THE

CALOTYPE PROCESS.

A Handbook

TO

PHOTOGRAPHY ON PAPER.

BY

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CAIUS COLL. CAMBRIDGE.

SECOND EDITION.

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PREFACE TO FIRST EDITION.

THE following pages have been written under the strong conviction, that in the present state of photographic literature it is utterly useless to multiply works of this class, unless the author resolves, in the first place, to describe *his own particular process*, and that only; and, secondly, to deal with that so *faithfully* and *minutely*, as that he may be followed by his reader with nearly the same degree of certainty as though he had been seen at work at it himself. For the difference between success and failure seems now to consist in attention *to minutiæ* and to the *niceties of manipulation*, rather than in any *diversity of the materials* employed, or any *striking novelty* in the mode of using them.

I am at present but little known to the photographic world, but the name of my publisher, who has himself witnessed the process in all its stages, will, I trust, be a sufficient guarantee for the truth of the following assertions in its favour.

In the first place, I maintain, that if the manipulator will carefully attend to the directions here-

after given, he will find the process, if not *absolutely* unfailing, at all events *very nearly* a CERTAIN one. And this certainty arises from the fact, that the time of exposure in the camera is not in *this*, that critical feature of the operation that it is in the *collodion* and the *waxed-paper* processes; for here, provided the picture be but exposed *long enough* for the complete rendering of the work in the shadows, it may then be exposed to a *considerable extent beyond* this point, without necessarily reddening the blacks, or embrowning the whites; since the mode of development which follows can be adapted to the aspect of the picture when taken from the slide, and in this way, good blacks and clean whites may always be obtained.

Secondly, that it is a process peculiarly adapted to THE TOURIST, since it requires but little apparatus, and involves the least possible amount of disorder or untidiness at inns; for I assume the bed-room of a hotel or lodging-house to be the scene of the greater part of the processes, and I adapt my description of them to meet the inconveniences of this sort of manipulating-room.

And, finally, that by this process, and, as I think, BY THIS EXCLUSIVELY, an enlarged field of action becomes open to the successful amateur, in the ready means which it affords for the production of GRAND AND IMPOSING PICTURES, such as may repre-

sent faithfully, and artistically, the finest objects and scenery in the world, and of *such a size* and quality as may render them worthy to become fellow-occupants, on the walls of our rooms and galleries, with the best engravings and paintings. For the manipulation of these large works is exactly similar to that of the small ones, and involves no increased risk of failure whatever.

Such are the merits of this process. It is a dry one upon paper not previously waxed, and it resembles in all its main points the original "Calotype" process, modified by certain slight, and perhaps apparently trivial, differences of manipulation; but, as I have said before, it is *exactly through attention to these little matters* that success and certainty are to be obtained, and I therefore desire to lay great stress upon them.

I have throughout assumed no previous photographic knowledge whatever on the part of the reader, and when the *theory* of any operation under discussion can be satisfactorily made out, I have given it to the best of my ability.

Not to interrupt too frequently the thread of the description, I have adopted the plan of giving references to Notes at the end.

Should this process, as I have described it, appear to the reader, *at first sight*, to be somewhat tedious and difficult, I must beg of him to bear in

mind, that the attempt to convey an accurate idea, by *words*, of even the simplest manual operation, will be found by no means a brief or an easy one: what, then, is likely to be the case with such a subject as the present? I can assure him, honestly, that the process is, in fact, when once it shall have become familiar, *an exceedingly easy and simple one*.

In conclusion, I may add, that I have taken the *utmost pains* to avoid the omission of anything which might conduce, in other hands, to the enjoyment of the same certainty that, I am happy to say, I have of late experienced myself. In return, it will be but fair in others to withhold their condemnation till they have made an *honest* trial of the process, as it stands recorded here, in every particular.

THOMAS SUTTON.

St. Brelade's Bay, Jersey,
March 1855.

PREFACE TO SECOND EDITION.

This Second Edition of my Handbook to Photography on Paper will, I hope, prove to be an improvement on the first in many respects.

In the body of the work I have added several useful suggestions. I have entirely rewritten the section on Positive Printing, and have given a formula that is consistent with the present state of our knowledge. In the Notes I have described a new method of iodizing the paper, by which bromine may be introduced; also, some remarks on the best kinds of paper to employ, and the mode of taking duplicate views for the Stereoscope.

In some concluding observations I have endeavoured to draw a faithful comparison between the merits of the Calotype and the Waxed-paper processes.

I believe the Calotype process to be well worthy the attention of the photographic tourist. Prints from fine Calotype negatives are scarcely distinguishable from those from glass negatives, and the process offers immense advantages on the score of convenience and economy.

With a good quality of paper, the process is so certain that it may almost be called infallible; for the time of exposure is not a matter in which an error involves inevitable failure. Great latitude is allowable in this respect.

In offering this second edition of my Handbook to my brother photographers, I am not without hopes that it may continue in some measure to fill a gap which has been long felt in this department of photographic literature, viz. a work on the Calotype Process.

T. S.

Establishment for
Permanent Photographic Printing,
St. Brelade's Bay, Jersey,
March 1856.

INTRODUCTION.

THE finished photograph on paper, which is usually mounted on cardboard, and thus offered for inspection and criticism, is called, in common parlance amongst photographers, a "Positive print," or simply a "Print." It should represent objects faithfully, and without distortion, in the same manner as an engraving or a drawing,—that is to say, the lights and shadows should be true to nature, the objects in their proper place (and not reversed), and the conditions imposed by the laws of plane perspective rigorously fulfilled. The Positive.

Our aim, therefore, in all our operations, is to obtain finally this Positive photograph, or Print.

The Positive, however, is not in the paper process, obtained *at once* (as in the daguerreotype) from the objects as they stand, but through the medium

of another photograph of the same objects previously obtained, and called the "Negative;" and by a process termed "Printing," which may either be executed at home by the amateur himself, or in printing establishments devoted to that particular branch of the art.

Printing.

The Negative.

The negative, therefore, must *first* be taken, and that by means of apparatus conveyed to the spot. In it the lights and shadows are all *reversed*, — the sky and high *lights* of the objects being rendered by *blacks*, the deepest *shadows* by *lights*, and the intermediate shades by the corresponding intermediate gradations of tint. The position, also, of the objects, as regards right and left, is reversed; and to judge of the merits of a negative it becomes necessary to view it by transparency, and with its back to the eye.

viewed by transparency.

There are, therefore, in photography on paper, two distinct operations,—

1. The production of the *Negative*.
2. The printing of the *Positive*.

Both operations are equally important; for although with a feeble and imperfect negative it is impossible to produce a rich and good positive, yet even *with* a good negative it is perfectly possible to produce a very inferior and bad positive. Both must be equally well done to ensure the reward for which the photographer has to encounter no inconsiderable amount of trouble and difficulty.

An unlimited number of prints may be taken from one single negative, and in this power of reproducing positives *ad infinitum* a great advantage is gained over the daguerreotype process. Hence it becomes evident that no amount of pains or trouble should be spared in the production of a good negative, —a work not to be undertaken hastily, or carelessly, or by the dozen, but, on the contrary, one requiring considerable thought and study, as regards the artistic composition of the picture, the proper effect of light and shade, &c. &c. So that, to attempt to avoid any part of the necessary *mechanical* trouble, and thereby to introduce the risk of failure, or the certainty of some inferiority in the result, would be unworthy and puerile in the extreme. Under this conviction, and at the risk of being thought sometimes unnecessarily prolix, I shall not hesitate to describe *most minutely* all matters connected with this important part of the subject, which I consider to be worthy of attention as conducing to a satisfactory result, and this quite irrespective of any additional trouble in the manipulation.

No pains should be spared in the production of the negative.

To proceed, then, in the proper order of work, we commence with the Negative Process.

Grubb's Lenses. August 1858

Diameter	Field	Unmounted	Mounted	Rods
1 in	stereoscopic	1. 6. 0	1. 16. 0	
2	6 × 5	2. 5.	3. " "	4 "
3	10 × 8	3. 15. 0	5. " "	6. 10.
3 1/2	12 × 10	4. 10. 0	6. " "	8. "
4	15 × 12	6. 15. 0	8. 15. "	12. "

5.
6.
10.

THE NEGATIVE PROCESS.

Portrait Combinations

4 × 3	4. 10. 0
6 × 5	8. 8. 0
7 × 6	15. 0. 0
10 × 8	32. " "
12 × 10	40. " "

Petzel's Lens

Diam.	foc.	Field
2 15/16	18	13 × 10 1/2

£10

Ordered. 6. Great Portland St. London. W.

THE NEGATIVE PROCESS.

This process involves six distinct operations, viz.—

1. To *iodize* the paper.
2. To render it *sensitive* to light.
3. To *expose* it in the camera.
4. To *develope* the picture.
5. To *fix* the picture.
6. To *wax*, trim, &c., the finished picture.

The first of these processes may be done at home, and at leisure. The iodized papers may be preserved for several weeks, and a stock of them should always accompany the tourist. The second, third, fourth, and fifth processes are performed "*en route*;" and the sixth at home, at any convenient opportunity.

CHEMICALS.

The chemicals required in the negative process are the following:

Crystallized nitrate of silver.
Iodide of potassium.
Gallic acid.
Glacial acetic acid.
Hyposulphite of soda.
Distilled water.

These chemicals may be obtained of sufficient purity, from all respectable photographic chemists.

The first three should be kept in *wide*-mouthed stoppered bottles, the acetic acid in a *small*-mouthed stoppered bottle, the hyposulphite in a wide-mouthed bottle with a cork, or in a large earthen jar with a lid, and the distilled water in a half-gallon bottle with a glass stopper.

One ounce of nitrate of silver, one ounce of iodide of potassium, one ounce of acetic acid, half-an-ounce of gallic acid, and one pound of hyposulphite of soda will suffice for several experiments.

The chemicals should be kept in a dry and cool place.

APPARATUS, &c.

The apparatus, and other articles required in the negative process, are—

1.—To accompany the Tourist.

The lens (Note 1).
The camera (Note 2).
The stand (Note 3).
The focussing screen (Note 4).
The dark slide (Note 5).
A small spirit-level.
Two dark Macintosh cloths, of different sizes.
A box of scales and weights.
Glass developing-slab.
Deal board.
Portfolio, containing blotting-paper, &c. &c.
Two gutta-percha dishes, which nest together.
Magnifying glass (Note 19).
Wooden paper-clips (Note 11).
Glass tubes (Note 12).
Cotton wool, *chemically clean.*

All these articles, and certain chemicals besides, will be required "*en route.*" It may seem to be, at the first glance, a somewhat lengthy catalogue; but, in fact, they will all be found to pack together very easily, and to form by no means a cumbrous parcel.

2.—At Home.

Several dishes, made either of earthenware or gutta-percha, in which to wash iodized papers.

A zinc apparatus for waxing negatives.

An iodizing brush, of camel's hair, bound with silver wire.

A graduated bottle for double iodide.

A funnel and stand for the same.

A one-ounce glass measure

FIRST OPERATION.

To Iodize the Paper.

The whole of this process may be performed by daylight; and it consists in applying a coating of yellow iodide of silver to the paper.

The following is a preliminary sketch of it:—

Sketch of the iodizing process.

The yellow iodide of silver is a powder, insoluble in water, and in order to apply it to the paper, it is first dissolved in a strong solution of iodide of potassium, which forms a double salt; viz. the double iodide of silver and potassium, called for the sake of brevity, "double iodide." This solution is then applied in the usual way, either by brushing, or floatation upon a bath; and the paper hung up to dry. When dry, it is placed in water for some hours, and the iodide of potassium dissolved out, leaving the yellow iodide of silver upon the surface, and in the pores of the paper, which is then dried again, and preserved in a portfolio until required for use.

Such is a brief sketch of the iodizing process,

and the rationale of it. The mode of obtaining the "double iodide" is given at considerable length in Note 6; and I proceed now to describe more minutely the two different modes of applying it to the paper.

1.—By Floatation.

Floating a good plan for wholesale work.

This is an excellent plan when papers are to be iodized *for commerce*, and in large quantities; but it will be found a somewhat costly one for the amateur, since a considerable quantity of expensive material is required in the first instance to fill a bath of large size.

Proceed thus:

Size of sheets.

First, cut the requisite quantity of Paper (see Note 7) to the proper size of each sheet, and make a pencil-mark upon the *back* of each sheet at one extreme corner. The sheets should be half an inch larger every way than the glass of the dark slide.

The bath.

Place a shallow bath of plate-glass (Note 8) (*which should be set apart for this purpose exclusively*), upon a table, in a *perfectly horizontal* position between yourself and the window; and about breast-high, if possible; and having seen previously, that it is not only clean, but *dry* (for if at all *wet*, it would render the solution turbid), pour the filtered double

iodide into it, to a depth of about three-sixteenths of an inch, and clear the surface from all air-bubbles. Then float the face of the paper upon it in the following manner :—Fold back a quarter of an inch at the narrow end of the paper, in such a manner that it shall not be wetted by the solution, then take an end corner in each hand, and suspend the paper vertically, with its lower edge upon the fluid, at a distance of an inch or two from that end of the bath which is nearest to you. Then gradually depress it upon the fluid, pushing the edge first in contact along the surface, until it reaches the farther end of the bath; then allow the upper edge of the paper to drop gently on to the liquid.

To float the paper on the bath.

In performing this operation, *take great care that the back of the paper be not wetted;* also, that no dry spots occur, untouched by the solution.

Allow the papers to remain upon the bath for a minute, then drain them into it for an instant, and hang them up to dry, attaching a narrow strip of blotting-paper to the lower corner, to facilitate the draining of the superfluous fluid. They may be suspended, either by means of pins, or needles with sealing-wax heads, or better still, by wooden clips (Note 9). *When pins are used, it is absolutely necessary that the chemicals should not touch them,* as this would occasion a stain, which might extend for some distance down the paper. To guard against

Time on the bath.

To suspend them.

this danger, pass the pins through the *dry* band which was folded back. Small papers may be suspended by one corner, but large ones will require to be suspended by the whole of the dry band, with three or four pins or clips.

To remove the paper from the bath.

The neatest way of removing a paper from the bath is to raise one corner by means of a strip of glass held in the left hand, and to seize that corner by a clip held in the other. When three or four clips are necessary, proceed thus:—Attach them all at the proper points before removing the paper, and allow them to hang over the edge of the bath; then pass a rod of wood like a yard measure through all the loops, and raise the paper by it, holding it in the middle. In this way the assistance of a second person is unnecessary. The rod with the paper hanging from it may be supported upon two round hooks screwed into the under side of a bar of wood. It is obvious that for this manœuvre the loops and clips should be all of the same length.

Suspension of large papers by clips.

The bath must be replenished as occasion may require; and never allowed to get too low.

When dry, the papers will have a reddish tint. They may be put away in a portfolio, for a few days, until it is found convenient to wash them.

2.—By Brushing.

Brushing the best plan for amateurs.

This is the plan which I recommend to the amateur. It answers *perfectly well* when managed with a little dexterity, which is soon acquired by practice. The brush should be a large round one, of camel's hair, *bound with silver wire*, and set apart for this purpose exclusively.

The Brush.

To apply the solution with the brush.

Take a soft pine board, a little larger than the paper,—upon this lay a sheet of clean white blotting-paper, and upon that the sheet of negative paper to be iodized, face upwards, having previously made a pencil-mark upon *its back*, at one corner. Pin it to the board by the two upper corners. Then pour the double iodide into a clean and *dry* wine-glass, and let the brush be perfectly *dry* when first dipped in, or it will render the solution turbid. Hold the board in the left hand, between yourself and the light, and inclining it gently, apply the solution with a *full* brush, copiously and fearlessly,—first, longitudinally all over, and then traversely all over, *precisely in the same manner as if laying on a broad sky wash in water-colours, and always keeping a flowing edge.* Take care not to let the solution run beyond the edge of the paper, or touch the pins. This done, hang up to dry as before, either by pins or clips.

When papers are hung up to dry in this manner, it is found by experiment that about as much fluid runs off as that which remains in the paper. It is economical, therefore, to place a wine-glass under each paper to catch the drippings.

The iodizing being now effected either by floatation or brushing, and the papers being dry, the next operation will be

To Wash the Iodized Papers,

in order to remove THE WHOLE of the iodide of potassium, and to deposit the yellow iodide of silver upon, and in the pores of the paper. *And it is of the utmost importance that the* WHOLE *of this iodide of potassium should be removed.* It has merely served as *the vehicle* for the conveyance of the iodide of silver to the paper; and if allowed to remain, it would instantly decompose the sensitive solution to be afterwards applied, and would render that part of the paper insensible to light, leaving there a *white blotch,* which would be ruinous to the picture. The importance, therefore, of the *thorough washing,* which I am about to describe, cannot be too much insisted on; as, if imperfectly and carelessly done, success in the after stages of the work will be impossible.

The whole of the iodide of potassium must be removed by washing

The iodized papers, when of small size, may be washed in earthenware dishes, kept for this purpose, and never used for any other; or, when of large size, in dishes made of zinc, about two inches deep, and furnished with a removable *thin* gutta-percha lining. The sides of these dishes, of whatever material, should be upright (or very slightly inclined outwards), and should by no means have lips at the corners, which I think a mistake; as, on agitating the contents of the dish, the fluid is very likely to run over at one or all of these lips, unless excessive care be taken to prevent it. The dishes should be sufficiently large to allow the paper to be entirely and constantly submerged.

The dishes.

Dishes without lips are to be preferred.

Fill the dish completely with common water, and first, place the paper face downwards upon it. Let it remain a minute; then remove it, and place it face upwards. Now, with a long feather, or a large camel-hair brush, remove most carefully all air-bubbles from the face, and wet it in every part. Then turn it over, and do the same to the back, leaving it back upwards in the water. In a few minutes the back will be seen, in all probability, *covered with minute air-bubbles;* brush these off as before; and change the water in about half-an-hour, removing the air-bubbles a second time, if necessary, *as these would occasion small white spots in the negative.* Allow the paper to remain face down-

To wash the iodized papers.

Remove small air-bubbles.

Papers to remain in

water for several hours.

wards in the water for several hours; agitate it occasionally, and change the water for the last time just before taking the paper out. Dry it by suspension, as described before; and when dry, put it away carefully in a separate portfolio, which keep always in a dry place.

With respect to the time that the papers should remain in the water, that will depend on the temperature of the water, and the thickness of the paper employed. With the thin Hollingworth's paper that I have recommended, and the water at a temperature of 60°, three or four hours will be sufficient, if the water is changed three or four times; but with a thicker paper, and the same number of changes, double that time would be necessary. Under any circumstances the water should be changed and the papers agitated as often as may be convenient, for unless the whole of the iodide of potassium is removed, there is great liability to the occurrence of white spots and blotches in the negative. It is better to exceed than not to attain the necessary time of immersion; but we must take care, on the other hand, that we do not injure the fabric of the paper, and render it woolly, by an egregious over-soaking. The tint of the paper will be a tolerable guide in this matter.

Changes of colour.

The following are the changes of colour which

the paper undergoes. Before washing, it is of a *reddish* tint; on immersion, it speedily changes to a *blue* or *grey;* and, in the course of an hour or so, to a strong *yellow.* To this succeeds a *pale* yellow, which is its final colour: when the paper has once acquired this tint, it has been immersed long enough.

Only one paper in one dish.

The washing should not be attempted in very cold, frosty weather; *nor should more than one paper be placed in a dish at a time.* The number of papers which may be washed in one day, will therefore depend upon the number of dishes devoted to this purpose.

I have described in Note 13 two other modes of iodizing the paper. In one of these methods (which is entirely new) I have shown how a bromo-iodide of silver may be applied to the paper; and the introduction of the bromine offers some advantages.

Iodized papers will keep indefinitely.

As I have before remarked, the yellow iodized papers may be preserved for some weeks; and now assuming the first process, viz. that of iodizing, to have been thoroughly understood, and accomplished at home, and a good stock of papers to have been procured, I shall imagine the scene of operations transferred to the room of an inn or a house in the

neighbourhood of the views to be taken, and shall proceed to the second operation, viz. to render the iodized papers sensitive to light.

SECOND OPERATION.

To render the Iodized Paper sensitive to Light.

A yellow light necessary for sensitizing.

The process of iodizing has been performed in ordinary daylight, the iodized papers not being sensitive to light; but in the sensitizing of them, it is obvious that we must manipulate in a light which is *not* "actinic" (or, in other words, which is *not* capable of producing a chemical change on a sensitive surface). A *yellow* light has, happily for our present purpose, this advantage (otherwise the unfortunate photographer would be condemned to work in *total darkness*, guided only by the sense of touch); and we may, therefore, avail ourselves of the yellow light of a candle, or of daylight, admitted *in moderation*, through a double or triple thickness of yellow

calico, placed in the window. This being the case, *any* room may be quickly rendered available for photographic purposes.

Yellow calico screen to the window.

Sensitive papers generally retain their colour and good qualities for twenty-four hours, and sometimes even for several days. The sensitizing for the following day *may*, therefore, be effected over night, and by the light of a candle; but it is safer to defer it until the morning of the day on which the views are to be taken, as we are then *more certain of the weather;* and in this case, recourse must be had to the screen of yellow calico before the window.

Better to sensitize on the day of taking the view.

Choose, therefore, if possible, a room with only one window, facing the north. Pin before it a large dark macintosh cloth, in such a way as to leave about four square feet uncovered, and in front of the opening, pin a double or triple thickness of yellow calico. Drawing-pins, with flat brass heads, are better for this purpose than common pins, as they are much stronger, and may be carried in a flat piece of cork.

To darken the room.

Drawing-pins.

The dark cloth should be composed of two layers of stuff, with india-rubber cement between them; and it will also be found useful for other purposes described hereafter.

The dark cloth.

Should the window be *small*, the yellow calico will suffice without the cloth.

The room being now darkened, the door should be secured against any sudden intrusion, and the sensitizing of the paper proceeded with.

The chemicals required "en route."

All the chemicals which I have detailed as necessary to the negative process must accompany the tourist, with the exception of the iodide of potassium. In addition to these, there should be a one-ounce stoppered bottle in a wooden case, containing a solution called "aceto-nitrate of silver;" a pint stoppered bottle, containing "a saturated solution of gallic acid in distilled water;" and a bottle of strong solution of gum arabic, with a small brush to apply it with.

To make Aceto-Nitrate of Silver.

Aceto-nitrate of silver

First scratch two marks upon the bottle which is to contain it; one at the level of six-and-a-half drams of fluid, the other at the level of one ounce. Fill the bottle *accurately* to the lower mark with distilled water, and add 50 grains of nitrate of silver; when dissolved, add glacial acetic acid until the mixture rises to the level of the upper mark; then shake well together. This solution is called aceto-nitrate of silver; it should be kept in darkness.

should be kept in the dark.

The above proportions are applicable to the

average strength of acetic acid, and to average circumstances of weather, &c. &c. But they must be varied to correspond with the variable strength of the acid and the temperature. Less acid should be used in the winter, and more in the summer.

To make a Saturated Solution of Gallic Acid.

To one pint (or twenty ounces) of distilled water add one quarter of an ounce of gallic acid. Let the bottle, containing this solution, stand for half an hour in a jug of hot water, and shake it frequently; nearly the whole of the acid will then be dissolved. *On the following day* filter it through a funnel, in the neck of which a tuft of cotton wool is inserted, and it is ready for use. In the course of some few days the solution will become discoloured; in this state it is better not to employ it, as it would certainly communicate a brown tinge to the paper, which is objectionable, although not absolutely fatal to the picture. A smaller quantity of gallic acid may be mixed, if preferred.

Use a jug of hot water.

Should it ever be necessary to employ the gallic acid immediately after mixing, the solution should be used cold, and double or treble the quantity should be employed.

A saturated solution of gallic acid contains about four grains of the acid to one ounce of water.

The Sensitive Solution.

Into a *scrupulously clean* wine-glass (Note 12), previously rinsed with distilled water, put

Gallo-nitrate of silver.

1 ounce	.	Distilled water
20 drops	.	Aceto-nitrate of silver
20 drops	.	Saturated solution of gallic acid.

This is the *sensitive solution;* it is called *weak* "gallo-nitrate of silver." (Note 11.)

To count the drops.

In order to count the drops easily, and at the same time to filter them, make two little paper funnels (one for each solution) with pieces of thin white blotting paper, two inches square, and pour half a thimble-full of the solution to be measured into each.

Gallo-nitrate very unstable.

The gallo-nitrate is an exceedingly *unstable* compound, and very ready to decompose and turn brown. It must, therefore, be *used promptly*, and the surplus immediately thrown away. It should also never be exposed to a ray of white light; *and the glass which has once contained it should not be employed again for the same purpose, until it has undergone the thorough washing described in* Note 12.

Glass should be well washed.

To Apply the Sensitive Solution.

Place a sheet of clean white blotting-paper upon a deal board, and upon this the iodized paper face upwards. Pin down the two upper corners, and apply the solution VERY COPIOUSLY with a Buckle's brush (Note 10), first longitudinally, and then transversely, precisely in the manner described for the double iodide. Then raise the paper dexterously by one corner, and holding it over a basin, allow the superfluous liquid to run off;—this done, replace it on the board, and blot off the remaining moisture from the surface with two or three sheets of *clean* blotting-paper; not rubbing too hard, but passing the hand *rapidly* and *gently* over the surface, as long as any wet or shining patches appear.

See page 15.

Blot off the surface moisture.

The next operation is to place the paper in the dark slide. The double slide described in Note 5 is commonly employed, and two papers are placed in this, *back to back*, with a piece of blotting-paper, or cardboard, or black velvet, between them. But I do not approve of this plan. Its only recommendation is its convenience. Those who do not like trouble may employ it, and occasionally obtain a first-rate result; but that I believe to be a happy accident. Those who agree with me that one choice negative is worth a score of faulty ones, will do well to adopt the following method; and attach their

paper to *the front* of a glass instead of placing it *behind* one.

This is a very simple matter; it only occupies a minute or two, and may be thus performed:—

To attach the sensitive paper to the glass.

Lay the sensitive paper *face downwards* on a piece of clean blotting-paper. Wipe the removable glass of the slide, and place it symmetrically on the paper; which being half an inch larger every way than the glass, there will be a margin all round which may be turned up, and then with a little very strong gum arabic attached to the edge and *back* of the glass. This done, place the paper carefully in the slide, with its face next to the front shutter. Shut it up securely, and let it lie in a *horizontal* position, *face upwards*, until it is ready to be packed and conveyed to its destination.

Advantages of this plan.

The paper will dry in a few minutes, and then lie as flat as the glass itself; and when exposed in the camera, nothing will intervene between it and the lens, either to disturb the focus, or absorb the light: but I have discussed the advantages of this method so fully in Note 7, that it is unnecessary to recapitulate them here.

I am aware that this method has its drawbacks; but I can assure the novice in photography, that he will sooner or later, if he persevere in the art,

become convinced of the fact, that no *trouble* is to be spared which will conduce to the perfection of the result. The fame of our first photographers depends not on the *number*, but on the *quality* of their negatives. With them, if it is worth while to take a negative *at all*, it is worth while to do it well.

All is now ready for the third operation.

THIRD OPERATION.

The Exposure in the Camera.

The point of view having been selected (if possible, on some previous day), *and the proper hour for taking the picture ascertained*, the following articles must be conveyed to the spot:—

The folding portion of the camera.
The front of the camera.
The ground-glass screen.
The dark slides.
The lens.
The tripod stand.

Mode of packing the apparatus.

The first three may form one parcel; they should be wrapped up (the glass screen between the other two) in the *large* macintosh cloth, and secured by leather straps with buckles.

The dark slides should form another parcel; and should be wrapped up in the *small* macintosh cloth, and secured by straps with buckles.

The lens should be carried in a leather case.

The stand should form another independent article.

Careful selection of the point of view.

On arriving at the intended locality, do not unadvisedly adopt the first spot that offers itself, but carefully reconnoitre the whole vicinity, and choose that point of view which seems to give the most artistic picture. It is obvious that, in some cases, a single yard to the right or left may make or mar the whole work. I invariably adopt the plan, now, of

Duplicate views for the stereoscope.

taking duplicates of the view:—not from the *same* point, but from *different* points, a few feet apart, and on the same level. When both pictures turn out well, they are adapted to the stereoscope, which is a great advantage. (Note 14.)

The camera should not be placed nearer to any object that it is intended to include than double its height, or breadth.

The picture a matter of much study and taste.

The selection of the point of view, and of the picture to be taken, must necessarily be so much a

matter of taste, that it is impossible to lay down any rules upon this subject. The amateur will at first, no doubt, commit many blunders; and will find much experience necessary, before his eye and taste shall have become tutored to the requirements of this particular branch of art. He should lose no opportunity of visiting galleries of photographs, and of comparing closely his own efforts with those of others. In particular, the general effects of opposing masses of light and shadow, and of gradations of distance, should be carefully studied. Also the *weak* points of photography,—such as the monotony of the skies, and the absence of life-like figures, and of colour, should be carefully borne in mind; no less than its *strong* ones,—such as its marvellous truthfulness and minute detail, artistic rendering of foregrounds, rock, foliage, &c. And he will doubtless find, after a long and cultivated experience, that not merely grand ruins, or mountain-passes, or fantastic oddities, truthfully delineated, make good photographs; but that nature has been bountiful to nearly every locality, and that many a charming "little bit" of rustic simplicity, which he may have passed by in his novitiate as too common-place, may really have been well worthy of his attention.

Galleries visited and comparisons made.

The weak and strong points of photography should be borne in mind.

When the view is decided on, plant the stand *firmly* upon the ground—for if it should move *but a single hair's breadth*, whilst the camera is at work,

To plant the stand.

the picture will be spoiled. Never trust to grass, or soft earth, or a damp sandy beach; but thrust the legs firmly into solid ground, or find three flat stones to place underneath them.

To fix the camera, &c.

Having firmly planted the stand, put the camera together and mount it in its place; then, by means of a small "pocket spirit-level," make the top truly horizontal. Next wipe the lens, if necessary, with a cambric handkerchief (not a silk one), and screw it on; then put the ground-glass into its place, and throwing the large macintosh cloth over the camera and your own head and shoulders, proceed to adjust the instrument and to focus the view as accurately as possible, with the help, if necessary, of a small magnifying glass. (Note 16.) Should there be too much foreground, *raise* the slide which carries the lens to a suitable height; or if too much sky, *depress* it. *You should never elevate or depress the camera itself,* if it be possible to avoid doing so;—since, in the former case, all the vertical lines of the picture would tend to a vanishing point *above,* and in the latter to one *beneath* it, instead of being exactly perpendicular; which gives to buildings a very unsightly appearance. Now, remove the ground-glass screen; give the thumbscrew, which secures the camera to the stand, an extra turn, to ensure perfect steadiness; place the cap on the lens; and, having satisfied yourself that no light can enter the instru-

See note 16.

Camera should always be level.

See that no light can enter.

ment through any crevices, put the dark slide into its place; raise the shutter; and throw the large macintosh cloth over the top of the camera, fastening it underneath by means of the straps, if there should be much wind.

All is now ready for the exposure.

Remove the cap from the lens, and note the exact time by your watch.

The Time of Exposure.

Photography has not yet arrived at perfection; and we are unable, at present, to take views instantaneously with certainty; some definite time of exposure is necessary, to enable the light sufficiently to impress the sensitive surface. In the daguerreotype, the collodion, and the waxed-paper processes, the time of exposure is a matter of some nicety; for a picture taken by any of these methods, when *under*-exposed, is defective in the details of the shadows; and when *over*-exposed, is solarized, or enfeebled and "reddened." But in the process which I am advocating here, *greater latitude is allowable, since a considerable amount of over-exposure may occur without necessarily ruining the picture;* as will be understood when I say, that in the processes just before alluded to, the mode of development is invariable, be the exposure long or short; while in *this* it can be so modified

Effects of wrong exposure in other processes.

Greater latitude allowable in this.

as to suit the visible state of the picture when removed from the slide; and a strong negative may always be obtained.

Rules for finding the time of exposure with different lenses.

When the photographer has ascertained by experiment the time of exposure for a particular lens and diaphragm under certain conditions of light, he may then calculate at once the necessary time for a *different* lens and diaphragm, at work under similar conditions, by bearing in mind the following facts:—

The time of exposure will depend on the intensity of the light in the image, and it will be *inversely* proportional to that intensity; that is to say, the *greater* the intensity the *less* the time.

Now, first, this intensity of light in the image will be exactly proportional (*cæteris paribus*) to the *size* of the diaphragm,—that is, to the *square* of its diameter. (For a circle of one inch diameter is four times as large as another of half-an-inch diameter, and so on.)

The same lens with different stops.

It follows, therefore, that *with the same lens* the time of exposure will vary inversely as the square of the diameter of the diaphragm employed.

Example.

For example, if a certain lens with a diaphragm of one inch in diameter will take a picture in one

minute, then with a diaphragm of half-an-inch it would require an exposure of four minutes; or with a three-inch aperture, the view would be taken in seven seconds.

1 in. = 1 m
" ½ in. = 4 m
3 in. = 7 seconds

Secondly, the intensity of light in the image will depend upon the *focal length* of the lens; and the rule is, that this intensity (*cæteris paribus*) will vary *inversely* as the *square* of the focal length. Different lenses with the same-sized stop.

For example: two lenses of equal aperture, and at work at the same time upon the same subject, have focal lengths respectively, of eighteen inches and six inches, the time of exposure required for the first will be nine times that for the second. Example.

6 in = 1 m
18 in = 9 m

For *different* lenses and diaphragms, the rule will be that—

The time of exposure will vary *directly* as the *square* of the focal length, and *inversely* as the *square* of the diameter of the diaphragm, or aperture. Different lenses and stops.

For example: two lenses—one of three inches aperture and six inches focal length, the other of half-an-inch aperture and eighteen inches focal length—are at work together; then the ratio of their times of exposure will be that of 324 to 1. So that if a picture could be taken by the first in one second, it would require five minutes and twenty- Example.

3 in: Aper: + 6 in: fo: l: = 1 sec: - D
½ in: Aper: + 18 in: f. l. = 5 m. 24 sec: -

four seconds by the other,—a difference which could never have been *guessed à priori*, and which will show the importance of rules.

Importance of rules.

But we may occasionally depart from exact rules, and adopt approximations to them without any *practical* disadvantage; and the following will be found at times a very useful guide, although not strictly correct in *all* cases.

Approximate rule for different lenses with same-sized stop.

The time of exposure with different view lenses, having the same-sized aperture, will be proportional to the size of the picture taken by them (or very nearly so).

Example.

Suppose, for instance, that three lenses of the *same* aperture are at work together; that the first takes a picture twelve inches by ten inches, the second nine inches by seven inches, and the third four inches by three inches. Then the times of exposure for the first, second, and third, will be as 120 to 63 to 12,—that is, the first picture will require twice as long an exposure as the second, and ten times as long as the third.

Time for a picture, 9 inches by 7, in the sun.

A picture, nine inches by seven inches, with a *half-inch* diaphragm, and without difficult masses of shadow, would require, in full sunshine, an average exposure of *about four* minutes; and with *an inch* diaphragm, of *about one* minute.

The most favourable circumstances of light under which a picture can be taken, are when a strong *diffused* light prevails during nearly the whole time of the exposure, and when a gleam of sunshine bursts forth at the end, to prick out the high lights, and give relief and solidity to the objects. When sunshine prevails during *the whole* of the exposure, the contrasts are frequently too violent to be pleasing.

The most favourable light for a view.

Figures in motion across the view produce little or no effect; but should one remain still, during any considerable part of the exposure, and then move off, this will certainly occasion a blemish.

Effect of moving figures.

The picture having been exposed for the time deemed necessary *for the perfect rendering of the objects in shadow*, replace the cap on the lens, shut the slide, and pack up as before.

Expose for the shadows and not for the lights.

FOURTH OPERATION.

To Develope the Latent Picture.

This must be done either in a room darkened as before described for sensitizing, or in the evening by candle-light. In the latter case, the candle should be either a rushlight or a small dip, *not a composite or wax-candle;* and it should not be brought within a yard of the sensitive paper. The camera tripod may be conveniently used as a stand for the candle.

A dip-candle should be used.

Cover the table upon which you are about to work with one of the dark macinstosh cloths, and upon the floor, close at hand, place a gutta-percha dish, half filled with common water.

To arrange the developing slab.

Upon the table place the other dish (which should be larger than the developing slab), and across the top of this, two bars of wood, on which to lay the glass developing slab (which should be quite clean). Then, by means of the spirit-level, level the slab exactly, by putting pieces of paper, or little wedges, under the dish. Any of the developing fluid which may run over the edge of the slab will then be caught in the dish beneath, and perfect cleanliness be ensured.

Cleanliness ensured.

Lay a sheet of clean white blotting-paper upon the deal-board, and then remove the glass from the dark slide. When the picture is of very large size, proceed thus:—Take out the back, and place the slide upon the floor, leaning against the leg of a table or chair, the glass outwards, then, with the right hand against the glass, incline the slide gradually towards it with the left, until the plate falls fairly out by its own weight upon the right hand. *In doing this, be careful on no account to touch the sensitive paper with the fingers.*

To remove the glass when large.

Remove the paper from the glass by means of a sharp penknife passed all round beneath it, then pin it to the deal-board face upwards, and shelter it from the light, whilst making the developing solution.

To remove the paper from the glass.

The Developing Solution.

This is gallo-nitrate of silver, much stronger than that previously used for sensitizing, *and in which the proportions to be observed between the aceto-nitrate and the gallic acid will depend upon the aspect of the picture when taken from the slide.*

Proportions to be observed depend on the aspect of the picture.

Should *no trace* whatever of the picture be visible, mix aceto-nitrate of silver and saturated solution of gallic acid in *equal* proportions.

No trace visible.

Should the sky and high lights of the picture be

Slight indications.

slightly browned, add two parts of aceto-nitrate to three parts of gallic acid.

Strong indications.

Should the sky and high lights be *very strongly* marked, through great over-exposure, add one part of aceto-nitrate to three parts of gallic acid.

The developing mixture should be made quickly in a *clean* wine-glass (Note 12), and as nearly as possible by guess, since the *exact* proportions to a great nicety are not material. It will require a whole glassfull to cover a picture twenty-four inches by twenty inches.

To apply the developing solution.

Apply it *rapidly* with a clean Buckle's brush (Note 12) in the usual manner, keeping a flowing edge, and not passing over the same place twice, but *bringing the solution gradually down the paper like an advancing tide.* Begin with the sky. Always use a full brush, and be careful to leave no dry spots untouched by the solution.

The whole picture should be covered in less than a minute.

Wait a minute or two, until the development commences, and then *repeat the process in precisely the same manner with* GALLIC ACID ALONE. Use the same glass and the same brush, and apply the gallic acid *copiously*, first longitudinally, and then transversely.

Finish with gallic acid alone.

Next,

Pour some gallic acid copiously upon the middle of the slab (which should be a little larger than the picture), and spread it all over by means of the brush just in use. Now remove the picture from the board, and with some dexterity drain it upon the slab, and then lay it, *face downwards*, upon it. It will soon become perfectly flat.

Lay it on the slab.

The development, which ought now to be advancing rapidly, must be carefully watched. When the dark parts of the picture begin to appear through, at the back of the paper, it will be time to lift up the corners and examine the front. *The development should not be arrested until the details in the deepest shadows are fully out.* It may be hastened by pouring hot water into a zinc dish beneath, but I do not recommend this as a rule.

When to stop the development.

Be very careful *not to wet the back of the negative* with the developing solution, since the stains upon the back would show in printing quite as much as those upon the face.

Stains on the back.

The development being completed (the time will vary from ten minutes to an hour), drain the paper for an instant, and lay it, face upwards, upon the board as before; remove all the surface moisture by blotting-paper (Note 15), and then place it, face downwards, upon the water, in the dish,—after-

Wash off the developing solution.

wards face upwards; wash it well by agitating the dish; then change the water and wash it again.

It is now ready for the fifth operation.

But before quitting this part of the subject, I must add some remarks on the subject of the visible state of the picture when removed from the slide.

In what I have just said, I have assumed that some hours have intervened between the exposure and development. A picture when sufficiently exposed, is developed to a certain extent *spontaneously,* in consequence of the presence of gallic acid in the paper. Hence it happens that, if we examine a picture immediately after the exposure, no traces may be visible, while the same picture put by for some hours, and then examined again, may exhibit considerable indications of its darker portions. How then, it may be asked, are we to proceed, when no traces are visible in consequence of the development immediately following the exposure?

To this I would reply, that experience will enable us to form a very good guess as to the proper mode of proceeding in such cases. There is no other rule that can be laid down: experience will be our only guide, and it will not deceive us in the great majority of cases.

FIFTH OPERATION.

To Fix the Picture.

The object of the fixing process is, to remove from the paper all that remains of the developing solution, and the whole of the iodide of silver. The picture will then be no longer sensitive to light. Object of the fixing process.

To effect this, make a solution of hyposulphite of soda in common water; the strength is not material; about "one ounce of hypo to six ounces of water" will be sufficiently rapid in its action. Put enough of this to cover the paper completely into a gutta-percha dish: then submerge the paper in this solution, and leave it there until the *whole* of the yellow iodide is dissolved out; which can only be ascertained with certainty by daylight. To dissolve out the yellow iodide.

Finally, wash the picture in abundance of common water, to remove all traces of the hyposulphite, which if left in would eventually destroy it; change the water "at least six or eight times"; leave it to soak in water for several hours, then press it between blotting-paper, and hang it up to dry. The hypo must be all removed.

Throw away the old hypo.

When the hyposulphite solution (which may be used several times) gets weak and discoloured, it should be thrown away, as of no further use either for negatives or positives.

No necessity for fixing at once.

There is no absolute necessity for fixing the negatives immediately after their development, and whilst *en route;* although this is the *safer* plan. They may be kept for days, or even weeks, screened from the light, in a portfolio, without much risk, and may be fixed at a convenient opportunity, several at a time. If this plan be adopted, then all the paraphernalia of the fixing process may, in general, be left at home. In this case the unfixed negatives should be *well* washed in water, and dried in the dark, or in a feeble light, before being put away.

The finished negative improved by waxing.

Excellent prints might be obtained from the negative in its present state, but it is greatly improved by being rendered more transparent; and this is readily accomplished by saturating the substance of the paper with white wax; as will be described in the next operation.

SIXTH OPERATION.

To Wax, etc. the Finished Picture.

First, trim the edges with a sharp knife, upon a thick board either of poplar or sycamore, having two adjacent sides accurately straight and at right angles. For this, select if possible, some prominent *vertical* line in the picture; and by the help of a carpenter's square cut the sides parallel to that, and afterwards the top and bottom, at right angles to them.

To trim the edges.

Some judgment and taste will be necessary in determining the best proportions for the picture; for we must not by any means invariably retain all that we have got, but balance the objects properly.

The shape requires taste and judgment.

To wax the pictures (when not of the largest size) procure the following apparatus:—A zinc dish, with upright sides, sufficiently large to receive them, and which is to stand in another zinc dish, supported, at about a quarter of an inch from the

The waxing apparatus.

bottom, by diagonal strips of zinc in the corners. The whole is to stand upon two blocks of wood about four inches thick.

To apply the wax.

Pour boiling water into the outer zinc dish, up to the proper level, and keep it at a boiling heat by means of a spirit-lamp placed underneath. Put the inner dish into its place, and rub a cake of clean white wax (which speedily melts) all over the bottom; lay the negative, face downwards, upon this, and then rub the wax all over the back of it; turn it over and do the same to the face. In this way many negatives may receive a coating of wax in a few minutes, and the heat will cause the wax to penetrate thoroughly the pores of the paper.

Negatives should be dry.

Dry the negatives well before the fire previously to waxing them, or they will not imbibe the wax equally. Also take care that no water finds its way into the dish with the wax.

To iron the wax out.

Finish, by ironing the negatives between sheets of dry blotting-paper (Note 15), with a moderately hot smoothing-iron, until no shining patches of wax remain on either side. And in doing this *be careful not to crease them,* as it is difficult to remove such marks *entirely* by any subsequent treatment.

The blotting-paper should be renewed when it becomes saturated with wax.

They will now be very transparent, and when held up to the light may be thoroughly examined.

To wax very large pictures.

Very large pictures may be waxed differently. The best plan for these will be, to melt the wax in a jar, placed in a saucepan of boiling water, and to apply it to *both* sides of the negative with a new and clean paint-brush. Then hold the negative before a good fire, turning it repeatedly, and allowing the superfluous wax to run off by one corner into the jar again. Afterwards iron as before.

To retouch a negative.

Should a negative require to be retouched in any part, this should be done *after* waxing, with Indian ink, ground on a plate in the usual way, and to which a few drops of albumen, or a little ox-gall, have been added.

If the "sky requires to be blacked" artificially, this may be done, either with lamp-black ground in thin size on a slab with a muller, or with "thick black paint ground in boiled oil or varnish," and applied at the *back* of the negative. The outline against the sky must be carefully and sharply defined with the brush.

Preserve them carefully.

The process for negatives is now completed. *They should be very carefully preserved in a portfolio,* and when in use handled with much caution; as if tumbled, or stained with chemicals, they will be irretrievably ruined.

N.B.—Every requisite for the practice of this art, as described by the author, and of guaranteed quality, may be obtained at the Photographic Institution, 168 New Bond Street.

CAUSES OF FAILURE.

The most frequent causes of failure in the negative process are—

1. Insufficient or careless "washing" of the iodized papers, which will occasion innumerable small white spots, or large white blotches in the negative. Bad iodized paper.

2. Dirty glasses and tubes, in the washing of which the directions given in Note 12 have not been rigorously attended to, and which will occasion all sorts of dirty stains and streaks. Dirty tubes and glasses.

3. Too strong a light upon the sensitive papers during the processes of sensitizing or development, which will produce "general discoloration." Too strong a light.

4. Too short an exposure in the camera, in consequence of which the due development of the shadows will not be attained, and the picture will be "defective in the half tones." Too short an exposure.

Use of the same vessel for different purposes.

5. The employment of the same vessels for several different purposes is an untidiness and want of method in the work, which will be *sure* to involve many a severe penalty, in the way of failures and misfortunes, *particularly when hyposulphite has been allowed to come in contact with other chemicals.*

Cleanliness will generally ensure success.

Excessive cleanliness, and strict attention to directions, will in general ensure success; for the process is, I believe, AS CERTAIN, when fairly carried out, as anything of this nature can possibly be expected to be, and far *more* certain, than any other with which I am acquainted; and I am sufficiently familiar with them all, to be able, I hope, to form a fair estimate of their comparative merits.

The Buckle's brush.

With respect to the use of the Buckle's brush, which I have recommended for laying on the gallo-nitrate, and which may be seriously objected to by some, it must be observed, that the mode of applying the solution with this useful little article is not by any means that of *random mopping* or *daubing*, but that considerable method is to be observed in the use of it; for when properly handled, and the board gently inclined, *the solution proceeds steadily downwards in an advancing tide*, and the paper becomes wetted quite as uniformly and evenly as if a glass rod had been employed to spread it, or as if it had been gradually depressed upon the surface of a bath.

Random mopping or daubing not allowable.

And this may be easily proved by applying a flat wash of some water-colour to the paper by the three different methods, and comparing the results when dry.

Use of blotting-paper not injurious.

The use of the blotting-paper for removing the surplus sensitive solution is also considered by some as highly objectionable; but I am inclined to suspect that, if the truth could be exactly ascertained, in many failures the *real* cause would turn out to be, not the unfortunate blotting-paper (which, when clean, must be perfectly harmless,) but a far more serious evil, viz. that of placing the *sensitive* side of the paper in contact with the dirty glass of the common slide. For my own part I have never experienced any failures which I could fairly attribute to the use of *clean white* blotting-paper.

Proportions of aceto-nitrate should be exact.

On the occurrence of failures, amateurs are but too ready to call in question the purity of the chemicals employed; but when these have been purchased of a respectable firm, they may be tolerably certain that the fault is rather *their own*. When every care has been taken apparently, in every stage of the manipulation, and the work nevertheless proves a failure, it will be well to make a fresh solution of aceto-nitrate; for should the proportions of the sensitizing solution have been incorrect, the paper may either brown all over, through the presence

of *too little* acid, or lose its sensitiveness, through an *excess* of it.

There is another important point to bear in mind in this process, and that is, THE QUALITY OF THE PAPER WHICH WE EMPLOY. If that is full of metallic spots, or sized with an improper substance, or of too loose a structure and too thick, it will be impossible to obtain a first-rate result. Consult my remarks in Note 7 on this subject.

THE PRINTING PROCESS.

THE PRINTING PROCESS.

THE Printing Process is that by which the Positive photograph is obtained from the Negative.

This branch of the Art is so important, and so many improvements have been made in it of late, that I have been induced to write a Treatise expressly on this subject, in which I have described the various methods in general use, with my own particular views and mode of printing. This work is now in the press, and will shortly appear under the title of "The First Familiar Lesson in Photography." But as the present work would have been incomplete without a chapter on Positive Printing, I have given a formula which I trust will be found to be particularly suitable to the requirements of the amateur; being both simple in manipulation and uniform in result; while the proofs obtained by it are in all probability PERMANENT.

This method involves seven distinct operations, viz.—

1. To gelatinize the paper.
2. To sero-salt it.
3. To render it sensitive to light.
4. To expose it in the pressure-frame.
5. To tone the picture.
6. To fix the picture.
7. To trim and mount the finished picture.

These operations should be performed at home, in a room devoted to this purpose.

THE CHEMICALS.

The Chemicals required in this process are—

Gelatine.
A salted rennet.
Pure chloride of sodium.
Nitrate of silver.
Sel d'or.
Hyposulphite of soda.
Pure animal charcoal.
Liquor ammoniæ.
Pure hydrochloric acid.
Distilled water.

The chemicals obtained of any respectable chemist, and guaranteed by him, will be found to give good results. Should the nitrate of silver contain a small excess of nitric acid, that will not perceptibly injure the proof.

THE PRINTING-ROOM.

This room should be provided with a sink and tap, and an unfailing supply of water. There should be convenient benches to carry the dishes, and the means of hanging up papers to dry. The window should be provided with yellow curtains, which may be drawn at pleasure. A dark cupboard will be found very useful.

This room should have a warm dry aspect, for cold and damp are fatal to the success of printing operations. It should contain a stove or fireplace, as the prepared papers require to be dried rapidly by artificial heat.

THE APPARATUS.

This will consist of—

Earthenware dishes with upright sides and without lips.

A bath of plate-glass for the gold bath, and also one of glass or gutta-percha for the silver bath.

One or more pressure-frames (Note 17).

An earthen pipkin, or saucepan lined with enamel.

Wooden paper-clips (Note 9).

Bottles, funnels, portfolios, and the usual sundries.

FIRST OPERATION.

To Gelatinize the Paper.

The paper to be employed should be that of Marion, or Canson frères.

The paper to be employed.

I recommend this paper in preference to that of English makers, on account of its smoothness and hardness of surface, on which better definition may be obtained. But the French paper, unfortunately, contains substances which are injurious to photographic chemicals. I allude more particularly to the blue dye, which I believe to be sulphide of sodium. I find it next to impossible to obtain a clean and perfect result on *plain* French paper, when used in the negative process; and I attribute this circumstance, not to the starch with which it is sized, but to the presence of some deleterious matter in the paper, such as that to which I have alluded. Whenever, therefore, French paper is used in photography, it becomes necessary to employ an organic substance, such as albumen or gelatine, in order to protect the photographic chemicals from the action of the deleterious substances contained in the paper.

And this precaution becomes doubly necessary when printing is performed by the negative process.

These remarks will explain the necessity for the application of gelatine in the first operation.

The print should be superficial.

But there is yet another object to be gained by the employment of gelatine. In the process which I am about to describe the photographic print is entirely *superficial.* Its beauty and vigour mainly depend on the manner in which the superficial layer of darkened material is exhibited. The gelatine, by filling the pores of the paper, and presenting a smoother surface for subsequent operations, plays a very important part.

To gelatinize the paper proceed thus:—

Boil in an earthen pipkin, or an iron saucepan lined with enamel, one quart of clear rain-water; and add to this half an ounce of pure gelatine or isinglass.

As soon as the gelatine is dissolved, strain it through a muslin into the dish which is to contain it; and before it gets cold, proceed to immerse the papers, one at a time.

Take care that they are perfectly wetted on both

sides, and then hang them up to dry by a pin at each corner.

The papers should be an inch longer than the negative, and a trifle wider.

When they have been all hung up, return to the first. You will find a quantity of fluid accumulated at the lower edge. The simplest way of getting rid of this is to cut off, with a pair of scissors, a strip half an inch in width from the bottom. This done, dry the paper completely before the fire, and put it away; then go on to the next.

The papers so treated may be preserved for a few weeks in a portfolio. But, as a general rule, it is better to prepare them as you want them.

SECOND OPERATION.

TO SERO-SALT THE PAPER.

This operation consists in floating the paper, face downwards, on the following bath:—

1 pint	. . Clear serum of milk
¼ ounce	. . Chloride of sodium.

Let the paper remain on this bath for ten

seconds; then hang it up to dry by two pins as before.

When nearly dry, finish by drying it before the fire, and put it away in a portfolio, which should be kept in a dry place. Do not prepare a large stock of these papers in advance, but prepare them as you want them; they do not improve by keeping.

The serum of milk may be prepared in the following manner:—

To prepare the serum.

Procure a quart of fresh milk. Let it stand a few hours, and then remove the thin portion of the milk from the cream by means of a syphon. Then add to this thin milk a piece of rennet, about the size of the palm of the hand. The rennet should be previously washed once or twice to remove the excess of salt, if it has been salted.

Place the vessel containing the thin milk with the rennet in a warm place, such as the hob, or in a slow oven. In about an hour the casein, or curd, will coagulate and separate from the serum or whey.

Remove the curd, and filter the whey through a clean towel folded twice, and suspended over the vessel which is to catch the whey as it drips through. In an hour or two the whole will have filtered through. It should be perfectly limpid, and of a greenish colour.

The whey still contains a portion of "casein" in solution; and this substance, which very much resembles albumen in its properties, is coagulated by the nitrate-bath in the next operation, and acts as a cement whereby the particles of reduced silver are held together and exhibited in the proper condition to constitute a beautiful and vigorous superficial picture,—rich and deep in tone, and without any of the disagreeable and inartistic effects of a varnished or albumenized surface. Use of the whey.

THIRD OPERATION.

To Render the Paper Sensitive.

Turn back a half-inch border at one end, which is to be kept dry, and then float the sero-salted paper for two minutes on the following bath:—

½ pint	. .	Distilled water
1 ounce	. .	Nitrate of silver.

Then hang it up to dry by two pins stuck through the dry band.

When nearly dry, hold it before the fire until quite dry, and then use it as soon as possible, as it deteriorates by keeping.

Avoid white light.

This operation must be conducted in a yellow light. And I may here observe, that to allow even a very subdued white light to fall upon the sensitive paper will injure the tone of the lights, and render them of a dirty grey tint instead of the pure cream-colour of a successful result. To obtain a perfect positive print is one of the most delicate operations in photography; and no liberties are allowable in any stage of the work.

When the nitrate bath becomes discoloured by use, filter it through "animal charcoal" in the following manner:—

Filter the nitrate bath.

Put a tuft of cotton-wool into the neck of a large glass funnel, and on that about a tablespoonful of pure animal charcoal. Then pour in the discoloured solution of nitrate of silver, and collect the filtered liquid in a bottle. Should the first droppings be cloudy, wait until the drops are clear and limpid, and then return the cloudy solution to the funnel.

The nitrate bath should *always* be filtered through a tuft of cotton-wool, or blotting-paper; and when

discoloured, through animal charcoal. With a dirty nitrate bath, it is impossible to obtain a clean pure positive; the lights will always be injured, more or less, by the sulphuret of silver in a discoloured nitrate bath.

"Kaolin" may be used instead of animal charcoal; some persons believe it to be better.

The nitrate bath, when not in use, should be kept in the dark.

Silver bath should be glass or gutta-percha.

The bath itself should not be formed of common earthenware, but either of glass or gutta-percha. The glaze on common earthenware "contains lead, and is acted on by the nitrate of silver, which occasions all kinds of cracks and stains," and finally attacks the earthenware itself. A glass bath is the best; and it should always be well washed after use.

As the nitrate bath becomes weaker by use, fresh nitrate of silver must be occasionally added.

FOURTH OPERATION.

To Expose in the Pressure-Frame.

The best form of pressure-frame.

The best form of pressure-frame for this process is that which opens at the back, and allows the operator to examine from time to time the progress of the work. It may be purchased at any photographic dépôt, where its mode of action will be explained. The glass should be very thick and strong; also free from specks, air-bubbles, and other defects. The patent plate-glass answers tolerably well for this purpose. The colour should be as white as possible.

Place the negative with its back to the glass, and on it lay the sensitive paper face downwards. Then lay, first, some black cloth, and then a pad of blotting-paper on the back of the positive, and afterwards the folding back of the pressure-frame, which screw with even pressure as tight as possible, consistently with safety to the glass.

Then carry the pressure-frame out of doors, and expose the glass to as strong a light as possible. If the sun is shining, incline it, so that the rays may

fall on the glass perpendicularly; but if not, place it face upwards, in a horizontal position.

The exposure to the light should not be attempted in rainy weather. Not to print in wet weather.

The time of exposure will depend upon the intensity of the negative. The tints assumed by the outside border of the positive paper, which projects beyond the negative, will be a good guide in this matter. They will occur in pretty nearly the following order, viz.:—A rose colour, a reddish brown, a purple brown, a deep violet, a metallic bronzed appearance. When the deep violet tint has been attained, it will in general be time to open the back and examine the appearance of the picture. With a good vigorous negative, the outside border should be perfectly bronzed. Tints of the outside border.

The positive, when sufficiently printed, should be a shade darker than it is intended to be ultimately.

The time of exposure will vary from about five minutes to as many hours, according to the light, the time of year, &c. &c. In London, during the dull winter months, it is scarcely possible to print at all by this method. The time of exposure.

When the positive is sufficiently printed, place it

The free nitrate should be removed.

in a dish and wash it well under a tap of water, to remove the free nitrate of silver, preserving the first washings. The importance of this will be understood when I say that 95 per cent of the silver employed is removed by this treatment from the paper. Throw, therefore, these first washings into a large pan, and add salt, which will in the course of a few hours precipitate the silver in the form of an insoluble white chloride of the metal. This may be preserved in a jar, and every few months reconverted into metallic silver, by a process which I will not now stop to describe.

When the print has been so thoroughly washed that the water is no longer rendered milky by the silver, add a few drops of liquor ammoniæ to the last washing-water. To be more exact, say six drops to one pint of water. The object of this is to convert the last minute traces of free nitrate of silver into the ammoniacal oxide of that metal, in order that the gold bath, presently to be employed, may not be decomposed by it. Then wash again copiously under the tap, to remove the free ammonia.

6 drops to one Pint.

Use of the ammonia bath.

Hot water must not be used.

Hot water must on no account be used in this operation, as it would dissolve the gelatine, and thereby effect a mechanical transfer of the greater portion of the darkened photographic material from the paper to the water.

PHOTOGRAPHY.

ABERDARE:
PRINTED BY WM. MORRIS, MANUFACTURING STATIONER, POST OFFICE.
1867.

PHOTOGRAPHY.

To secure adhesion of Collodion to the Plate.

Albumen of one egg to ten ounces of water. Pour on a flat dish ; place a side of a plate on the surface of fluid by the aid of a pneumatic plate holder ; then rear up and dry. Collodionise sensitise ; wash ; pour over the plate a two grain solution of Bromide of Ammonium to one ounce of water :—expose as soon as possible after it is dry and develope. The plates will not keep over the day.

Hot Water Process.

Sensitise ; wash.

Gallic Acid	.....	2 grains.
Water	.....	1 ounce.

Pour over the plate.

Albumen	.....	1 ounce.
Water	.....	4 ounces.

Pour over the plate and then plunge in a dish of hot water.

Developement.

1

Protosulphate of Iron ... 40 grains.
Sugar of Milk ..... 12 grains.
Acetic Acid ..... 25 minims.
Water ..... 1 ounce.

Or, 2

Gelatine ..... 1 drachm.
Water ..... 1 ounce.

Boil fifteen minutes with one drachm of Caustic Potash, add two ounces of water, neutralise with sulphuric acid, and finally add *four* drachms of glacial acetic acid. Use this as an intensifier for negatives with the double sulphate of iron and ammonia. It does not become turbid on the addition of silver.

Or 3

1st.—*Stock of Nitro Gelatine.*

Gelatine ..... 3 drachms.
Water ..... 1 ounce.
Nitric Acid ..... 1 ounce.

Preserve for use.

2nd.

Double Sulphate of Iron and Ammonia	4 drachms.
Nitro Gelatine	1 drachm.
Alcohol	1 drachm.
Water	6 ounces.

Dissolve and filter. This developes and sufficiently intensifies a negative

4

Glacial Acetic Acid	6 drachms.
Nelson's Gelatine	1 drachm.
Water	6 ounces.

Add one ounce of this solution to one pint of a Saturated Solution of

Protosulphate of Iron	4 ounces.
Acetic Acid	$1\frac{1}{2}$ drachm.
Water	20 ounces.

If weakness of image arises from over exposure, fix before further intensifying.

Tannin Developer.

Carbonate of Ammonia... 20 grains.
Distilled water ..... 10 ounces.

Wash off before using another developer.

Pyrogallic Acid ..... 2 grains.
Citric Acid ..... 1 grain.
Distilled water ..... 1 ounce.

Use this before any silver solution is used : or

Pyrogallic Acid ..... 1 grain.
Glacial Acetic Acid ..... 30 minims.
Distilled water ..... 1 ounce.

The developement may be continued after fixing.

Printing.

Nitrate of Silver ..... 60 grains.
Water ..... 1 ounce.
Nitrate of Potash ..... 10 grains.
Nitrate of Magnesia..... 10 grains.
Acetate of Lead ..... 2 grains.

Or, add 2 grains of Nitrate of Uranium.

Toning Baths.

A.

Chloride of Gold	.....	1 grain.
Acetate of Soda	.....	20 grains.
Carbonate of Soda	.....	20 grains.
Water	.....	10 ounces.

Mix the Carbonate of Soda and Gold first and then add the Acetate of Soda ; or, 30 grains of Acetate of Soda, without the Carbonate, may be used : but mix 24 hours before using.

B.

(1.) Chloride of Lime ..... ½ ounce.
Distilled Water ..... 16 ounces.

(2.) Chloride of Gold ..... 1 grain.
Carbonate of Lime [Chalk] 3 grains.
Water ..... 1 ounce.

In 8 ounces of hot distilled water put No. 2, and after five minutes put half-an-ounce of No. 1.

It is the only bath which gives a black tone.

C.

Water ..... 18 ounces.

Gold ..... 3½ grains.

Benzoate of Ammonia ... 6 grains.

This gives a dark violet colour.

D.

Chloride of Gold ..... 5 grains.

Tungstate of Soda ..... 20 grains.

Boiling Water ..... 5 ounces.

Add

Sulphocyanide of Ammonium 5 grains.

Water ..... 5 ounces.

Fix with Hypo of Soda.. 1 ounce.

Water ..... 6 ounces.

To Clean Fingers.

Glauber Salts ..... ¼ ℔.

Chloride of Lime ..... ¼ ℔.

Water ..... 4 ounces.

And then wash off the smell by using a cake of pipe clay.

The fi
nitrat
should
remov

6. drop
one gi

Use of
ammo
bath.

Hot w
must
used.

FIFTH OPERATION.

To Tone the Picture.

Make the following gold bath :—

2 quarts	. .	Distilled water
15 grains	. .	Pure sel d'or (not chloride of gold)
1 dram	. .	Pure muriatic acid.

Pour a sufficient quantity to cover the bottom into a plate-glass bath, and place the print upon it face downwards ; then turn it over, and spread the solution over the face with a camel-hair brush.

In a short time, varying from three to ten minutes, the shadows of the print will recover the deep violet tint which they had lost in the ammonia bath, and the lights will assume a delicate cream colour.

Now remove the picture, and wash it again once or twice under the tap.

Wash out the gold bath, and employ fresh solution for the next picture.

If the prints are left too long in the gold bath they acquire a cold, inky tint, which is objectionable,

and the lights became too yellow. On the other hand, if not left long enough, the fixing bath of hyposulphite of soda reddens them too much.

Exclude white light

The operation of toning the print should not be conducted in a white light, but a ray now and then may be allowed to fall upon the paper, in order to show the tint of the lights. When one picture has been toned, and the time of remaining in the bath ascertained, the time for the others may be regulated by the watch.

SIXTH OPERATION.

To Fix the Print.

Place the print for fifteen minutes in the following bath:—

1 quart	. .	Clean rain water
6 ounces	. .	Hyposulphite of soda.

Then remove it, and wash it well in a dozen changes of water under the tap. Put it to soak in a large pan of water, along with others, for twenty-four

hours, occasionally agitating the water, and changing it at least six times. Then press it between the folds of a clean cloth, and hang it up to dry.

The hypo reddens the print slightly, but it recovers its dark colour on drying.

As soon as the hypo becomes discoloured it should be thrown away.

Test for the hypo.

If the drops which fall from the paper after the last washing, when collected in a watch-glass, give a red precipitate on the addition of a drop of the nitrate bath, the paper must be washed again, as it still contains hypo.

Most important to remove the hypo.

It is absolutely necessary to remove all the hypo-sulphite of soda from the paper; for if any remain, it will endanger the permanence of the print.

SEVENTH OPERATION.

To Trim and Mount the Finished Picture.

Procure a thick board of sycamore or poplar, with two adjacent edges perfectly smooth and straight, and accurately at right angles.

On this lay the print, and taking some pro-

minent vertical line in it, cut the sides parallel to that, by means of a sharp knife, against the edge of an iron carpenter's square. Then, without shifting the picture, adjust the square to the other edge of the board, and cut the top and bottom of the print.

Mount with isinglass.

To mount it, employ a warm solution of isinglass, laid on very thinly with a clean hog-hair paint-brush. Damp the cardboard slightly with a sponge, and apply the print to it as nearly as possible in the required place by eye. A little practice will soon render this perfectly easy. Lay a piece of cardboard on the face of the mounted print, and rub on this very hard with a handkerchief, to make the print adhere, and to prevent the formation of air-bubbles on drying. Then place the batch of mounted prints under a bookbinder's press, with glazed millboards between them; and leave them under pressure for a couple of days.

Sour paste must not be employed.

Isinglass is the cement recommended by the Printing Committee, as it does not absorb moisture so readily as paste. Sour paste will infallibly cause the fading of the photograph. Freshly-made starch is better than paste or gum arabic.

The photograph is now finished.

In colour and general effect it will be very artistic, and in all probability quite permanent.

But the process which I have just described is better adapted to the requirements of the amateur, than to the work of a printing establishment. I do not, therefore, employ it myself; for in the winter season it would be next to useless. The only process capable of being employed on a large scale, and in all weathers, is that which I have already described in the first number of "Photographic Notes."

The formula now given has, however, been much approved, and is, I believe, becoming a general favourite. Some of our most eminent photographers have spoken highly of it; and amongst them I may mention the names of Messrs. Hardwick, Polluck, and Shadbolt, all members of the Printing Committee.

There can be no doubt that, even if inferior in some respects to that which I employ myself, it is a great improvement on the old methods of colouring by the agency of sulphur, and employing paper coated with white of egg.

1. Bath. 35grs. Ng silver to 1 oz of water

2. Albumen Wash – the white of 3 eggs –
Distilled water 4 drachms –
Liquor Ammonia of the Pharmacopeia. ½ drachm

3. Collodionize –

4. Sensitize. – 2 minutes. drain – cover in water just enough to cover it – & gently move until the frothiness has left. say – ½ minute

5. Put on Albumen wash – working round, say in ½ min.

6. Wash well by a stream over the plate

7. Dry – by fire –

8. Develop.
1 Pyrogallic Acid. 4 grains –
2 Acetic Acid. 30 drops
3 Water –
& to each drachm 1. to 2 drops of the silver bath

By smell quantity of honey to the Albumen to prevent cracking

Varnish of Soehnee & Sons –

Patent Plate Glass. J. A. Forrest & Co. 58 Lime St. Liverpool

Beens's Negative Collodion. 115 Warwick Street. Leamington.

Yellow Serge. Burnett. Piazza Covent Garden London

Colchon & Sean Photographic Plates. F. Warwick. 32 Sloane St. S.W

Varnish. Söhnee & Sons.

NOTES.

NOTES.

1.—The Lens.

Use of the lens.

The use of the lens is, to produce a real *image* of the objects at which it is presented upon a surface *sensitive to light;* and thus to give a photographic representation of them.

The view lens.

The Calotype process not being well adapted to portraiture (in which rapidity of action is necessary), we are not concerned here with the *combinations* of lenses manufactured expressly for that department, but require simply a *view lens;* that is, an achromatic lens, formed of two lenses in close contact, and in the form which is called "concavo-convex." This lens should be mounted (with the *concave* side to the view) in a brass tube, capable of sliding *easily* in an outer tube, which latter is secured to a movable portion of the front of the camera. By means of this sliding adjustment of one tube within the other, the lens may be brought exactly to the proper distance from the sensitive surface, or, in other words, to perfect "focus."

Rack and pinion unnecessary.

The adjustment may be effected either by the hand, or by a rack and pinion; I prefer the former method, since the rack and pinion are liable to frequent derangement, besides being unnecessary in view lenses. Within the inner tube, and at a proper distance *in front of the lens*, should be placed a system of circular "*diaphragms*," or "*stops*," the largest of about one inch, and the smallest a quarter of an inch in diameter; and in front of these,

again, there should be a cap, with which to close the end of the tube, and exclude the light altogether when necessary.

Necessity of achromatism in the lens.

In order to understand fully the necessity for *achromatism* in the lens, the reader must follow me through a brief explanation of the nature of *light*. It is then, not *light*, which produces a photographic picture (which is an erroneous term), but another property of the sunbeam termed "*actinism*," working by means of certain rays, to which the term "actinic" has been recently applied, and which differ entirely in their *effects* from the luminous rays, although possessing *some* properties in common with them. On decomposing a ray of white light, by refraction through a prism, into the seven prismatic colours, viz. red, orange, yellow, green, blue, indigo, and violet, and on applying a piece of sensitive paper to the spectrum, we find it *most* darkened in the neighbourhood of the *violet* colour, *slightly* in that of the *red*, and *not at all* affected in that of the *yellow*, while the effect with other colours will vary according to their proximity to these three. Now a single lens, not achromatic, gives these seven different coloured images or pictures, at seven corresponding distances from it; and upon focussing the objects, at which the lens is presented, upon a ground-glass screen, the *yellow* picture will be the *visible* one (the yellow being the luminous rays). So that a sensitive surface placed in the "visual" focus (as it is termed) would be *out of focus* for either the red or violet pictures. Hence arises the necessity for an *achromatic* arrangement of the lens; that is to say, *for an arrangement in which the red, the yellow, and the violet pictures shall be combined into one.* By using *two* lenses of different kinds of glass in close contact, instead of a single lens, we are enabled to effect this for the *red* and *violet* pictures; while, at the same time, the *yellow* picture will be near enough to this combination for all practical purposes. It is true that, by using *seven* lenses in contact, formed of *seven* different kinds of glass, we could combine *all the seven* pictures into one; but such a plan is never attempted, as it would involve so many practical disadvan-

Violet rays the most actinic.

Coincidence of the red, yellow, and violet pictures.

tages, as to counteract any benefit that might be derived from it, in the shape of perfect achromatism.

Meniscus lens a failure.

A simple meniscus lens has been sometimes recommended, on the ground that the focus for violet rays, being about one-thirtieth part of the whole focal length *nearer* to the lens than the yellow or visual focus, we have only to find the visual focus, and then to push the lens inwards through the space required. Experiment has yet to determine whether this cheap form of lens could be rendered available in photography. Theoretically, it ought to succeed.

Use of the stop.

The use of the diaphragm, or stop, is to render the picture *sharper* and *better defined*, particularly near the edges; and it acts by reducing the size of the pencils of light which enter, or cutting them as it were to a finer point, by diminishing the *base* of the cone of rays, while the *length* remains the same: but in doing this, we clearly gain in sharpness at the expense of light; still, as we are supposed to be taking inanimate objects, this is of but little consequence, since loss of light may be compensated by increased time of exposure.

A good lens necessary.

The *quality of the lens* is a matter of great importance in photography. At whatever cost, the amateur should start with a good instrument; and the best will be found to be the cheapest in the end.

Size of the picture as compared with focal length of lens.

The *size* of the picture depends, not upon the *size* of the lens, but upon its *focal length*, which may be ascertained by finding its burning focus in the sunshine, and then measuring the distance of this burning focus (or sun's image) from the lens. The breadth of the picture may be about two-thirds of this focal length. Or, with a *very small stop indeed*, its *diagonal* may be *equal* to the focal length. A very wide field of view will in this case be included, which is sometimes advantageous.

As some guide to the novice in these matters, I may mention that a view lens of 16 inches focus, with a stop of three-eighths of an inch in diameter, ought to take a well-defined picture, 12 inches by 10 inches, and that

such a picture would include an angle at the eye of about 40° ; that is, about the one-ninth part of the entire panorama.

2.—The Camera.

This is the dark box in which the sensitive paper is exposed to the action of light, through the intervention of the lens, in order to obtain the negative picture.

There are many different forms of camera in use, and these should be seen and explained at the repositories where they are sold, in order to be fully understood. The most portable, and I think the best for *views*, is the single "*folding*" camera. When not of preposterous size, this may be carried by a strap over the shoulders, like a knapsack, without much inconvenience. And even for *very large* pictures, I still give the preference to this form.

Single folding camera.

Photographic views are, in general, of an oblong form, and seldom exactly square. The longer side of the oblong will be sometimes horizontal, and at other times vertical, according to the nature of the view to be taken. The camera must, therefore, be capable of taking *both* classes of picture with equal facility, or it would be but an imperfect instrument. Also, the lens should be attached to a *sliding adjustment* in the front of the camera, in order that it may be raised or depressed to suit the requirements of the view ; and that, whether the instrument be on end, or in its ordinary position. To effect this in both cases, the common plan is, to mount a slide which works parallel to the bottom, upon another which works parallel to the side ; but this mode is, I think, somewhat cumbrous and inelegant, and the arrangement is very likely to become fixed just at the moment when it is required to work *easily*. For myself, I give the preference to a *square* removable panel in the front, on which the slide may work, and which may be placed in either of the two positions required, with equal facility ; or, perhaps, better still, a *circular revolving* panel, *not* removable, and by

Camera should take both long and upright pictures.

Double-sliding adjustment of front.

means of which the lens may be brought, in either position of the camera, opposite to any part of the picture which may be thought desirable.

The mode of using the camera, and of focusing, had better be learnt where the apparatus is purchased; to attempt to describe it here would involve a long and scarcely intelligible description. It will be sufficient for me to state, that the focus for *near* objects is *longer* than that for distant ones; and that in taking views, in which many different distances occur, a mean should be struck between them, and the inevitable imperfections of focus in parts, remedied by the use of a *small stop*.

3.—The Stand.

The camera stand should be strong, firm, and portable; and the camera should be susceptible of rotation upon it in a horizontal plane, whilst adjusting it to the boundaries of the view.

All these objects are secured by the stand in common use, called the "double-tripod," which is composed of a brass triangular top, supported upon three pairs of legs, made of some hard wood. The top has central bars; and in the middle of it is a hole to receive a thumb-screw, by which to attach the camera to the stand; and about which, when loose, it turns freely when required.

This form of stand can be taken to pieces and easily packed. For *very large* cameras, a wooden top is, perhaps, preferable. But in either case, it is well to have the top slightly hollowed in the middle, so that the camera may rest upon the three extreme points of the triangle, which ensures great steadiness: care must be taken, however, when this is the case, not to turn the thumb-screw so tightly as to split the bottom of the camera.

4.—The Focussing Screen.

This is a sheet of ground glass, exactly the size of the picture, and fixed in a frame. Its use is, to enable the photographer to select and examine the picture which he is about to take; in order that he may properly adjust the camera and the focus. For this purpose, it is inserted in the camera, in the same groove which is to receive the dark slide subsequently, and with its ground surface next to the lens. And it is important to ascertain, when purchasing an apparatus, that the ground side of the focussing screen, when in its place in the camera, does *really* occupy the same position with respect to the lens that the sensitive surface afterwards does; for if it should not, all the focussing upon it will be erroneous, and the photographs deficient in sharpness. But in well-made instruments, purchased of a respectable maker, this important point is sure to be attended to.

5.—The Dark Slide.

This is to contain the sensitive paper during its exposure in the camera.

Dark slides are made, either *single* or *double*. In the former, the paper is placed *behind* a sheet of plate glass; and in the latter, two papers are placed back to back, *between* two glasses. In either case, the glass should be entirely free from all imperfections.

Objections to the slides in common use.

There are, however, in my opinion, many objections to *both* these forms of slide. The glass *in front* of the paper, and consequently between it and the lens, absorbs and reflects a considerable amount of light, and thus prolongs greatly the necessary time of exposure, while it *disturbs the true focus*. It has also the effect of rumpling the paper as it becomes dry; and, upon an uneven surface, it is obviously impossible to obtain a *perfect* picture. Another

serious imperfection in the double slide is, that the light frequently passes through one paper and acts upon the other, thereby spoiling both pictures.

How to obviate them by straining the paper in front of the glass.

But all these disadvantages of the slides in common use may be obviated by attaching the paper to the *front* of the glass, instead of placing it *behind* it. This is done when the paper is damp (as I have described when treating of the second operation for negatives), and in a few minutes the paper becomes dry, and then lies as flat as the glass. The slides for this purpose should be similar to those in use for collodion plates, with this difference, that three-eighths of an inch of space, or more, should be allowed between the glass and the front shutter; otherwise, the paper, when first put in, might touch the wood, and thus be stained: for in this state, it must be remembered, that it does not lie so flat as it does afterwards, when dry.

The back of the slide should be *removable*, and not attached to it by hinges.

Like the rest of the apparatus, this form of slide should be seen to be understood and appreciated. I attach great importance to it, as an *essential condition of success*.

The plate-box and yellow bag.

When more than two or three views are to be taken in a day, it may be managed by means of one single slide, and a plate-box, containing a dozen or more glasses, with the sensitive papers attached. To change the papers, it will be necessary to retire to some *shady* place, and then to envelope the head and arms in a large bag of yellow calico, of double or triple thickness. Under this shelter the papers may be changed, without any fear of the light affecting them.

When only two or three views are required in a day, the better plan will be to use a separate slide for each paper.

When carried, the slides should be either enclosed in a case, or wrapped up in a dark cloth, and *never needlessly exposed to the sunshine*, for, in spite of every precaution, light seems to penetrate them in a manner quite un-

accountable. As a rule, no one should be allowed to touch them but the photographer himself. Let me advise him strongly, always to carry the slides and the lens himself, or to take extraordinary precautions when these are committed to the custody of others.

6.—To make the Solution called "Double Iodide."

Take a four-ounce, wide-mouthed, stoppered bottle, which keep for *this purpose exclusively*, and upon the outside of it make a scratch with a file, corresponding to the level of three ounces of fluid. Wash the bottle well, and finally rinse it with distilled water. Then fill it up to the mark with distilled water, and add forty grains of nitrate of silver. Dissolve this by putting in the stopper and shaking the bottle. I may remark here, that in weighing the chemicals, it is well to lay a piece of clean blotting-paper in each pan, balancing them exactly, and then to put the weights into one paper, and the chemicals into the other; in this way the necessity for glass pans is avoided, for the chemicals should never touch brass or copper.

How to weigh the chemicals.

The nitrate of silver being dissolved, add to the solution thirty-two grains of iodide of potassium, and shake well together as before. On the addition of the iodide, the solution will become extremely turbid and yellow. When the crystals are all dissolved, allow the precipitate to settle, which it will do in a few minutes, and then pour off very carefully as much of the fluid as is possible. The precipitate is *yellow iodide of silver*, and is quite insoluble in water. Wash it twice in cold distilled water, in order to remove all the nitrate of potass and other impurities. This is done by filling the bottle with distilled water, shaking up as before, allowing to settle, and then pouring off the fluid, repeating the operation a second time.

There is now clean iodide of silver in the bottle, moist-

ened with a little water, and this is to be dissolved in a strong solution of iodide of potassium.

To do this, add, first, one ounce and a half of distilled water, and 400 grains of iodide of potassium. Shake up well, and the whole of the yellow iodide will disappear, being dissolved in the iodide of potassium, and leaving the solution nearly colourless. Now add distilled water, a few drops at a time. Upon the addition of the water the surface of the solution will become instantly turbid, but it will clear again upon being shaken. Repeat this addition of the water until the solution no longer clears itself again, and then add a crystal or two of iodide of potassium, in order to restore its perfect transparency. In this state an exact balance will have been struck between the *water* and the *iodide*, and it only remains to filter the solution, which will then be ready for use.

As a guide to the quantity of water which ought to have been added the second time, the whole quantity of double iodide obtained should be *about* three ounces,—that is to say, it should reach the level of the scratch on the bottle, or thereabouts.

7.—The Paper to be Employed.

1st.—*For Negatives.*

Hollingworth's paper the best for negatives.

The best paper that I have ever met with for negatives is a THIN sample of paper manufactured by Messrs. Hollingworth (the successors of Messrs. Whatman). This paper gives an amount of definition scarcely inferior to glass. It is always employed by M. Flacheron of Rome, and was first introduced to my notice by that gentleman. It may be obtained of my publisher. There is a *thick* description of Whatman's paper, resembling drawing-paper, sometimes used in photography; but this should not be employed for any subjects in which delicacy of detail is

required. The texture is so loose and woolly, that the blacks appear to be covered with minute white specks. Nevertheless, this description of paper answers very well for rough, artistic studies, which depend more upon general boldness of effect than fineness of line. It gives strong blacks, and good half-tones.

The thin sort that I have recommended is not *entirely* free from spots, occasioned by particles of brass detached from the cylinders by which it is rolled. But the paper may be obtained *un*rolled, and in its rough state. It is then much more free from metallic spots. In this state it may be sent (either before or after iodizing) to any copper-plate engraver, to be rolled between glazed millboards in his press. The speckled appearance of the blacks, to which I have alluded as peculiar to Whatman's paper, is owing to the looseness of its structure. But this may be obviated by submitting the paper to severe pressure, and thereby rendering it denser and more transparent, besides glazing the surface.

Nash's paper. I have found Nash's paper tolerably good.

Turner's paper. Turner's paper, in my hands, seems to fail in giving sufficient intensity in the blacks. It is also liable to the frequent occurrence of spots. But good definition is to be obtained upon it, and a general harmony of effect which suits some subjects.

There is a peculiarity in the sizing of Hollingworth's paper which seems to be particularly favourable to the chemistry of the Calotype process.

2dly.—*For Positives.*

French and German paper best for positives. The best papers for positives are the hard, well-rolled, French and German papers, sized with starch. Of these the papers of Messrs. Canson frères, and also of Messrs. Marion, and the "Papier Saxe," are the best.

8.—Glass Baths, etc.

Glass baths.

These are made by cementing, with marine glue, wide strips of *thick* plate-glass (*flat* side downwards), to a plate-glass slab, which forms the bottom.

Slate baths.

A slab of slate may be hollowed out into a bath very successfully; and this answers well enough for some purposes.

Gutta-percha baths.

Gutta-percha baths are little acted on by the chemicals, and are *very flat at the bottom:* which is a great desideratum where expensive solutions are used.

In baths of very large size, a piece of wood, an inch thick, is cemented to the bottom; one corner being cut off in order that a small pipe of gutta percha may be affixed to the bath; and which may be inserted into the neck of a bottle, when it is necessary to draw off the solution. The tube is furnished with a plug, or lengthened stopper, which passes through the liquid when in use.

9.—The Paper Clip.

For a woodcut of a very simple clip of my own invention, see the "Photographic Journal," for September 1854, and some comments upon it in the two succeeding numbers.

There are also some very good American clips, to be obtained of the publisher, at 1*s.* per dozen.

Separate sets for separate purposes.

Separate sets of clips should be set apart for separate purposes, as when used indiscriminately the wood soon becomes stained, and communicates its stains to the papers.

10.—Glass Tubes.

These are to form the handles of what are called "Buckle's brushes," used in applying the sensitive and the

developing solutions. For papers of all sizes they should be about three inches long and half an inch in diameter. To form a Buckle's brush, push one half of a tuft of cotton wool (chemically clean) into the tube, and allow the other half to remain out, and form a sort of mop.

11.—The Sensitive Solution.

I have given this of the *full strength*. There may be circumstances of temperature, &c., under which it might be desirable to reduce it, possibly as much as *one-half*. I have occasionally used it of only *one-fourth* this strength, and with perfect success. With some qualities of paper, it may be advisable to omit altogether the gallic acid, particularly during hot weather.

12.—Washing Glasses and Tubes.

Importance of chemically clean glasses and tubes.

I have stated that gallo-nitrate is an *exceedingly unstable* compound. It is not enough that vessels which have once contained it should be washed with simple water, for a single particle of the old solution remaining in the pores of the glass will be sufficient to establish rapid decomposition in the whole of a fresh solution, and that by a process in chemistry called "catalysis." This decomposition of the gallo-nitrate solution is particularly fatal to *paper* work.

To prevent it, wash the glasses and tubes which have been used for this compound, either with a weak solution of "cyanide of potassium," and then in abundance of water; or, better still (as the cyanide is a dangerous poison, and very unsafe to employ when there are any cuts or scratches upon the hands) in the following manner:—

First in water, then in the hyposulphite bath for a minute or two; then in water copiously; then in either soap and water or salt and water; and finally in abundance of clean water, changed three or four times.

This washing *must positively be attended to*, or every picture in which the same tubes and glasses may have been used a second time without it will invariably fail.

The glass developing slab is an exception to this rule; it will be sufficient to wash that and the gutta-percha dishes simply in an abundance of plain water.

13.—On some different Modes of Iodizing the Paper.

First Method.

Make a solution of nitrate of silver of the following strength:—

1 ounce .	. Distilled water
16 grains .	. Nitrate of silver.

Float the paper on this for one minute, and hang it up to dry in the dark.

When dry, immerse it in the following solution:—

20 ounces .	. Distilled water
1 ounce .	. Iodide of potassium.

This converts the nitrate of silver in the paper into the iodide of silver—with an excess of iodide of potassium, which entirely destroys its sensitiveness.

Allow it to remain for two minutes on the bath, and then hang it up to dry.

When dry, wash it in water for an hour or two, to remove the excess of iodide of potassium, as I have before described.

Then treat it, in all respects, like the other iodized paper.

Second Method.—By which a Bromo-Iodized Calotype Paper may be obtained; which is insensible to light.

This method is now published for the first time, and, so far as I have tried it, it seems to obviate some disadvantages attendant on the usual plan.

The use of bromine in this department of photography is one of the *vexatæ questiones*, about which much diversity of opinion exists.

For my own part, I cannot but think that the introduction of bromine with the iodine is a very desirable improvement.

If we refer to the early history of the daguerreotype process, we find that the simply iodized plates of Daguerre possessed but little sensibility; and if we consider the albumenized process on glass plates, as at present practised, with the albumen merely iodized with iodide of potassium, we find that process extremely slow in its action. I remember one day, in company with Mr. Macpherson of Rome, our exposing an albumenized glass plate, for one hour, to an extensive view of the city from the Janiculum, in strong sunshine, and the exposure turned out to be about right. The albumen in this case was simply iodized, it contained no bromine. Again, in the calotype process, unless the paper contain some size of an accelerating nature, the simply iodized papers have to be treated with gallic acid in the sensitive solution. It has frequently occurred to me, that a paper coated with the bromo-iodide of silver, and rendered insensible to light by a final washing in a weak bath of iodide of potassium, might permit of our dispensing with the gallic acid in the sensitive solution. And the trials which I have made of the following plan appear to confirm me in this opinion. But I give it as the result of experiments conducted in the depth of winter, and the reader may possibly be able to improve upon my proportions.

1st. Float the papers in the following bath for two minutes :—

1 ounce	. .	Distilled water
12 grains	. .	Iodide of potassium
2 grains	. .	Bromide of potassium.

Then hang up to dry in a feeble light.

2d. Float the papers in the following bath for three minutes :—

1 ounce	. .	Distilled water
40 grains	. .	Nitrate of silver.

We have now a bromo-iodide of silver in the paper with an excess of nitrate of silver ; so that it is now highly sensitive to light : but that is not what we want in the calotype process ; our object is to be able to carry about with us a stock of prepared papers *in*sensible to light, and which may be rendered sensitive at any time, *en route*, with the aid of the Buckle's brush, and without the nuisance of employing a *bath* of nitrate of silver.

On removing the paper from the nitrate bath, place it in a vessel of water, and wash it well (preserving the washings) to remove as much as possible of the excess of nitrate of silver. Then immerse it in the following bath :—

1 pint	. .	Clean rain water
1 dram	. .	Iodide of potassium.

This converts the small excess of nitrate of silver in the paper into the iodide of silver, with an excess of iodide of potassium. The paper therefore loses its sensitiveness.

After remaining for two or three minutes in this bath, remove it and wash it for an hour or two in water, in the manner described for the ordinary iodized paper, in order to remove the excess of iodide of potassium ; and when dry preserve it in a portfolio for use.

In sensitizing this paper the gallic acid may be omitted.

In all other respects follow the treatment that I have already described.

This paper appears to me to be quite as sensitive without the gallic acid as the iodized paper is with it; and it appears to preserve its sensitiveness much longer without discoloration. But that is not all. The details in the shadows and the dark foliage seem to come out better, and a more harmonious picture is produced. I shall give the result of my further experiments in this direction in my monthly publication, entitled, "Photographic Notes."

14.—The Stereoscope.

Large duplicate pictures of the same object, taken from different points, may be viewed, either in a reflecting stereoscope or by a pair of prismatic spectacles, and the effect is very striking and peculiar. If the photographic tourist will bear this in mind, his works, if well selected, will be found to possess considerable value and interest.

In some remarks on the Stereoscope which I have published in the third number of "Photographic Notes," I have described a method of constructing a stereoscopic magic lanthorn, fitted with photographic slides (coloured or uncoloured). When this instrument is exhibited, each of the spectators is to be furnished with a pair of prismatic spectacles, of cheap and simple construction. The two pictures on the white screen (which are magnified images of the photographs), when properly viewed in these spectacles, will appear as one possessing stereoscopic effect.

The photographic slides must be produced by printing from a negative superposed on the dry sensitive side of an albumenized glass plate.

If the print is on paper, the negative must be laid with

its *back* in contact with the sensitive surface, when the *reflecting* stereoscope is employed.

With respect to the distance apart of the two points of view. The stereoscope always dwarfs the object viewed in it, and represents it as a *model* of the original. The distance of this imaginary model from the eye may be determined thus. Find what ratio the distance of the object bears to the distance between the two points of view. Then the distance between the eyes ($2\frac{1}{2}$ inches) multiplied by this ratio, gives the apparent distance of the model from the eye.

Distance apart of the two points of view.

For instance, if we take a church-tower 100 yards distant from points of view 5 yards apart, and view the pictures with properly constructed prismatic spectacles, the single picture will convey the idea of a model of the tower, placed at a distance of 50 inches from the eye.

For pictures of 9×7 the distance apart of the two points of view should be about one-twentieth part of the distance of the object. No exact rules can be laid down. The artist should master the theory of the subject.

15.—Blotting-Paper.

That which has been employed for absorbing the surplus *sensitive* solution must not be used a *second time* for that purpose, but it may be employed for removing the surplus *developing* solution; and again, afterwards, if perfectly dry, in the ironing of the waxed negatives.

16.—Ross's "Focusing Magnifier."

This is a useful little instrument, for enabling us to examine the focus accurately on the ground-glass screen. It is composed of two lenses fitted into a tube (like the eye-piece of a telescope), and it can receive an adjustment adapting it to the sight of different operators. When in

use, one end of the tube is applied to the glass screen, and the eye to a small orifice at the opposite end. It magnifies considerably, and will be found very useful where great nicety of focus is required.

17.—The Pressure-Frame.

The best form of pressure-frame for sun-printing is that which opens at the back, and allows you to inspect the state of the print from time to time. These were originally manufactured in France, but they are now to be had at every repository of photographic apparatus, at a tolerably cheap rate.

18.—Some Remarks on the Waxed-Paper Process.

I have experimented considerably with the waxed-paper process, and a great number of negatives on waxed paper have at different times passed through my hands. I have observed, as a general rule, that these are somewhat deficient in sharpness of definition and purity of the lights. On the other hand, I am inclined to believe that the half-tones and the details of the shadows are sometimes better exhibited on waxed paper than by the calotype process; which circumstance I attribute entirely to the presence of bromine in the formula for waxed paper. I grant, therefore, most willingly, to the waxed-paper process considerable merit in the *artistic* character of the results. The faults to which I have alluded appear to me to be principally owing to the imperfect method of waxing the paper, and to over-exposure and over-development. By employing the waxed-paper formula on thin Hollingworth's paper *not previously waxed*, very fine results may be obtained. The principal objections that I make to M. Le Gray's formula are, the introduction of such a variety and quantity of organic matter,

which, in common with the cyanide and fluoride in the iodizing solution, appear to be of very questionable utility. At any rate, most excellent results may be obtained *without* them ; and we should always endeavour to simplify a formula as much as possible, unless we are able to *prove* the utility of an additional ingredient by an appeal to facts.

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