fix in his own estimation the reputation of the heavy plate.

In making a choice of plates, therefore, it would appear to be a matter of perfect indifference with an experienced operator what kind he would use,

except so far only as the labor required in cleaning them was to be taken into consideration.

The distinction between a scale plate, a Scovill No. 1, S. F., heavy A, star, crescent, eagle, or any other brand, consists in the superior finish of some, and the thinness of the silver in the cheaper qualities.

Consequently, let the complaining operator but employ the diligence inculcated in this article, to clean his plate thoroughly, so as to bring it to a perfectly even and level surface, and he will seldom be troubled with specks, clouds, dark patches, and the host of other obstacles which heretofore have tormented him.

CHAPTER VI.

AN ACCOUNT OF WOLCOTT AND JOHNSON'S EARLY EXPERIMENTS, IN THE DAGUERREOTYPE. BY JOHN JOHNSON.

[From Humphrey's Journal, vol. ii 1851]

As a general thing, however perfect any invention may be deemed by the inventor or discoverer, it falls to the lot of most, to be the subject of improvement and advancement, and especially is this the case with those new projects in science which open an untrodden field to the view of the artisan. Such has been, in an eminent degree, the case with the discovery first announced to the world by Mons. Jean Jaques Claude Daguerre, of Paris, in the year 1839, and which excited unbounded astonishment, curiosity and surprise. It may be questioned had any other than Daguerre himself discovered a like beautiful combination, whether the world would have been favored with details exhibiting so much care, patience and perseverance as the Daguerreotype on its introduction. Shortly after, these details reached the United States, by Professor S. F. B. Morse, of New York, who was, at the time of the discovery, residing in Paris. By this announcement, the whole scientific corps was set in operation, many repeating the experiments, following carefully the directions pointed out by Daguerre, as being necessary to success. Among the number in the United States, was Alexander S. Wolcott (since deceased) and myself; both of this city. On the morning of the 6th day of October, 1839, I took to A. Wolcott's residence, a full description of Daguerre's discovery, he being at the time engaged in the department of Mechanical Dentistry, on some work requiring his immediate attention, the work being promised at 2 P.M. that day; having, therefore, no opportunity to read the description for himself (a thing he was accustomed to do at all times, when investigating any subject). I read to him the paper, and proposed to him that if he would plan a camera (a matter he was fully acquainted with, both theoretically and practically), I

would obtain the materials as specified by Daguerre. This being agreed to, I departed for the purpose, and on my return to his shop, he handed me the sketch of a camera box, without at all explaining in what manner the lens was to be mounted. This I also undertook to procure. After 2, P.M., he had more leisure, when he proceeded to complete the camera, introducing for that purpose a reflector in the back of the box, and also to affix a plate holder on the inside, with a slide to obtain the focus on the plate, prepared after the manner of Daguerre. While Mr. Wolcott was engaged with the camera, I busied myself in polishing the silver plate, or rather silver plated copper; but ere reaching the end preparatory to iodizing, I found I had nearly or quite removed the silver surface from off the plate, and that being the best piece of sliver-plated copper to be found, the first remedy at hand that suggested itself, was a burnisher, and a few strips were quickly burnished and polished. Meantime, the camera being finished, Mr. Wolcott, after reading for himself Daguerre's method of iodizing, prepared two plates, and placing them in the camera, guessed at the required time they should remain exposed to the action of the light; after mercurializing each in turn, and removing the iodized surface with a solution of common salt two successful impressions were obtained, each unlike the other! Considerable surprise was excited by this result, for each plate was managed precisely like the other. On referring to Daguerre, no explanation was found for this strange result; time, however, revealed to us that one picture was positive, and the other negative. On this subject I shall have much to say during the progress of the work. Investigating, the cause of this difference occupied the remainder of that day. However, another attempt was agreed upon, and the instruments, plates, etc., prepared and taken up into an attic room, in a position most favorable for light. Having duly arranged the camera, I sat for five minutes, and the result was a profile miniature (a miniature in reality,) or a plate not quite three-eighths of an inch square. Thus, with much deliberation and study, passed the first day in Daguerreotype—little dreaming or knowing into what a labyrinth such a beginning was hastening us.

[Description of apparatus represented on pages 192 and 199:]

A.—The Box—about 4 inches long by about 2 outside diameter.
B.—The Reflector soldered to a brass screw, and mounted in the rear of the box.

c.—The slide to regulate the focus to the plate holder.
d.—The standard to the plate holder screwed to the slide.
f.—The plate-holder frame having two small ledges, * *, for the plate to rest upon.

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g.—The plate resting upon the ledge., * *, and kept against the frame by the spring
h. The plates used were about 3/8 of an inch square.
A.—The window with the sashes removed.

B and C (p. 199) are large looking-glasses mounted as plain reflectors, the lower one C having rotary motion upon the saddle, resting upon the sill of the window in order to direct the rays of the sun upon the reflector B, at any hour of the day—the vertical motion of the reflector C being necessary, the sun varying in altitude so much during the hours most favorable to the production of portraits. The reflector C was {193} kept up to the required position by the handle lever, upright post and bolts. Reflector B was hinged at its upper end at the top of the window frame, the only motion being necessary was that which would reflect upon the sitter the incident rays from reflector C—the reflector B being kept at the required angle by the connecting lever m, etc. Suitable back-grounds were placed behind the sitter.

[Illustration: Fig. 12]

The reflector B and C, had frequently to be renewed, the heat of the sun soon destroying their brilliance or power of reflecting, light, before renewing them, however, we resorted to the springing of them, by which means their power was increased for a period.

The camera or reflecting apparatus, invented by Mr. Wolcott, was, from the nature of the case, better adapted at that day to the taking of portraits from life, than any other instruments. After carefully examining the camera described by Daguerre, and the time stated as necessary to produce action for an image, it became evident to the mind of Mr. Wolcott at once, that more light could be obtained (as the field of view required was not large) by employing a reflector of short focus and wide aperture, than from a lens arrangement, owing to spherical aberration and other causes. Many

experiments having been tried with the small instrument figured (p. 199), a reflector for taking portraits from life was determined on, having eight inches diameter, with twelve inches focal distance for parallel rays; this was to admit plates of two inches wide by two and a half long Mr. Wolcott having on hand reflectors of the right diameter, for Newtonian telescopes, of eight feet focal distance, resolved (as it was a matter of experiment) to grind down or increase the curve for the focal distance before named—this required time. In the mean time, many plans were pursued for making good plates, and the means of finishing, them. As the completion of the large reflector drew to a close, our mutual friend, Henry Fitz, Jr., returned from England, whither he had been on a visit, and when he heard what we were about, kindly offered his assistance; he being well versed in optics, and having been before engaged with Mr. Wolcott, in that and other business is offer was gladly accepted—Mr. Wolcott himself having frequent engagement; to fill as operator in the details of mechanical dentistry. Thus, by the aid of Mr. Fitz, the reflector was polished, and experiments soon after tried on plates of two by tow and a half inches, with tolerable success. Illness on my part quite suspended further trial for nearly four weeks.

On my recovery, early in January, 1840, our experiments were again resumed with improved results, so much so as to induce Mr. Wolcott and myself to entertain serious thoughts of making a business of the taking of likenesses from life, intending to use the reflecting apparatus invented by Mr. Wolcott, and for which he obtained Letters Patent, on the 8th day of May, 1840. Up to January 1st, 1840, all experiments had been tried on an economical scale, and the apparatus then made, was unfit for public exhibition; we resolved to make the instruments as perfect as possible while they were in progress of manufacture. Experiments were made upon mediums for protecting the eyes from the direct light of the sun, and also upon the best form and material for a back-ground to the likenesses. The length of time required for a “sitting,” even with the reflecting apparatus, was such as to render the operation anything but pleasant. Expedients were ever ready in the hands of Wolcott: blue glass was tried and abandoned in consequence of being, at that time, unable to procure a piece of uniform density and surface: afterwards a series of thin muslin screens secured to wire frames were prepared as a substitute for blue glass. The objections to these screens, however, were serious, inasmuch as a multiplication of them became necessary to lessen the intensity of the light sufficiently for due

protection to the eyes, without which, the likenesses, other than profiles, were very unpleasant to look upon. Most of the portraits, then of necessity were profiles formed upon back-grounds, the lighter parts relieved upon black, and the darker parts upon light ground; the back-ground proper being of light colored material with black velvet so disposed upon the light ground, this being placed sufficiently far from the sitter, to produce harmony of effect when viewed in the field of the camera. Other difficulties presented themselves seriously to the working of the discovery of Daguerre, to portrait taking—one of which was the necessity for a constant and nearly horizontal light, that the shaded portions of the portrait should not be too hard, and yet, at the same time, be sufficiently well developed without the "high light" of the picture becoming overdone, solarized or destroyed. In almost all the early specimens of the Daguerreotype, extremes of light and shade presented themselves, much to the annoyance of the early operators, and seriously objectionable were such portraits. To overcome this difficulty, Mr. Wolcott mounted, with suitable joints, upon the top of his camera, a large looking-glass or plane reflector, in such a manner that the light of the sun (as a strong light was absolutely necessary), when falling upon the glass could be directed upon the person in an almost horizontal direction.

Early in February, 1840, Mr. Johnson, Sen., (since deceased) sailed for Europe with a few specimen likenesses taken with the instruments completed as above, with the intention of patenting the invention. On his arrival a joint arrangement was effected with Mr. Richard Beard, of London, in patenting and working the invention in England. Up to February, 1840, but few friends had been made acquainted with the progress of the art in the hands of Mr. Wolcott and myself. From time to time reports reached us from various sources of the success of others, and specimens of landscapes, etc., were exhibited at Dr. James R. Chilton's laboratory, in Broadway, much to the gratification of the numerous visitors and anxious expectants for this most wonderful discovery. Dr. Chilton, Professor J. J. Mapes, Professor J. W. Draper. Professor S. F. B. Morse, all of this city; Mr. Cornelius, Dr. Goddard and others of Philadelphia; Mr. Southworth, Professor Plumbe, and numerous others were early in the field; all, however, using the same description of camera as that of Daguerre, with modification for light, either by enlargement by lens and aperture for light, or by shortening the focal distance.

At a conversational meeting of the Mechanics' Institute, Professor J. J. Mapes being present, a question was asked if any one present could give information relative to portraiture from life by the Daguerreotype. Mr. Kells, a friend of Mr. Wolcott and a scientific and practical man (since deceased), at once marked out upon the black-board, the whole as contrived by Mr. Wolcott. This gave publicity to the invention of Mr. Wolcott. Shortly after, Professor Mapes, Dr. Chilton, and many others, sat for their portraits, and were highly gratified. Professor Morse also came and proposed to Mr. Wolcott to join him in the working of the invention, etc.

From this time much interest was manifested by our friends in our progress. Rooms were obtained in the Granite Buildings, corner of Broadway and Chambers street, and fitted for business. The rooms being small, it was soon found impracticable to use the arrangement of looking-glass, as previously spoken of; a new plan became necessary, to introduce which, the sashes were removed, {199} and two large looking-glasses were mounted in proper frames, thus:—

[Illustration: Fig. 13]

Just in front, and between the sitter and {200} the reflector, upon a proper stand, were used those paper muslin screen before described; also screens of tissue paper. These screens, however, when they were used, required so much time for a sitting, that some other medium, as a protection to the eyes, became absolutely necessary. The most plausible thing that suggested itself was blue glass; but, as this could not be found, numerous were the expedients proposed by the friends of the art, who from time to time visited our rooms. At the suggestion of Professor Mapes (who is ever ready to assist those in perplexity), a trough of plate glass s, about twenty-eight inches square in the clear, and from three to four inches thick, was filled with a solution of ammonia sulphate of copper, and mounted on the frame as in the sketch, which, for a time, answered extremely well; soon, however, decomposition of this solution became apparent from the increased length of time required for a sitting, although to the eye of an observer, no visible cause for such long sittings could be pointed out. Professor Mapes being appealed to, suggested that to the above solution a little acid be added which acted like a charm—shortening the time for a sitting from six, eight, or ten minutes to that of about one. Decomposition,

however, would go on by the action of light and heat through the solution. New solutions were tried, when the whole were finally abandoned as being, too uncertain and troublesome. (The reflecting apparatus R, was placed upon the stand as in the sketch, with a wedge for elevating the camera, between it and the table, to obtain the image properly upon the plate.) A quantity of blue window glass was next obtained, and holes drilled through the corners of it, and several sheets were wired together to increase the size, and, when complete, was suspended from the ceiling in its proper place, and so arranged that when a person was sitting, this sheet of glass could be moved to and from, the object of which was to prevent shadows on the face of the sitter produced from the uneven surface of the glass. This latter contrivance was used until a perfect plate of glass was procured.

The number of persons desirous of obtaining, their miniatures, induced many to entertain the idea of establishing themselves in the Art as a profession, and numerous were the applications for information; many persons paying for their portraits solely with the view of seeing the manner of our manipulations, in order that they might obtain information to carry on likeness-taking as a business.

The reflecting camera being a very troublesome instrument to make, and difficulties besetting us from every source, but little attention could be given to teaching others; and, indeed, as the facts seemed to be at this time, we knew but little of the necessary manipulations ourselves. In course of time, several established themselves. The first one, after ourselves, who worked the discovery of Daguerre for portrait taking in this city, was a Mr. Prosch; followed soon after by many others, in almost all cases copying the reflecting arrangement for light, as figured above, many using it even after we had long abandoned that arrangement for a better one.

Innumerable obstacles to the rapid advance of the daguerreotype, presented themselves almost hourly, much to the annoyance of ourselves, and those dependent upon our movements for their advancement. Among the most difficult problems of the day, was the procuring of good plates. Messrs. Corduran & Co. were among the first to supply the trade; at that early day, however, it was a very rare thing, to be able to procure an even perfect surface, from the fact that a pure surface of silver could scarcely be obtained, the manufacturers deeming it too much trouble to prepare silver plated copper with pure silver—the result was, that in attempting to polish

perfectly such plated metal as could be procured, the plates would become cloudy, or colored in spots, from the fact of having more or less alloy, according as more or less of the silver surface was removed in polishing the plate fit for an impression. To explain more clearly, it was the practice of most silver platers to use an alloy for silver-plating. In the reduction of the ingot to sheet metal, annealing has to be resorted to, and acid pickles to remove oxides, etc. The number of times the plated metal is exposed to heat and acid in its reduction to the required thickness, produces a surface of pure silver. The most of this surface is, however, so rough as to be with difficulty polished, without in places removing entirely this pellicle of pure metal, and exposing a polished surface of the alloy used in plating. Whenever such metal was used, very unsightly stains or spots frequently disfigured the portraits. The portrait, or portion of it, developed upon the pure silver, being much lighter or whiter than that developed upon the alloy; it therefore appeared that the purer the silver, the more sensitive the plate became. Accordingly, we directed Messrs. Scovills, of Connecticut, to prepare a roll of silver-plated metal, with pure silver; it fortunately proved to be a good article, but, unfortunately, a pound of this metal (early in 1840) cost the round sum of $9. Like descriptions of metal, the same gentlemen would be glad to furnish, at this time, for $4. Soon after this, some samples of English plated metal, of a very superior quality, came to our possession, and relieved us from the toil of making and plating one plate at a time, an expedient we were compelled to resort to, to command material to meet the pressing demands for portraits.

Having it now in our power to obtain good plated metal, a more rapid mode of polishing than that recommended by Daguerre was attempted as follows:

This metal was cut to the desired size, and having a pair of “hand rolls” at hand, each plate, with its silvered side placed next to the highly polished surface of a steel die, was passed and repassed through the rolls many times, by which process a very smooth, perfect surface was obtained. The plates were then annealed, and a number of plates thus prepared were fastened to the bottom of a box a few inches deep a foot wide, and eighteen inches long; this box was placed upon a table and attached to a rod connected to the face plate of a lathe, a few inches from its centre, so as to give the box a reciprocating motion. A quantity of emery was now strewn

over the plates, and the lathe set in motion. The action produced wag a friction or rubbing of the emery over the surface of the plates.

When continued for some time, a greyish polish was the result. Linseed, when used in the same manner, gave us better hope of success, and the next step resorted to was to build a wheel and suspend it after the manner of a grindstone. The plates being secured to the inner side of the wheel or case, and as this case revolved, the seeds would constantly keep to the lower level, and their sliding over the surface of the plates would polish or burnish their surfaces. This, with the former, was soon abandoned; rounded shots of silver placed in the same wheel were found not to perform the polishing so well as linseed. Buff-wheels of leather with rotten-stone and oil, proved to be far superior to all other contrivances; and, subsequently, at the suggestion of Professor Draper, velvet was used in lieu of buff leather, and soon superseded all other substances, both for lathe and hand-buffs, and I would add, for the benefit of new beginners that those who are familiar with its use, prefer cotton velvet. The only requisite necessary is, that the buffs made of cotton velvet should be kept dry and warm.

The greater number of operators, with whose practice I am familiar, use, for polishing plates, prepared tripoli, imported from France, or Browne's rotten-stone. The former of these articles is very objectionable, inasmuch as there is no positive certainty of being enabled to procure or make the article of uniform grit—the nature of the substance rendering, it impossible to reduce it to varying degrees of evenness, by the well known process of washing, for that purpose, and the burning of rotten-stone changes its chemical nature somewhat, at the same time rendering, this invaluable article harsh and gritty. And especially, no reliance can be placed upon burned rotten stone if purchased from those who do not give very great attention and care to its preparation; and the same remarks apply to rouge.

The best article for polishing Daguerreotype plates is rotten-stone, such as can be procured in any town, prepared after the following manner: Procure, say half a dozen wide-mouthed bottles, of suitable dimensions, numbering each from one to six. Put into No. 1 about half a pound of rotten-stone, and nearly fill the bottle with water. Then, with a proper stick or spatule, mix well the rotten-stone and water; after which, let No. 1 rest for, say one minute, then carefully pour off into bottle No. 2 (or, what would be better, draw off by a syphon) as much of the floating particles of

rotten-stone as is suspended in the water. Again fill bottle No. 1 with water, agitate it as before, and decant it to bottle No. 2, care being taken to draw off only the suspended particles of rotten-stone.

When a sufficient quantity of washings from bottle No. 1 is collected into bottle No. 2, a similar process must be gone through, as above stated, for No. 1; the difference being in the care required, and in the time allowed between the stirring or mixing the rotten-stone and water. The floating particles of rotten-stone, after four minutes' subsiding, will be found fine enough for the finest Daguerreotype polishing required.

A quantity of such washings may be collected in a large bottle, and allowed to stand a few hours, when all the rotten-stone will have settled. The water may be poured off and the rotten-stone put into an evaporating dish, and while being dried, must be constantly stirred to obtain an impalpable powder.

Further washings may in like manner be resorted to for finer qualities of rotten-stone. In my practice, I have used the articles at two and four minutes' settling, and occasionally have prepared it after standing for eight minutes. So fine a quality as this, however, is seldom required. In using, rotten-stone, I mix with it, for polishing, fine olive oil, until I obtain a thin paste—and the best of all methods for polishing (well planished) Daguerreotype plates, is one like that used for glass by lens polishers; that is, by using a disc or buff-wheel, and having, a suitable holder by which to secure the plate, and then by pressing the plate against the revolving buff, well saturated with the mixed oil and rotten-stone, a very good surface is obtained. A quantity of plates may be prepared in this way, and all the adhering oil, etc., may be removed by a clean hand, or lathe buff, after which each plate must be heated to the point necessary to burn off the remaining oil great care being required not to overheat the plate. A very slight excess of temperature will at once destroy all the polish previously obtained. The test for ascertaining the right temperature is at hand; the adhering oil will be driven from the plate in the form of smoke when the right temperature is reached. The moment the smoke ceases to rise from the plate, the heat must be removed, and the plate quickly cooled upon a piece of iron.

A quantity of plates thus prepared may be kept on hand for any required time, and the labor of one minute, with a lathe or hand-buff with dry

charcoal, or rather, prepared lampblack, will perfectly polish the surface ready for indexing, etc. This lampblack also requires some care in preparing. Take a small-size crucible, properly temper it by a slow fire, that it may not be cracked after which, fill it with common lampblack, cover it over with a piece of soap-stone, and again replace it in the fire. Build a good hard coal fire around it continue the heat for two or three hours, being careful not to raise the cover till the crucible be quite cold. Pulverize when using it. It is very desirable to keep this lampblack dry and warm. Some operators use much rouge I would recommend the above in preference; but those who feel that they cannot dispense with the use of rouge, had better try a large addition of prepared lampblack to a small one of rouge, as this latter article, unless great pains be taken in its preparation, will adhere and work itself into the body of the surface, so that it cannot be removed therefrom; and I have seen many specimens of Daguerreotype very much injured in effect from this rouge tint disseminated throughout their shaded features, at the same time that the whole general effect of such pictures is that of a want of life. It is true that with the use of rouge a very high degree of polish may be obtained, but probably not higher than can be produced with many other substances of a less objectionable nature.

From the announcement of the discovery by Daguerre to the beginning of the year 1840, I am not aware of any attempt to lessen the time for the action of an image, or an impression, other than that of the reflecting camera invented by Mr. Wolcott. Early, however, in 1840, Mr. Wolcott was desirous to be enabled to further shorten the time for a sitting, and having some knowledge of bromine and its action, by request, Dr. Chilton prepared a small quantity; but Mr. Wolcott did not succeed very well with it, he having invariably used too much in combination with iodine to produce that sensitive coating now well known to the profession. Professor Morse, of this city, Dr. Goddard, of Philadelphia, and others, in the years 1840 and 1841, were acquainted with the use of bromine. N. Griffing, of this city, or myself, used with tolerable success, iodine in large excess to nitric acid and water; and, subsequently, to nitro muriatic acid (which reacted and formed a peculiar chloride of iodine); this latter combination proved to be preferable to simple iodine, at the same time somewhat more sensitive, and was used by me in this city up to the time of my leaving for London (October 1, 1840). On arriving in London, I instituted a series of experiments in the various chemical combinations, solely with the view to be enabled to obtain

more speedily a portrait than it was practicable to do with any known chemicals at that date. The high latitude, and the winter season of the year rendering but a feeble light at best, the greater the necessity for a more sensitive chemical preparation to the shortening the time for a sitting. Near the beginning of the year 1841, I discovered and practically applied, chloride of iodine to great advantage, and, as far as memory serves me, I believe the first used in this country was some made and shipped, Messrs. Harnden & Co., from London, to Mr. Wolcott, in New York.

About the same time, Mr. John Goddard, of London (who was associated with myself), discovered a rather valuable combination of chemicals, consisting of a mixture of iodine, bromine, iodus, and iodic acid, and a proper combination of those bodies gave an action somewhat more sensitive than chloride of iodine—but the "high lights" of the portraits would become solarized or overdone, more frequently with this combination than with the chloride of iodine. Throughout the year 1841, I used, with great success, chloride of iodine, applied as one coating—occasionally in conjunction with Mr. Wolcott, attempting the use of iodine, bromine, and chlorine, and at times with more or less success. The difficulty of exactly combining, the three elements above mentioned, in order to produce a certainty of result with harmony of effect, was the work of many months, with great labor and study, the slightest modification requiring a long, series of practical experiments, a single change consuming, frequently, an entire day in instituting comparisons, etc., etc.

Early in the year, 1842, I discovered a combination of chemicals (now known in London as "Wolcott's Mixture," in hermetically sealed bulbs) of exceeding uniform character, very sensitive to the action of light, and specimens produced in 1842-3, with this combination, will bear comparison with the best specimens produced at this late date.

About the same time, I discovered that however much overdone a Daguerreotype might be, the means were at hand to save or redeem it. It has long, since been known to operators, that if a plate be exposed to light after being coated, unless it be again coated, a clear and distinct picture could not be obtained upon the same plate without first repolishing and recoating the same, care being taken that no light fall upon the prepared surface. To prevent solarization, coat a plate as usual, expose to the action of light any required time (according to circumstances), say from quarter to one half

more time than would be required in the ordinary method of procedure; observe, before putting the plate in the mercury box, place it over the vapor of iodine, bromine, or chlorine, etc. (carefully excluding the light), for a very brief period, great care being required to have the selected vapor very much diluted with air, in order to success. Many experiments will be required ere arriving at satisfactory results. Specimens now unknown to general operators, for harmony of effect, have been, and may again be produced by the method pointed out above. I have found the best general effect, and the most certain result to follow from the use of the vapor of chlorine—but this requires more than ordinary care. I would, therefore, recommend the use of iodine. Thus: to a few grains of iodine, add an ounce of warm water (which will become tinged with iodine); when cold, to half a pint of pure water in a new and clean coating box, put, of the above, fifty drops; stir and mix well this small quantity of iodine in with the water; in ten minutes this box will be ready for use. Great care and judgment will be required in the application of this vapor to the plate; if the plate remain over the vapor too long, the developed picture will have a faint and misty appearance; if not exposed long enough, the “high light” will be solarized. I have great hope of the ultimate use of this process, as it is the only means yet discovered to be enabled to secure specimens of extremes of light and shade, yet producing harmony of effect; and I would call the attention of the profession to the fact, that a plate may be exposed to the action of light for any length of time (a thousand times longer than required to act for the lesser quantity of mercury to deposit itself, or that amount necessary to form a perfect specimen), and be restored by the application of any of the vapors above mentioned, remarking that for extremes for solarization, denser vapors will be required. Much remains to be done with this discovery to the application of the Daguerreotype.

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