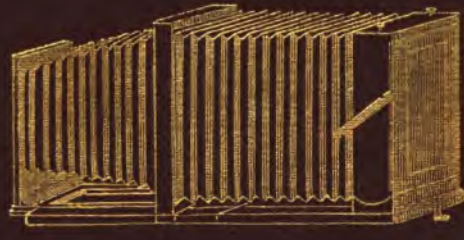
THE AMATEUR'S PHOTOGRAPHIC GUIDE BOOK.



STILLMAN.

1874.

THE AMATEUR'S

PHOTOGRAPHIC GUIDE BOOK,

BEING

A COMPLETE RÉSUMÉ

OF THE MOST USEFUL

DRY AND WET COLODION PROCESSES

ESPECIALLY FOR THE USE OF AMATEURS.

By W. J. STILLMAN.

PUBLISHED BY M. P. TENCH,
[Late C. D. Smith & Co.,]
PHOTOGRAPHIC INSTRUMENT MAKER,
153, FLEET STREET LONDON.

1874.

TO MY FELLOW-MEMBERS

OF THE

AMATEUR PHOTOGRAPHIC FIELD CLUB

THIS LITTLE BOOK IS RESPECTFULLY DEDICATED WITH KEEN PLEASURE IN RECALLING THE DELIGHTFUL DAYS SPENT WITH THEM IN EXPLORING THE LOVELY NOOKS OF ENGLISH LANDSCAPE, AND IN THE HOPE THAT MANY YEARS MAY SEE OUR NUMBER UNDIMINISHED.

London, April, 1874.

Chapter I.

The improvements made in the appliances of photography are so great, and the simplicity and certainty of its practice (brought about by the commercial applications of the discoveries of the host of experimenters and practicians all over the world) are such that, so far as the practical results are concerned, it is an art within the reach of every one who has the inclination and leisure to attempt it. The number of skilful amateurs in England is already very considerable, and the work shown by some of them is literally the very best of its kind the world can show. The investigations and elaborate scientific experiments which some of them have undertaken and carried through have so completely explored the ground, and so largely aided to establish its practice, that, more than any other study allied to science, it may be called the result of amateur investigation. Even of those who have become professional photographers, so many were amateurs drawn into it from pure love of it, fascinated by the artistic charm inherent in it, and drawn to a more

devoted allegiance to nature by the closer insight it has given into her traits, that, while it will scarcely be admitted by general consent to a position amongst the fine arts, we find it impossible to deny the title of artist to some of them, or of an essentially artistic character to the occupation—so many opportunities does it offer for the display of the artistic instincts and perceptions; while the apparatus has been so much simplified, and the chemical manipulations even now comprised in the practice have been so much anticipated by regular manufacture, that there is no reason why every tourist, every scientific student of nature, and every artist even, should not avail themselves of this most rapid and precise aid to memory, to illustration, and to scientific research, *without appreciable trouble or loss of time.* Cameras are made which may literally be carried in the pocket, and the sensitive plates ready to receive the impression are manufactured of greater reliability than they can be prepared by the average amateur. The chemical operations are so much simplified that three four-ounce vials contain the whole requisites for the summer's working of an amateur; and even the paper for the prints is furnished ready for the printing. An expenditure of a few pounds will enable any traveller to illustrate his own travels, and the

tourist who does not indulge the *cacoethes scribendi*, to preserve in his album the transcripts of every scene worth his transcribing. Considering the facility of the acquirement, it is surprising that so few comparatively have learned it, and it is safe to conclude that the principal reason is that the extent of the commercial improvements is as yet imperfectly understood. It is my intention in this little book to make it clear that, to any one of tolerable practical capacity, two or three hours' study will suffice to be put in the way of what is, after all, the only final master—experience; and that patience and exactitude only are needed to realise all that the taste can require of the art.

The amateur whose leisure is not great, whose means deter him from large expense, or whose aim is to accomplish only a special class of work, will do well to limit himself rigidly, for a time at least, to some speciality, for the double reason that excellence is far more easy when only a single set of rules and directions is to be followed; and that a tolerably complete success in doing one thing well is exceedingly encouraging when one attempts another acquisition in another branch of the art. Experimenters do not always succeed even in the simplest line of work; but the man least likely to do anything really good is he who starts with the intention of doing every-

thing, and so encumbers himself with complications of apparatus and processes that he wearies himself with unsuccessful experiments before he has done one thing which gives him the satisfaction of a triumph. Young photographers start off with emulous enthusiasm, having seen the admirable work done by so many amateurs (for all good work seems so easily done that it is the first quality of it to excite emulation), and, instead of concentrating their ambition on a single point, almost invariably attempt to do what even professionals, always at work and always studying, rarely pretend to do—carry on the various branches of photography at once.

The student who has a definite scientific or pictorial demand to meet is fortunate, and with average common-sense and tolerable patience is certain to accomplish what he needs. To mark out for those who know nothing whatever of what may be done or how anything is to be done what is necessary for each particular branch of photographic reproduction of nature, and what seems to me the simplest and most certain way to attain it, will be my first task; and if I seem to those more or less expert somewhat trivial in my directions it is because I know by experience that the surest way to acquire a good original method is first to acquire with precision and minuteness

some other person's method, and then, when you feel the freedom of success, you may take liberties with your regulations, and enlarge them to suit your inventiveness, if you have any—if not, you remain always safe in the known and trustworthy directions.

Two branches of the art present themselves at the outset for consideration, and according to the choice of the amateur will be the directions which he must follow. If his taste be only for landscape his apparatus may be simple and inexpensive, and his labour reduced to the minimum by the use of commercial dry plates, which improve in excellence with every season, and the employment of which, from the side of economy as well of money as of time, is preferable to preparing his own plates; while, with a concentration of his attention merely on the development of his pictures, he will attain better results than he is likely to arrive at with the same expenditure of trouble in any other way.

In this part of my manual I shall, therefore, give such directions as will be required by an amateur who only attempts outdoor work with dry plates, supposing him to have these prepared to his hand; and shall then give those requisite for outdoor operations with wet collodion, leaving preparation of dry plates in full, and the more

complicated matters of indoor portraiture, grouping, instantaneous work, &c., to the appendices. The use of dry plates need not prevent the operator from taking figures, either as pictures or studies, in a bright light; but, in general, rapid satisfactory results are not attainable save with much experience with dry plates. In a good, early summer daylight I have taken groups in small size with Liverpool extra-rapid plates—a Dallmeyer rapid rectilinear requiring only about five seconds' exposure of one of these plates; but such pictures will not, for optical reasons presently to be noticed, be satisfactory as portraits, while, if larger portraits be attempted in any ordinary outdoor lighting, the results will be still less agreeable, so that, on the whole, the dry-plate worker had better limit himself to such objects as will permit an exposure of one minute and upwards, a dry plate having no limit in that direction. It is quite possible to take tolerable heads with dry plates, but it will require a special portrait apparatus; for the lenses fittest for outdoor work will not be quick enough for indoor portraiture, and that degree of delicacy in modelling and rendering of slight details which is sufficient in landscape, or even in small figures considered as accessory to landscape, is not so when applied to the human face. The open

sky gives a light which is very difficult to manage, and any attempts at out-of-door portraiture, *even with wet collodion*, had better be deferred to the time when experience has made the way easier; while dry-plate work is still less likely to be successful.

The extreme of portability and economy in the use of material is given by the so-called "Pocket"

Camera, (invented by Mr. C. D. Smith, of 153, Fleet-street, to whose ingenuity we are indebted for many devices to render photography more easy for tourists and amateurs especially), fitted with a single combination landscape lens. It

gives pictures of the size of $4\frac{1}{4} \times 3\frac{1}{4}$ or 5×4 inches (or may be made larger if required, but these will be found exceedingly convenient sizes), and in these dimensions may easily be carried in the pocket of a paletot, with all its accessories, except the tripod, which makes a staff.

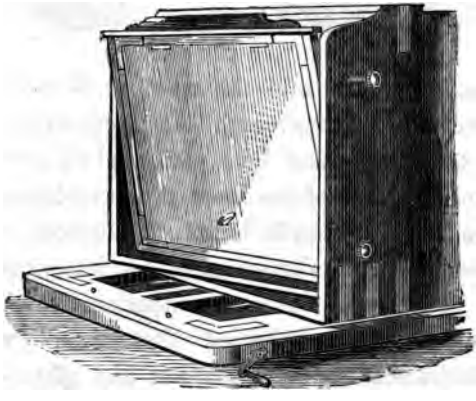
The lens is what is known as the meniscus—the most convenient for use where a brief exposure is not imperative and no straight lines occur in the margins of the picture. It brings the distance and foreground into focus more equally, and covers the whole plate with more sharpness than a double lens, and is considered by experienced landscape photographers to give a more brilliant and satisfactory negative than any other form. The next size larger, most to be recommended, is $7\frac{1}{4} \times 4\frac{1}{2}$, or, as Mr. Gordon prefers, $7\frac{1}{4} \times 5\frac{1}{4}$; but the former seems to me preferable, as it makes a print which answers admirably for illustration for an ordinary octavo volume, and, at the same time, by the addition of a partition in the centre and a pair of stereoscopic lenses, may be used for taking stereoscopic negatives. Larger sizes than this, the most convenient for general purposes, are 8×5 and 8×10, beyond which an amateur will rarely care to venture. But, in fact, for an unprofessional photographer the $7\frac{1}{4} \times 4\frac{1}{2}$ will be found sufficient for every purpose of pictorial re-

presentation, and a larger size becomes more or less burthensome to a tourist. For the purpose of securing *souvenirs* of a journey the 4 × 5 will be found sufficient; while the new improvements in enlarging negatives introduced to public convenience by the Autotype Company enable a 4 × 5 negative, if perfect, to be enlarged to several times as large, if requisite.

If a larger size than the pocket be decided on, the simplest and most portable camera is this, supposing only pure landscape is required.

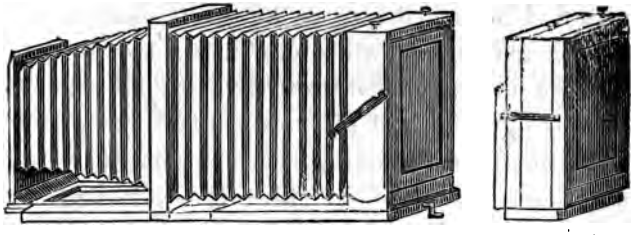
When the purpose of the amateur is to include architecture, a more complicated camera and a doublet or compound lens which shall preserve the rectilinearity of the lines of the buildings are required. The simple lens, of whatever form, produces a certain distortion of the image which, in the landscape lens recommended, is what is known as "barrel-shaped distortion," where parallel lines at opposite sides of the plate curve outwards at their middle like the sides of a barrel. The doublet or rectilinear lens corrects this ten-

dency, and restores the lines to their true relation. But, as it often happens that the camera must be pointed upward to include the whole of an architectural arrangement or single building even, the ordinary camera would give at such times a convergence of all the perpendicular lines, to obviate which the back of the camera holding the plate is made to swing in such a way that it shall always remain parallel to the plane of the building to be photographed, by which the parallelism of the lines of the structure is preserved in the photograph. Of this arrangement, known as the "swing-back," there are two forms adopted and to be recommended—the ordinary, shown below,



and one that I have lately invented and adapted to a camera, which offers certain advantages for

the use of architectural and scientific amateurs, and which is here shown.



The advantages of this camera are these:—It is very compact and as readily got into position as any of the simpler forms, and by its extreme capacity for extension enables the photographer to use a great variety of lenses of longer or shorter focus, so as to become, in fact, capable of magnifying objects of still life, of scientific interest, &c., &c., to the extent of six diameters, producing details of architecture of large size from a distance, or, on the other, of using the short-focus stereoscopic lenses as well as the smaller cameras. The swing of the back is regulated by the screws at the top, and is not only vertical, but lateral, permitting one side of a view which may be nearer than the other to be equally brought into focus.

In whatever branch of the art the amateur may feel inclined to venture he must always bear in mind that the apparatus is responsible in great

part for the quality of the results, and that no inferior implement is cheap. If he succeed he will find himself drawn on by the fascination of the occupation, and will add to his stock of lenses, enlarge his size of plate, and diversify his collection by new styles of pictures—in fact, the great drawback to photography as an amusement is the absorbing nature of it. Like the collecting of antique gems, Damascus blades, old porcelain, or any other article which develops the taste, the desire of acquisition often drives the amateur beyond the limits of prudence. Fortunate is the neophyte who is measureably content, and is more eager to do one thing well than all things indifferently. Making a collection of lenses is no joke; for, with the diversity of arrangements now produced by the opticians, each having a peculiar and occasional use, and with the desire to work a size or two larger which almost invariably comes up after a little experience, the number of lenses one accumulates in a few years is sure to be beyond the most liberal estimate with which he makes the first venture.

To return to the first step and the simplest appliances, we shall, by the plan I propose, plunge *in medias res*, and take a picture at once. The experiment with the commercial dry plate will serve a double purpose—enable the student to

enjoy what is really the most fascinating part of the business without the drudgery of preparation, and allow him to ascertain at the minimum of expense if he is likely to succeed and has the patience to go on; while, if his time be limited, or his ambition, he may be content to give all his attention to the refinements and artistic requisites, the choice of subject, exposure, and development of the picture.

There are several kinds of dry plates now produced and sold at reasonable prices which offer good chances of success to the amateur. The easiest of use, and giving the most satisfactory result with the minimum of labour and skill, are, in my own experience, the Liverpool Dry-plate Company's. Besides these, there are Colonel Wortley's, of extraordinary quickness, and the Russell and collodio-albumen, made by Pollitt and Co., Manchester—the latter being, in the hands of patient and dexterous manipulators, capable of giving the best practical results of any dry plates, but too difficult of development for inexperienced persons. The Wortley plates I can say less about; but, as I have found them, as well as the collodio-albumen, less easy of development than those I have recommended for the first essay, it is advisable that the trial of them by a beginner be delayed, as they are at least less likely

to be satisfactory than plates which, without the same sensitiveness and, possibly, other good qualities, are more certain in the hands of one unused to all photographic manipulations.

The plates come in packages of one dozen each. These packages should be opened carefully in a yellow light, and the plates put at once in a plate-box, which should be light-tight and be kept in a dry closet. A common tallow candle will serve for working or examining plates by, but wax or stearine will have sufficient actinic power to affect the films. The camera should be provided with double slides for two plates each, and, before putting them in, the collodionised surface should be gently dusted with a camel's-hair brush, such as is used for damping paper for the copying-press, care being observed that it is perfectly dry and clean and is never used for any other purpose.

The plates having been put in the slide by the yellow light (a small room lighted by a window glazed with *ruby* glass will be better than the candle if all stray beams of white light be carefully excluded, but, in default thereof, let it be done by the tallow candle the night before exposing the plates) the operator proceeds to select his view and focus it. This should always be done with the full opening of the lens, and if the

view be a broad one, with a distance equally distant, the focus must be found on a point about one-third the length of the plate from either end; if a deep view, like a lane scene, with the extreme distance near the centre, then this distance should be in the sharpest focus. The real field of any lens is of the shape (approximately) of that of a portion of the surface of a sphere, the concavity being towards the view and the lens; and the nearer the object to the lens the farther from the lens will be the point at which the image of it will be formed. The sides of the plate, therefore, being farther from the lens than the centre, are better situated for receiving the image of nearer objects; while, if all the objects included be in the same plane, the point one-third from either side will generally put the most important part of the view into focus, and the whole will be tolerably sharp when a small stop is used.

Having adjusted the camera to the view, move the lens (or camera-back, whichever may be the movable part of the camera, as this differs in different forms) so as to increase gradually the distance between the ground glass and the lens, looking at the former all the time under a focussing cloth (black cotton velvet by preference, unless you like the expense of silk velvet) so as to see the image more clearly, until the view

appears sharp and clear on the glass, as described above, when put on the cover of the lens, insert the stop required (the effect of the stop being to make the detail more definite over all parts of the field not in perfect focus, but at the same time to prolong the time of exposure), put the slide in place, and then draw out the shutter of the slide, and uncap the lens, after which let nothing touch the camera, or any other part of the apparatus, until the exposure is over.

The duration of this will be according to circumstances—the conditions which will differ being the intensity of the light, the power of the lens and size of the stop used, and the sensitiveness of the plate. The first of these the most experienced photographer will sometimes be mistaken in, and no rule can be given except in the most general terms. The beginner should never venture on dimly-lighted scenes or interiors, but select a bright day and an object in clear sunshine. With such a view, an ordinary landscape lens, and the slow Liverpool plates, I used to give four to six minutes with the smallest stop of the lens, in Greece and Italy. In England I have found the exposure required to be about one-half longer in the spring time. Using a Dallmeyer rapid rectilinear I have generally given the same plates in the East two minutes with the No. 4 stop, and

three minutes in England. The collodio-albumen require about the same time; the "rapid" Liverpool half as long to one-third; and the "Russell," of Dawson's manufacture, about the same, the Wortley plates being somewhat quicker than these. The simplest plan to learn the exposure requisite is this:—See that the sliding shutter of the plate-holder moves very easily, so that you may draw it out without producing the least motion in the camera; then place the camera in the position on the tripod that enables you to draw this flap out laterally, so as to expose the plate at the end only, and gradually uncover it from side to side. Now adjust the view, tighten the screw of the tripod so as to make the camera rigid, and, instead of drawing the slide out the whole length, draw it a quarter of the way and uncap the lens. When it has had two minutes' exposure cap the lens again, gently draw the slide out another quarter, uncap, and leave it two minutes longer; then another quarter and another two minutes; and then the whole distance; and after another two minutes put on the cap and close the slide. If the camera has not been moved, all parts of the view will be sharp; but on development it will be seen that it shows four different degrees of exposure, the last having had only two minutes, the former

four, six, and eight respectively, and the development will show which is right. Or a safer plan is to expose four plates in rapid succession—two double plate-holders being used—two, four, six, and eight minutes, supposing in both cases a single view lens, stopped, and slow Liverpool plates, on a fair summer day in England. [The exposure required in September will be three or four times that needed in April—the latter month, and May, being most favourable for photography.] The two minutes' plate will almost certainly be much under-exposed, the four minutes' probably somewhat so, and the six minutes' will be more likely to meet the average requirements than the eight.

Here however, again, much depends on the development. Supposing the four minutes' exposure to be just sufficient, a careful development will make a better negative of the six minutes', and may make a good one of the eight. The development is conducted as follows:—Rub off with a moist sponge or coarse linen cloth the red pigment from the back of the plate, and then take it up on a pneumatic holder; pour over it alcohol diluted with an equal quantity of water, after which wash under a tap until the water flows over it freely and without any appearance of greasiness; then pour on it a solution of pyrogallic

acid of the strength of three grains to the ounce of water, and let it remain on a minute or more, keeping it flowing on the plate by rocking it gently so that no corner of the film gets dry. [Or a more certain plan with the inexperienced worker is to use a shallow tray very little larger than the plate, and put enough of the solution into it to cover the plate.] After being in the solution of pyrogallic a minute or two the high lights ought to appear on the film very faintly, darkening its surface. If this take place the exposure is about right; if it appear very quickly, and all the subject be seen, the exposure was too long; if nothing appear, the time was too short. In the first case, add one drop of a solution of bromide of potassium, of the strength of ten grains to the ounce, to the developer, and six drops of a dilution of aqua-ammonia (of the highest strength) with twelve times its bulk of water—*i.e.*, one ounce aq. am. fort. to twelve of water—and mix the solution well in the glass; then return it on the plate, when the details will appear and grow stronger. After another minute or less, as experience will teach, hold the negative up to the light, and you will see that the sky and brighter parts of the view appear blackish, and this density will increase as you go on adding ammonia, drop by drop, and continuing

the development, the addition to be made at intervals; but when the sky, or densest part, no longer permits you to see readily the illuminated objects round the candle or bars of the window through the film you must stop the development. If then the details in the deepest shadow be not faintly visible the exposure was still too short. If the shadow portions begin to grow dark altogether you must wash off the developer at once, and if then the lights are not sufficiently opaque the opacity must be increased by a treatment which I shall describe presently; but the negative should be now fixed in either case by dipping in a tray containing a solution of one ounce of hyposulphite of soda to ten ounces of water, and leaving until all the milky-white, unchanged part of the film is dissolved out, when wash carefully under a gentle stream of water for a couple of minutes. In case the whole image appears rapidly on pouring on the pyrogallic acid, put five drops of the same bromide solution in the developer, return to the plate as before directed, and leave for a minute, waving back and forth, when add a single drop of ammonia, and increase, drop by drop, until the requisite opacity is obtained, when fix, as before, in the hyposulphite. If nothing appear after applying the pyrogallic add ammonia, drop by drop, returning the solution

to receive each addition; but in this case you can hardly expect to obtain a good picture. If it be very much over-exposed more bromide than above directed must be added before any ammonia; but in this case also it will hardly make a satisactory negative. But with a little experience you will manage to save a plate exposed twice or even three times as long as is really necessary.

The general law that you should remember is this:—If the exposure be just, the application of a strong solution of pyrogallic acid will show faintly on the film all the brilliantly-lighted parts; if the exposure be too little you will only see the sky line, and the whole sky will appear slowly and darken slightly; if too long the lights will start out quickly, and the shadows rapidly become veiled. To prevent this more or less bromide solution must be added to the developer, according to the quickness with which the image comes out.

With the extra-rapid Liverpool and other very sensitive plates a trace of bromide should be added in all cases before the ammonia. Colonel Wortley uses a very effective developer, which contains a large proportion of ammonia, but I have not found this answer so well for the other varieties of commercial plates, and it is more hazardous for beginners. I shall, therefore, advise trying it later, by his formula, when experience has made it easier to correct mistakes.

The apparatus requisite for these operations is, besides the camera and its fixtures, a pneumatic plate-holder, or two or three shallow trays a trifle larger than the plate, made of flat glass set in a wooden frame, somewhat like a school slate, the latter being the safer for a beginner, but the former much the most convenient when sufficient skill is acquired. If you use the trays lay a thread across before putting the plates in, to lift it out by. Not indispensable, but *very* convenient, are the pneumatic dropping-tubes (either fitted to bottles or made to pass through a cork after a fashion which I introduced a year or so since, and which can now be obtained of most photographic dealers) and an india-rubber water bag, with a long flexible tube and dip, which, being hung up above your sink or wash-bowl (I generally use my wash-bowl when travelling), will give sufficient head of water to wash effectively and rapidly. The solutions will be carried in three bottles, each having its dropping-tube; and a small bottle of common methylated alcohol does for the first wetting, being returned to the bottle and used over and over again, with occasional filtering.

The greatest care should be observed not to allow the plate to become partially dry while developing; and should one corner of it become so, the developer must be poured off, and it must

be wetted again with alcohol and water before returning the developer, and this, of course, will necessitate washing the whole surface once more after the alcohol. With the trays there is scarcely a danger of this.

I have never found difficulty in obtaining sufficient intensity in the Liverpool or Russell plates with alkaline developer alone; but if the plate should not be dense enough to print with, it may be intensified by the following method:—If the negative has not been "fixed," *i.e.*, had the unchanged bromide of silver dissolved out by hyposulphite of soda, it should be carefully washed after the alkaline development, and covered with a solution of pyrogallic acid of about one grain to the ounce of water, with a few drops of a solution of nitrate of silver of the strength of twenty grains to the ounce, with the same quantity of citric acid, and keep this flowing back and forward until the requisite density is obtained. If the negative have been fixed, wash it well and cover it with a solution of iodine and iodide of potassium (about one grain each to the ounce of water is a convenient strength) for a minute, and then, after washing, again apply the pyrogallic acid, with nitrate of silver and citric acid as before.

A convenient manner of using the pyrogallic acid is to dissolve one ounce of it in three ounces

of absolute alcohol, and of this solution four minims will contain about a grain. The dropping-tubes I have mentioned have the minims marked on them; but if the alcoholic solution be dropped in you must allow two drops to one minim.

I have written throughout as if the operations were to be performed without the assistance of an expert, though, of course, it would be much better to see a practical photographer go through the operation before undertaking it. If, however, this is not practicable, I think that the above directions followed with care will suffice.

It will be found very useful to have some of the sensitive paper, which is now sold at many shops for photographic materials, always with you, keeping it in a blank book under pressure, to try the negatives when the first are made, in order to judge what the proper density is—experience alone giving the right judgment of this point.

You must expect to waste *at least* a dozen plates before getting a really good result; so do not let the first failures, all but inevitable, discourage you.

In using the more sensitive kinds of dry plates failures very often result from two causes—working by a light in which there is too much actinism, as in the yellow glass furnished for use in the wet collodion process, which is not sufficiently deep or

red to protect the sensitive bromide film; and from pushing the development too rapidly, the strong ammonia sometimes producing small transparent spots on the plate, and sometimes causing the shadows to be veiled all over even when exposure has been right. Nothing in photography need be done in haste.

Chap. II.

WET COLLODION.

The apparatus so far described is, except the dropping-bottles and trays, equally necessary for wet collodion, and if the success of the experiments in dry plates has been such as to encourage the experimenter to go farther, he will find the operations with wet collodion not very much more difficult than the foregoing.

A "dark-room" is necessary—one in which all light entering shall come through orange or ruby glass. There may be as much of this as you like, and wet collodion is even not so sensitive to yellow light as the dry bromide plates. All cracks and holes which may admit light must be carefully

stopped, and the door should have a black curtain before it, so that anyone entering carelessly may not expose a plate during development to a chance ray from this source. Next provide a sink, not less than two by four feet, with a waste pipe; a tank and tap over it.

You will require a vertical bath of glass, or of wood lined with pure india-rubber or wax (vulcanite or porcelain will answer), for the nitrate of silver solution, with a dipper to let the plate down and raise it out again; one either vertical or flat, for the fixing solution; the same developing glasses used for dry plates; a plate-holder, either pneumatic or other, there being many forms in the market. The fixing-bath will be the same as in the dry process. Procure a bottle of negative collodion. There are numerous excellent kinds in common use, and easily procurable at any photographic dealer's—Mawson's being excellent for portraits; Huggon's having a quality which enables the plate to be kept a long time between sensitising and development; Rouch's; Blanchard's, the most satisfactory for landscape work I have ever used; Edward's, recommended for great sensitiveness, but dearer than the others. But either of them will do, Huggon's perhaps having an advantage for a beginner, that it sets more slowly

and enables the coating to be done more deliberately. Make a solution of sulphate of iron of the strength of ten grains to the ounce of distilled water, with an addition of thirty minims of glacial acetic acid; a solution of nitrate of silver, thirty grains to the ounce of distilled water, sufficient to fill the bath to within an inch of the top; a plate-holder, for *cleaning* the plates; and a bottle of a cleaning compound composed as follows:—One ounce tripoli, one ounce common alcohol, five ounces water, and two drachms of ordinary spirits of ammonia; and, with a broad camel's-hair brush, you have all the outfit necessary.

Begin by cleaning the plate, which is of the utmost importance, as, if not well done, it is impossible to get a good negative. Put the plate in the plate-holder, screw it firmly in, and pour on the centre half-a-teaspoonful, more or less, of the tripoli mixture, and with a pledget of cotton-wool or a clean linen rag rub it rapidly all over the plate, and continue to rub it a minute or more with some force, when, with another pledget of wool, rub off all that it will remove, and finish with a third, or with *papier* Joseph—a fine, soft, chemically-clean French paper—or with old linen well washed in soda and rinsed thoroughly. Chamois leather is used by some, but the old linen is more satisfactory in my own experience.

Clean half-a-dozen or a dozen plates before coating the first, as, when newly-cleaned, they are electric and attract dust. The cleaning should be done out of the operating-room—if possible several hours before, but not several days, or even one day, unless they are kept in tight grooved boxes, as the glass attracts a deposit from the open air if kept in it, and must be cleaned again. When you are ready to begin operations put your silver solution in the bath, having taken the precaution to wash the latter thoroughly, finishing with a little distilled water. Put the dipper in the solution (a silver wire bent in the form of a ⅄, with hooks to receive the edge of the plate at the ends of the diverging limbs, makes the best dipper; next to this, one of mahogany, saturated with pure bees'-wax); take your plate on the pneumatic holder and dust it slowly with the camel's-hair brush; and then, holding it level, pour the collodion on, as shown in the following diagram, the circle A A showing about the extent of the glass which should be covered by the collodion when the pouring ceases. This pool will, of course, spread if the plate be held level, and cover finally a much larger space; but to secure an even and available film it must be made to flow over, and a portion of it off again. This will be done by inclining the plate slightly, so that the pool flows in the direc-

tion of 1 until it reaches the corner, when the plate must instantly be tilted to allow it to flow towards 2, and the edge of the pool takes the form C C. When the edge touches 2 incline the

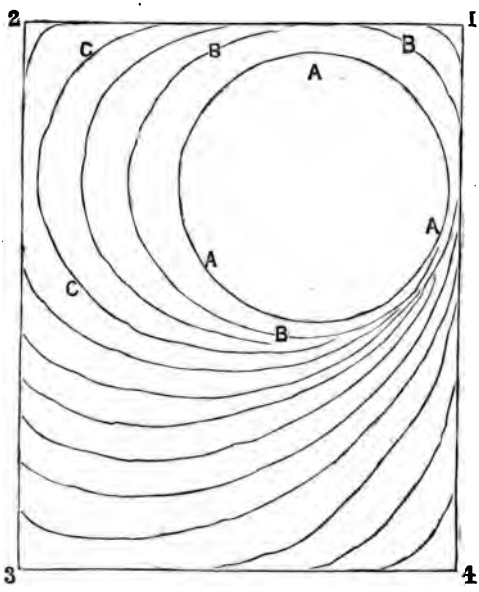


plate again, so that it shall flow as the succession of lines indicates towards 3, and finally off at 4 into the bottle again, or, what is better, into another bottle kept for the purpose, to prevent specks of dust, which may get into the collodion on the plate, getting into the pouring-bottle and thence into the subsequent film, as well as preventing

the deposit at the bottom of the bottle from being stirred up. The change of the bottles will require a little dexterity, as it must be done without taking the eye from the plate or allowing the flowing of the collodion to hesitate an instant, as the least stoppage makes a line and endangers the coating of the whole plate. It will be better at first to allow the collodion to flow back into the same bottle from which it was poured, and the second bottle may be more easily brought into play afterwards.

This operation of coating the plate is the most difficult in wet collodion, and the beginner is very dexterous if he does not fail dozens of times before he succeeds once. It must not be done too quickly, because the film would be left too thin; it must not be too slowly done, as that makes ridges, and the collodion sets before the film has been entirely formed, and the plate is not completely covered. It must be done without haste and, if possible, without waste, as if the collodion runs over the edges of the plates and gets on the under side it makes the film set more slowly on the parts opposite. It must be done deliberately and regularly, the flow being at the same rate from beginning to end of the operation. Some pour the collodion on in the centre of the plate, which makes inequalities much more likely.

When the surplus collodion begins to run over the corner 4, raise the opposite corner 2 slowly and steadily, to enable as much of the collodion to run off as will, rocking the plate from side to side as it runs, so that the flow shall be alternately in the direction of the edge 1-4 and 3-4, otherwise there will be small ridges formed in the direction of the flow, which will make crapy marks on the negative.

As soon as the collodion no longer flows from the corner of the plate, and the film at the corner 4 has become set so that the finger leaves a print on it without lifting the collodion in the least, the plate is ready to dip in the silver solution. To do this the dipper must be withdrawn from the solution, so that the lower end rests on the edge of the bath. The plate is placed on it and lowered steadily, without an instant's hesitation or pause, until it is entirely covered by the solution. Not in too great haste, either; from one to two seconds should be occupied in the immersion, and if a pause be made there will be found a line across the plate where immersion was checked. If it go in too rapidly, the rush of the solution up the film will be likely to make streaks at the lower edge, where the dipper breaks the regularity of the flow along the surface of the plate.

The first plate with a new silver solution should be allowed to remain in it for several hours, as the solution will dissolve a certain amount of the iodide of silver formed in the film, so that the film comes out marked over the whole surface with transparent spots and blotches; but the solution once saturated, the subsequent plates enjoy perfect immunity. Some operators prefer putting a little iodide of potassium in the bath, which forms a certain quantity of iodide of silver, with which the solution is at once saturated; but this method involves most careful and tedious filtering, while by the method I recommend, if the water be properly distilled and the crystals of nitrate of silver selected to make the solution, it will be free from floating particles of any foreign substance, and by working carefully you may go on for many plates without filtering. This process, which will become necessary later, and which is a nuisance, will be treated of with particularity, as well as many other points of importance which the beginner will soon stumble over, in the appendix on Baths. A few specks and "pin-holes" will not much matter to the beginner, as he will not expect to make perfect negatives from the outset.

If the collodion be well ripened—which will be known generally (or ought to be) by its colour,

which should be, for a beginner, about that of a brown sherry—there will be no need of acid in the bath; but if the collodion be colourless, it will be best to put about five minims of pure nitric acid to every ten ounces of bath.

Your first plate is, of course, good for nothing; but if you are impatient to be working while the iodising of the solution is going on, you may practice coating plates, at which you will probably—unless you are dexterous beyond the average—waste the better part of your first bottle of collodion before you get a perfect film. A good plan for the impatient is to prepare your solution over-night, and leave a coated plate in it until morning.

Now, suppose you intend trying a picture. Having selected your subject (do not be so thoughtless or unkind as to begin with a portrait of your friend, and do not attempt portraits in general without a properly-constructed glass room), and got it carefully focussed with the full opening of the lens, stop the lens down until it gives the definition you require. Put the cap on the lens, and go to prepare your plate. If you wait to arrange your subject until you have got your plate coated you will be hurried, and not do it satisfactorily; and if you are delayed and perplexed by the arrangement or choice of view your plate may spoil.

of it may be allowed to escape over the further edge, but if much be lost it will not be easy to get the requisite density without adding more silver. The developing solution should be kept in motion on the plate until the details appear in the most faintly-lighted part of the subject, when hold it under the tap and wash off all the solution thoroughly.

This development is a critical operation, and must not be done in a flurry. You must keep your eye on the plate, and not on the developing-glass, to see that the slope of the former is enough to make the developing solution run readily over to the opposite side, yet not so quickly as to leave a break in the wave, which should begin at corner 1 and finish at 4; then, tilting the plate, flow it to and fro in both directions. If your plate be under-exposed you had better put it amongst those to be cleaned, and try again—no device will make a good negative of it. If over-exposed you may save it by stopping the development when the shadows begin to appear, washing the plate and flooding it with a solution of iodine and iodide of potassium, as recommended for the dry plates, and then, after washing again (taking care that white light does not fall on it in the interim), pouring on another dose of developer with a few drops of the solution of nitrate of silver and

without making any stains; but it requires experience. I have given a darkly-lighted wood scene twenty-five minutes' exposure without markings in the negative, and with proper precautions, such as putting cold wet cloths at the back of the plates, even much longer than that may be given; but five minutes, or ten, will probably be all you will require under ordinary circumstances.

Your exposure finished, you return to your dark room for development. I prefer to develope on a pneumatic holder (not the same one used in coating the plate, however, as the least trace of iron on a plate going into the silver solution would injure it); but many prefer to hold the plate by the thumb and first two fingers of the left hand. The holder is far neater and stains the fingers less, while it diminishes the liability to stains in the negative. You remove the blotting-paper and take the plate out of the slide on the holder, and, holding it in the left hand, take the developing glass in the right, and, holding the lip down close to the edge of the plate, pour the solution on without splash but quickly, pouring it along the whole edge of the plate, which must have a slight inclination so as to let it run rapidly over to the opposite edge, when the plate must be tilted back to keep it from flowing off. A portion

Now fix and wash the negative well, and stand it on a shelf to dry. It will sometimes happen that a film will split or come off in this final washing, either from a plate not being thoroughly cleaned or from a bad collodion; sometimes, too, from under-exposure, or being too long in the fixing solution. The latter fault should be avoided carefully if there be any tendency in the film to leave the glass, and the negative must be taken from the fixing solution as soon as you see, by looking at the back of the negative—the uncoated side—that all the opalescent patches have disappeared. If the negative have been properly exposed there should be a few points in the foreground of glass apparently free from any deposit —clear glass. If there be much of it, the negative was under-exposed; if none, then over-exposed or fogged.

And here we come to a chapter of accidents. Fogging—by which term is understood an appearance of veiling over the whole of the negative, preventing the shadows from being seen when we look down on the negative held over a black object—is due to many causes. The first is an alkaline silver solution; the test is with litmus paper, and the remedy an addition of nitric acid. Then organic impurity in the solution, to remedy which directions are given in the ap-

pendix on Baths. Iron or hyposulphite in the solution; remedy—acid, which failing make a new one. Cracks or holes admitting light into the operating room; remedy—stop them. Over-exposure or over-development; remedy obvious. If you have bought a cheap or an old camera you may have fog from little holes admitting light while the plate is being exposed, and in this case you may wrap it in a black cloth before opening the slide.

There are various marks which may be found on the negative, and must be described. Little points of transparency in the sky or lights are generally owing to specks in the nitrate solution, which must be filtered; or to dust falling on the plate before exposure, either from the room or camera. Opaque specks are rare with good collodion, but comets and streaks of opacity are due to substances in the bath, probably having some chemical action independent of the developer; at any rate, the remedy is the filter. Streaks along the plate in the direction of the dip, slightly waved, are probably from an insufficient immersion in the bath. If only at the 3—4 end, and resembling somewhat the lines of the aurora in form, they are from dipping too soon after pouring; if at the 1—2 end, with a tendency to opalescence and insensitive to the

light, making blank spaces in the negative, they are from too long an interval between the coating and dipping. Marks resembling the texture of crape predominant at the corner of the plate by which the collodion is poured off are also indications of dipping too quickly; or, if the collodion have been used repeatedly, of the solvents losing their strength by evaporation and accumulating a larger proportion of water than is needed (for absolutely pure alcohol and ether are equally undesirable with too low a standard).

It is always to be recommended to purchase collodion of some well-tried make, as any attempt to make your own collodion is sure to better nothing, and to develope numerous defects which perplex and discourage the beginner.

If your negative be satisfactory you may now varnish and put it away for printing from; or if you only want a few prints, or to test its strength for experience in judging of the proper density of the negative, you may pour over it, after the final washing, a solution of gum arabic, one ounce to eight of water, which will protect the film for a long time if care be used. This is also very useful in case the film is found to be inclined to slip on the plate—or off it—which it will do sometimes from having been dipped too quickly, and also from the plate not being perfectly clean.

To varnish the negative take any recommended varnish—there is not much difference in the commercial articles, the chief point being that the varnish, once applied, shall be soluble again in alcohol—warm the plate before a red fire, without flame, to a temperature which the hand will just bear comfortably, holding the back to the fire, and then pour the varnish on the face in the same way you did the collodion, and, when it ceases to run from the corner, hold the varnished side to the fire until it dries, which it should do with a brilliant surface; if not, the plate was not warm enough, or was not held to the fire quickly enough after the varnishing. There is a very useful amber varnish which is applied to a cold plate, but, being costly, it is not much used.

Chap. III.

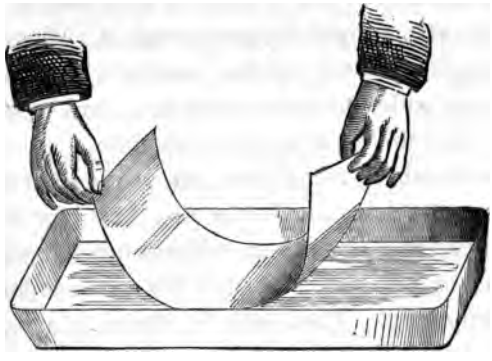
POSITIVE PRINTS.

You naturally wish now to try the negative, and see what the positive results are like. At present you can imperfectly judge, for if the negative, when held over a black substance and seen by

reflected light appear satisfactory as a picture, it will be found too feeble to make a good print; only the darkest portions should appear in this position. Experience will teach you how to judge of the negative held up against the light, but you must first print them.

For this purpose you may procure positive paper ready for the printing, now sold in most of the depôts of photographic materials, and is made by several manufacturers. If this be not at hand you must prepare your own paper. Procure a flat porcelain bath (the size of a quarter-sheet of photographic paper will do best for beginners). Put in it enough of a simple solution of nitrate of silver, sixty grains to the ounce of water, to cover the bottom half-an-inch to an inch in depth. Take a strip of clean paper, two inches broad and as long as the bath is wide, and draw it gently along the surface of the liquid from one end to the other to skim off all floating substances, scum, &c., &c. Then take the paper, cut to size, in the manner shown in the following diagram, let it down with the albumenised side next the solution, so that the middle shall touch first, and let the ends follow equally and rapidly, so as to leave no bubbles under it, and not to make any pause in the gradual descent of the paper. Let it lie three minutes, when take it by one corner (horn or wood nippers

are convenient implements to do this with), raise it slowly from the bath, let it drip for a minute or so, and hang it by wooden clips on a card



drawn across a room where the light can be shut out until perfectly dry. All this must be done in a very faint light or in the yellow light of the dark room. If too much light be admitted it will be shown by the discolouration of the paper.

When perfectly dry cut the paper to the size of the negative, and lay the latter in the printing frame with the back to the plate glass of the frame—that is, the side holding the image up—and lay the paper on it, albumen side next the negative, cover with a piece of white felt or several folds of white blotting-paper, and put the pressure board on and fasten in its place. The mechanism will explain itself. Expose it to the

sun or open sky until the print is of a satisfactory depth, which is a little deeper than the finished print should be. This can be ascertained by lifting one flap of the pressure board, taking care that the strong light does not reach it. When the printing is sufficient put the print in a blank book and keep under pressure until the number which you intend toning at once is complete.

Put the whole, when done, into a vessel of clean water—porcelain flat baths are best for these purposes—and rinse them without much handling in three or four waters or until the water no longer appears milky. Then transfer them to a toning bath made as follows:—For every whole sheet of paper to be toned take ten ounces of rain or spring water, or distilled water if that in ordinary use be not tolerably pure, thirty grains of acetate of soda and one grain of chloride of gold, and a-half of chloride of gold and sodium. These should be mixed and kept in the dark a day before the toning is to be done. Or another form, which may be mixed an hour or so before using, may be made by the substitution of ten grains of carbonate of soda for the acetate.

Whichever of these toning baths may be preferred—the former giving the best results almost universally—the prints, when washed, should be transferred to it rapidly, each one being com-

pletely immersed and put face downward; and when the whole quantity are in (it is not advisable to tone more than about two sheets at once until long experience is obtained) slip out the under one and put it on top, keeping the whole mass in agitation sidewise as much as is convenient, and so rapidly pass them each from the under to the upper side, keeping up the rotation with complete immersion of each as it comes on the top, and before the other is laid on it, as, if the prints adhere, there will be spots of imperfect toning. If you are toning prints 10 × 8, a bath 12 × 10 inches will be large enough, and a smaller than this is not convenient for any size of print.

The prints will rapidly change their colour in this bath, and when they begin to assume a bluish colour —which you must verify by examining it momentarily in a white light—transfer them as they take the tint to a dish of clean water until all are toned. In this operation nothing will give complete success but practice, as the colour with which the prints issue from the gold will be changed to one slightly warmer by the fixing-bath of hyposulphite of soda, and practice alone will tell how much allowance must be made for this. If the light in which the toning goes on be too strong it will produce a dusky pink tone over the whole, not at all agreeable; and if the prints

be removed too soon they will be of a foxy warmth. If left too long they become of an ashy blue-black, like bad ink, cold and weak in the shadows.

When the whole have been toned, pass them into another bath with a solution of hyposulphite of soda—two ounces to twelve of water will be sufficient for four sheets of paper—and leave them in this for ten minutes, when put under a tap and let fresh water run slowly in, weakening and washing away the solution of hyposulphite. After ten or fifteen minutes of this gradual washing, drain the prints in a mass and add fresh water, in which move the prints about a few minutes, when pour away and repeat; after which pour on water as hot as the hand will bear, and, moving the prints well about in this for three or four minutes, pour off and wash in two more cold waters, draining the prints completely after each one, when they may be pressed between blotting-paper and dried separately. If the albumen surface of two prints dry in contact they will adhere as if they were glued together.

To mount your print use a paste of starch with one-fifth part of white gelatine.

These directions are sufficient to enable you to produce a good print, and it is necessary that you should understand printing in order to be able to

prove your negatives; but, as a rule, unless you take up photography professionally the printing will prove more expensive in your hands than in that of a professional printer; or, if you have not one of those accessible, send your negatives to the nearest local photographer, who will doubtless print them for you. This part of the work is mainly drudgery, and presents little inducement to an amateur; while the waste of doing things on a small scale is enormously greater than when they are done largely and by professionals.

This waste, however, may be diminished by saving your washings, &c., as follows:—Put the first washing water from the prints into a jar and throw in a handful of common salt. Put the hypo-sulphite solution, after fixing the prints, into another jar, and add to it sulphide of potassium. Trim all your prints before washing to a narrow border, and put all the waste into a bag to burn some day, when throw the ashes into the jar of washings. The residues so collected may be sent to a refiner to be reduced to silver. For the gold bath, when you have finished, pour a little solution of proto-sulphate of iron into it and collect the brown deposit, which you may, when sufficient has been collected, wash with dilute nitro-sulphuric acid and redissolve with *aqua regia*. But I cannot assure you that all this will not cost more than it will return you. The

well-known Roman photographer, Mr. Anderson, assured me that he recovered ninety-three per cent. of all the silver he used in his operations. If you average fifty per cent. you will do well at first; but the cost of that in chemicals, utensils, &c., will have to be weighed, and in my own experience it has never paid to collect residues on a small scale.

I have thus gone through, as simply as possible, all the operations involved in the production of a photographic positive, but there are many points which will soon become important to notice as the first difficulties are overcome and results of a better kind are demanded. These I will treat in appendices in the order in which they would occur from their natural sequence in the manipulations, advising the student not to trouble himself about them until he has gone through all the preparation implied in the preceding text, and found that he can at least take a photograph of tolerable quality, unless, indeed, he find some serious stumbling-block before he has done that, which I do not anticip ate if he follow my directions exactly.

Appendix A.

BATHS AND BATH SOLUTIONS.

On the condition of the solution of nitrate of silver, technically known as "bath," depend most of the uncertainties which belong to the wet collodion process. The solution gradually accumulates soluble salts from the collodion, and from the same source alcohol and ether, while from impurities accidentally introduced or derived from bad samples of collodion it gathers organic matter, while it loses silver taken up to form the iodide and bromide. The accumulation of soluble salts seems to have no other ill effect than deception as to the real strength of the bath; the accumulation of alcohol and ether produces finally a tendency to repel the developer, forming lines and streaks such as would be produced by greasiness. To drive these off put the solution in a wide-mouthed bottle, which place in an earthenware bowl large enough to hold the solution in case the bottle breaks, and put it in the oven for a few hours, or until it has been evaporated to about two-thirds its former bulk, when fill up with pure water again, and filter before acidifying.

The organic matter becomes more serious, whether it be in solution in the nitrate of silver or in suspended particles. In the former case it makes "fog"—a general

clouding and staining of the film on applying the developer—and the only effectual remedy is to neutralise the bath by addition of a little oxide of silver and put it in the sun until the action of the light blackens all the organic matter, which, after a time, will become deposited and the solution become clear again, when filter as above before acidifying again. Sometimes, when you require the bath to work with immediately, a few drops of nitric acid—say one to five drops pure concentrated to ten ounces of solution—will make it work clear again for a time. If the solution do not become clear after sunning for a day it should be put in the oven as for alcohol &c. and then sunned again. The most obstinate cases of disordered "bath" may be cured in this way, unless hypo-sulphite solution has found its way into it. If the foreign matter be in the form of specks, making pinholes, the only need is to filter them out.

The most convenient form of filter is that made by Mr. F. W. Hart, and known as the "Economic Filter." It is a bottle with a syphon passed through the stopple, at the end of which, inside the bottle, is a filter, and the solution poured into the bottle is readily filtered back into the bath. In default of this employ a large glass funnel with a pledgett of cotton-wool washed in soda solution and well rinsed afterwards, put in the tube so that the solution, when poured in the funnel, shall run in a fine stream—not too readily, or the particles will pass through with the solution. Twenty ounces of bath ought to occupy at least five minutes in going through. I prefer this to filtering-paper, having tried both critically. The cotton will serve

as long as it allows the solution to pass through. The funnel may be put in a rather wide-mouthed bottle and placed in a corner out of the way of an accidental jog, or may be supported over it by a filtering stand procurable of all dealers in apparatus for chemical or photographic purposes.

There will sometimes be found in a solution long used another source of pin-holes—the crystallisation on the film of the iodide of silver held by the nitrate, and which, as the latter grows weaker by use, is crystallised out. This will be known by examining the surface of a film so affected, when minute points will be found all over it. The remedy is to add nitrate of silver enough to bring the bath up to its original strength. There is, however, one peculiarity of this re-crystallisation—that on a warm day it will suddenly appear, and disappear again when the bath is cold once more. The nitrate solution will hold less in solution when hot than when cold, and a sudden rising of the temperature causes a deposit of the crystals. The remedy is, however, the same.

Of vessels in which the nitrate solution is kept there are two forms, vertical and flat, the latter being sometimes provided with a well at one end, so that when the bath is raised at the flat end the bath flows into the well, and then the plate being laid on the part prepared for it and lowered suddenly the solution flows in a wave entirely over it. This form has the advantage of requiring little solution, but rapidly accumulates dust particles and requires frequent filtering. Of this form the bath may be glass or porcelain. The vertical bath is glass, porce-

[illegible]ain, vulcanite, gutta-percha, or wood saturated with wax or lined with marine-glue.

There is no necessity for using distilled water for the bath. Common well water, rain, or melted ice will do, only it should be sunned well after the nitrate has been dissolved and before acidifying. The ordinary distilled water of the chemists will require the same treatment.

The bath strength is not above thirty grains of nitrate to the ounce of water, and nitric acid may be added freely up to a minim per ounce without injury for [illegible] purposes. Indeed, Mr. Hawes, of Boston, U.S.A., uses a solution only twenty grains to the ounce with from three to ten minims of acid per ounce. But this requires a special collodion in which chloride is substituted for bromide, and with ordinary collodion a very slight acidity is preferable where rapidity is an object. But I have never found any advantage in a strictly neutral bath.

To ascertain the acidity or alkalinity of any solution employ litmus paper; and an argentometer is necessary to judge of the strength of the solution, always remembering that an old solution has salts in it which may be approximately estimated at one-third the amount in weight of the silver lost. If, therefore, you find that a solution originally thirty grains strong is reduced to twenty according to the argentometer, you must calculate that it really contains about fifteen grains of nitrate of silver.

Appendix B.

CLEANING PLATES.

In using new plates the best plan for cleaning them is to soak them for a time in dilute nitric acid—one ounce to twenty of water—and then rinse them well in running water or under the tap, wiping them dry with carefully-cleaned cloths; but when they have been used it may require, after the acid, the tripoli mixture beforementioned and careful polishing with clean dry cloths or *papier Joseph*. In the case of very adherent films, either of dry plates or very old collodion, it may be necessary to use Mr. M. Carey Lea's detergent—one ounce bichromate of potash and one of sulphuric acid to twenty ounces of water. Let the plates lie an hour or so in this, when the films will wash off readily.

A ready way of getting clean plates is by coating with albumen. Dissolve the white of one egg in sixteen ounces of water, add ten minims strong ammonia, and filter carefully through washed tow. On taking the plate from the washing water pour on it, so that it shall flow over the whole surface, a little of this dilute albumen, and, after draining a moment, another similar quantity—just enough in either case to flood the plate completely, and then stand on the corner in a small tumbler or wide-mouthed bottle to drain a few minutes, when put on a shelf with clean blotting-paper to dry. By having a dozen

of these small tumblers in a row on a shelf you may get along very rapidly, as, before the dozen is complete, you may remove the first to the blotting-paper. The albumen must be carefully wiped from the back before the plate is coated with collodion, or the albumen would rapidly foul the silver solution. This preparation has also the advantage of giving great adhesion to the film, which with new collodion or a very acid nitrate solution is not always easy to obtain.

Another device which I have much used is to rub over the plate rapidly a little of an ethereal solution of wax, and then warming the plate slightly before a fire until the wax melts, and rubbing off all that would come off with a pledget of cotton-wool. This gives a chemically-clean surface, and prevents the condensation of vapours on the plate, besides retaining its efficacy permanently.

For the preparation of dry plates the albumen is to be preferred. A solution of pure india-rubber in chloroform—one grain of the former to an ounce of the latter—is more convenient in some respects, but not so sure to bring no evil consequences in the way of markings, &c.

A weaker albumen solution is equally effective so far as adhesion is concerned, but is not sufficient to hinder entirely any action of impurities on the glass.

Appendix C.

ON DRY PROCESSES.

The simplest form of preparation of dry plates is the process known as the "tannin" of Major Russell. This may be employed either with bromo-iodised collodion, or simply bromised; in the former case what is known as extra bromised is preferable. The plate, having been sensitised as for the wet process, is placed in a bath of pure water—distilled, or rain, or well water, if it contain no appreciable quantity of a chloride—and kept there, in motion if time is any object, until all greasiness disappears, when it may be washed under a tap for a minute, and then put into a bath of water with about five grains of bromide of potassium per ounce, and left there for two or three minutes. After rinsing again under the tap a carefully-filtered solution of tannin—two grains to the ounce of water—is poured over and off again, to be followed by another, when the plate must be put in a tumbler as with the albumen, or on a sheet of blotting paper doubled up into a thick wad, until it is surface-dry, when it should be put into a drying-box, of which many kinds are recommended, the simplest being a common travelling-box of a good size, the bottom of which being covered with blotting-paper the plates are put round the sides of it, and an iron weight, from fourteen to twenty-eight pounds, heated as hot as the hand will bear, put into the middle,

and the box being closed, is left for several hours. A tin foot-warmer filled with hot water is more safe and equally convenient if at hand.

The plates must not be moved while drying, or lines of unequal density will be formed, and the heat must be sufficient to dry them in from half-an-hour to an hour. Of course all this must be done in the dark room.

A stronger solution of tannin produces more vigorous images but is less sensitive; the tannin being washed off makes the plates rather more sensitive, but gives rise, in my own experience, to more marks.

The exposure should be about six times that of wet collodion; and development with alkaline pyrogallic acid until the image appears, then followed up with silver and pyrogallic, as already shown for intensification.

When bromised collodion is employed a silver solution of double the strength prescribed for wet collodion should be used, and the development may be by the alkaline method, without needing intensification by silver. The collodion should be salted with eight grains of bromide of cadmium to the ounce.

A more valuable process though not so easy of manipulation, is the GUM GALLIC, due to many amateurs perhaps, but mostly accredited in its best formulæ, to Russell Manners Gordon, Esq. It requires a substratum, preferably india-rubber; and as far as the washing, &c., the directions are the same as for the tannin process, but in place of tannin the following preservative is poured over the plate:—

Gum arabic	20 grains.
Sugar-candy	15 „
Gallic acid	3 „
Water	1 ounce.

The gum and gallic acid solution must be mixed only when wanted, and be filtered carefully before applying.

A convenient formula for the developer for gum-gallic plates, where the greatest developing power is required, is this:—

Water	1 ounce.
Liquid ammonia (880)	20 minims.
Water	1 ounce.
Bromide potassium	1 grain.
Alcohol	1 ounce.
Pyrogallic acid	2 drachms.

Drop into the developing-glass five minims of the solution of pyrogallic acid, and then add half-an-ounce of each of the other solutions. When the details are out intensify as before. The plates, when prepared, must have a coat of red water-colour applied over the back.

The most trustworthy of all the dry processes thus far developed, is, without doubt, the Taupenôt or collodio-albumen. This is, however, tedious in preparation, though, considering its certainty, it will, I think, be found to give better results in proportion to the labour required than any other, except an emulsion process, which is the simplest in manipulation of all.

In the collodio-albumen process the plate is first coated with an iodised collodion, and the film sensitised in an ordinary thirty-grain bath, decidedly acid. It is then

washed, and put into a solution of iodide of potassium of a strength of five grains to the ounce of water, and allowed to remain there for two or three minutes, when it must be drained for a minute, and coated with the following preparation:—

White of egg	4 ounces.
Water	½ ounce.
Iodide of potassium	9 grains.
Bromide „	9 „
Ammonia (880)	3 minims.

This must be well beaten or shaken in a bottle capable of holding five or six times the bulk of the solution, and then filtered through a funnel, in the neck of which a piece of fine sponge is loosely pushed, so as to make the albumen run slowly. This may be prepared the day before needed, and may be kept a long time—being re-filtered when wanted.

Of this solution pour over the plate, after draining, enough to cover it well—say two drachms for a plate 7¼ × 4½—and, when it has been allowed to flow to and fro for a minute, pour off into the sink, and pour on a similar quantity of fresh solution. Flow it as before to and fro a few seconds, and then pour into another bottle, to be filtered back into the stock bottle when you have finished. The plate must be placed on a corner on blotting-paper to drain, and then dried as hot as convenient. In this state the plates may be kept indefinitely, if dry.

When they are required for use they must be dipped in a solution of nitrate of silver of the strength of the

usual solution, with one ounce of glacial acetic acid for every forty ounces of solution, washed well under a tap, and, if to be exposed and developed at once, dried in this state; if to be kept for more than ten days they must receive, after washing, a final application of a solution of gallic acid, two grains to the ounce of distilled water, carefully filtered.

The development is with alkaline pyro. and subsequent intensification, taking care not to keep the alkaline solution on after the image is faintly visible, or, which is much safer and cleaner, beginning with pyrogallic acid alone, and adding, a drop at a time, citro-nitrate of silver of the usual formulæ.

Mr. Gordon has worked out a formulæ for a modified albumen proccss which I have found very good and useful for plates which are to be used within ten or twelve days. It is a modification of Bartholomew's process. I append it from his MS. :—

"Beat up six eggs and three ounces of *distilled* water. After twelve hours pour off the clear liquid into a graduated measure; add five minims of strong liquid ammonia to each ounce, and bottle for use. (This will keep good for months, and only requires filtering through sponge for use.)

"When going to prepare plates take some of the above (allowing half-an-ounce for each $7\frac{1}{4} \times 4\frac{1}{2}$ plate), and to every ounce add twenty minims of a thirty-grain solution of nitrate of silver and five minims of ammonia. Mix the ammonia and silver by *pouring the silver into* the ammonia *before* adding them to the albumen.

"Do not mix them with the albumen till just before the solution is wanted; but enough can be mixed at once for any number of plates you are going to prepare.

"The mixture will keep for an hour or two; and even if it become slightly opalescent it seems to make no difference in the result.

"After the preservative is applied to the film, and well worked over it for about a minute, wash it off *thoroughly* under the tap, swill with distilled water, and finally flood the plate with a three-grain gallic acid solution.

"Use an *alkaline* developer, as plain pyro. and silver will not do."

Many other modifications have been suggested, but these will be found, I think, the most reliable and free from faults. The time of exposure of either process is about six times that of wet collodion if used without the alkaline developer; with it, about three. If, however, the gallic acid be added in final wash, the exposure must be doubled in either case.

It would be treating the subject of this appendix insufficiently to omit the emulsion processes, though success in them in the hands of the inexperienced amateur is always problematical, and the results in the hands of any amateur uncertain and perplexing.

The plates will require a preliminary coating—by preference, albumen—and must be perfectly dry before coating. An emulsion is prepared as follows:—Take of a powdery pyroxyline, 100 grains; ether, five ounces; alcohol (non-methylated at 805), two and a-half ounces. To this quantity add eighty grains of bromide of cadmium, and, when the solution of pyroxyline and bromide is complete, filter, or permit to depose, and pour off the top.

To sensitise proceed as follows:—Put three ounces of the collodion into a bottle capable of holding about five

ounces. In another bottle put one ounce of alcohol at 805, and add to it forty-eight grains of nitrate of silver dissolved in twenty-four minims of distilled water, and having warmed it by putting the bottle into warm water until the silver redissolves, put it into the collodion, agitating for a few minutes, when add twelve minims of pure concentrated nitric acid,* and after five or six hours filter through a funnel and washed cotton, when it will be ready for use. Coat the plates and put them in a bath of pure water for ten or fifteen minutes, or wash under a tap for two or three (first washing a minute in distilled water) and apply a preservative of one grain of pyrogallic acid to one ounce of distilled water. This is substantially Mr. M. Carey Lea's modification of the emulsion process, and is, on the whole, I think, the best. This emulsion by a slightly greater addition of nitric acid may be made to keep some time, but no results from an emulsion kept long in any condition, especially with excess of nitrate of silver, will give as good results as a fresh one. The image is less distinct, and the distances are liable to fade away in development, much as if they were subject to excessive halation, a fault which no backing will cure.

A modification which I have worked out will, however, give very fair results, and the emulsion keeps quite indefinitely, the plates requiring no kind of preservative coating, and being, at the same time, very fairly sensitive. The pyroxyline for this is best made of paper, and, so far

* Mr. Lea says *aqua regia*. There is little difference; but the chloride gives more density, and is less sensitive

as I know, the following formula, which I owe to Mr. Gordon, is the best :—

Papier Joseph	100 grains.
Sulphuric acid 1840	6 ounces.
Nitric „ 1450	3 „
Water	1 oz. 3 drs.

Temperature, 140°. Immersion, twenty minutes.

Make the plain collodion as follows :—

Pyroxyline	100 grains.
Alcohol, 825	5 ounces.
Ether rect.	2½ „
Nitrate of silver (finely pulverised)	80 grains.

Agitate and keep warm till the whole of the nitrate has dissolved, when allow to depose. After two weeks draw off, and sensitise by adding to each three ounces one ounce of ether and thirty-two grains of bromide of ammonium pulverised as finely as possible, and when this has had time to dissolve completely—say after six hours with occasional agitation—add twenty grains of nitrate of silver. Agitate occasionally for several hours, add to it five minims per ounce of an alcoholic solution of gum ammoniac. To prepare this pulverise the gum, and on one ounce of the powder pour two ounces of absolute alcohol, and agitate for a few minutes, two or three times, and then leave to depose, when pour off the clear portion for use. It will require several days to depose. I have kept this emulsion for six months without any change being perceptible. Development should be by the strong alkaline pyro. as given for the gum-gallic plates, and as soon as the image fairly appears more ammonia must be added.

A convenient formula is as follows :—

No. 1.—Pyro..... 3 grains.
Water ..... 1 ounce.
No. 2.—Ammonia (880)..... 2 drachms.
Water ..... 1 ounce.
No. 3.—Bromide potassinm ..... 1 drachm.
Water ..... 1 ounce.

First pour on the pyro. solution. If the image appear readily, add to the developer four drops of No. 3 and six of No. 2, and, after a minute, add four minims more of No. 2. When this seems to have lost its force, and development is arrested, wash thoroughly and intensify with citro-nitrate of silver. The plates do not generally require backing, but in some instances are better for it. Exposure is about twice that of wet plates.

Appendix D.

ON DEVELOPERS.

The developer which thus far has proved the most trustworthy for wet collodion, and all cases where it is applicable, is the solution of sulphate of iron. It has been, and still is, employed for dry plates even, but I cannot recommend it either for cleanness or rapidity, when compared with the combination of an alkali and pyrogallic acid.

Where great delicacy of film is required, as for negatives which have to be magnified, a collodion containing an iodide alone is often used, and a developer of pyrogallic acid, one grain to the ounce, with twenty to thirty minims of nitric acid; but with a bromised collodion iron becomes necessary. Any desirable result may be obtained by modification of it, and I carry into the field or keep in my dark room two solutions—one of five grains per ounce, and the other quite saturated, each with thirty minims of acetic acid—and a saturated solution of acetate of soda, with just alcohol enough added to make it flow over a plate after the iron, and a few drops of glycerine. For a well-lighted view the five-grain solution is sufficient in general, and it will bring out the sky and delicate distances as a strong developer will not, whatever may be the exposure; while by watching carefully the development of these portions of the negative, and adding som

of the saturated solution at the moment they are well out, the development goes on in the less lighted parts harmoniously, and without losing the gradations of sky and distance, which are already established and continue to intensify. But in order to do this easily and certainly one must look through the negative while the development is going on; and to enable me to do this I have the shutter of my dark box window to open downward, and fitted with a reflector, so that, without holding up the negative, I see through it at all times. In this way I obtain all the command over my development which can be got by pyro. and alkali, and in photographing architecture, where white masses come against blue sky, with masses of shadow in the foreground, I have found this practice quite invaluable.

Photographers in general are too much addicted to intensifying their negatives, and with a ripe collodion and weak iron developer careful manipulation will always give a sun-lighted subject all the density required for a good print. In looking over the display of photographs at the Vienna Exhibition I found that, with very few exceptions, they were over-developed, and equally under-exposed; and I think that the experience of every one who has had much to do with beginners in photography will have noticed that these are the almost universal faults, and that the over-development is generally the consequence of under-exposure, as the neophyte, in his efforts to bring out the detail which he thinks lacking, carries his negative beyond the proper density before he is aware of it. This is especially the case with dry plates, of which more

anon. The most judicious course is in all cases to give ample exposure, and unless one is working for instantaneous effects it is quite a matter of indifference whether he gives ten seconds or sixty; but whenever it happens that the exposure given is too little, the only chance of saving the negative is to use a very strong developer, and let a portion of it run over the edge of the plate, carrying with it as much of the silver solution as possible, and developing a feeble image, but in which all the detail possible will appear, when the negative may be finished with the weaker solution and some citro-nitrate of silver added. But the best results will always be obtained by a longer exposure and a weak development, finishing with the stronger if the shadows need it.

An iron-developed negative, well washed and laid in the sun to dry before fixing, will gather intensity in drying, and this simple expedient will sometimes suffice to intensify a deficient negative, especially when the collodion is new, and employed to shorten exposure; but in every case the secret of good development is in having sufficient exposure to adjust your developer to any emergency or chance of error, and in using a collodion of sufficient age.

The development of dry plates becomes a much more complicated matter since the introduction of the alkaline method. As we employ a bromide or iodide, with or without bromide, in the film we find the conditions of development differ radically. When the film is sensitised with pure bromide the image is formed in it, when with an iodide it is more or less superficial. This is well

known to every one, I suppose; but there is a consequence not so well known—that with an iodide and a surface development there is less tendency to accidental defects than in the bromised film, for the reason that in the latter the developer has the power of exerting its reducing power down to the bottom of the sensitive layer, and will have many more chances of finding a defect than one which acts mainly on the surface and accumulates the image from the developer. Taking as extreme instances the emulsion collodio-bromide, and the collodio-albumen with iodised collodion as the basis, we find by the universal testimony of dry-plate workers that the albumen film is the freest of all known from defects of any kind, while the emulsion can never be depended on for uniformity and freedom from such defects as lie in the substance of the film, as the developer goes to the very substratum to find them. The lower component of the collodio-albumen film is, in fact, insensitive, or should be made so to secure the best results, so that the image may be kept on the surface as far as possible. If there be a bromide in the collodion the alkaline developer will penetrate to it and bring out any imperfections existing there; while with an iodide only in the collodion, and a short immersion in the second bath, no image will be formed in the collodion.

A great deal has been said on the subject of bath *versus* emulsion plates, and on both sides; but there is one fact connected with this subject of development which is generally overlooked, viz., that a bath plate, if properly sensitised, will not have the whole of the bromide con-

verted, but will have an equal thickness of sensitive film over the whole surface, and will be withdrawn from the action of the nitrate before the accidental inequalities are reached and converted. This may be accurately enough ascertained by the appearance of inequalities in the density of the film, and the best plates will be those which are not too deeply sensitised. The emulsion, however, like a bath-plate too long in the bath, is entirely sensitive, and a slight thickening in the film shows in greater density, as even the Liverpool plates, which are so carefully prepared, will show, when the fleecy thickening comes in the sky. Now, in the bath-plate described the action of the developer, of course, extends only as far as that of the bath, while in the emulsion it penetrates to the glass if the exposure has been long enough.

This will explain, also, why a wet plate allowed to remain in the bath the minimum of time gives a more equal and better graduated image, especially in the sky, than one which has remained until the whole amount of salts in the collodion has been converted to salts of silver. No matter how long the exposure may have been, the developer can only convert this even, superficial film of salts of silver, and the reduction cannot be spotty. This is not always a desirable state, and tends to flatten the image, possibly, but there are circumstances where it may be an important condition. Where the sky and a delicate distance are the most important elements in the picture a film should only be allowed the minimum of immersion; but in a wood scene, or subject in which strongly-contrasted masses of shadow and light are of

chief interest, the plate should have full time in the bath. With the former, also, an exposure rather limited, and a developer of low strength; with the latter, a strong developer and good exposure. The rule being that the more the contrasts are to be forced, the weaker the solution of iron must be; and the more the contrasts need to be toned down, the stronger the iron.

Colonel Wortley's strong developer has an extraordinary power on bromide films, and certainly produces a dense image with a minimum of exposure, where a weak developer will not; but if the film be so constituted (as very sensitive emulsions generally are not) as to permit of a dense image being formed slowly, and with gradual increase of the strength of the developer, I think the result is preferable. Certain forms of emulsion will not produce a dense image without the developer on Colonel Wortley's formula, or near it, and these are exactly the most sensitive, but, at the same time, those which do not produce the most satisfactory results in a negative. I prefer very much a film with which we can commence development with a feeble solution, and gradually increase the strength, as we then have the development far more under control than when we begin with the full strength, in which case any over-exposure, unless known and calculated on, becomes fatal to the negative. I have used as much as twenty minims of strongest aqua ammonia to the ounce of developer without fog, and with excellent results, but if the plate was over-exposed there was no saving it; and even when we know that a plate was over-exposed, and calculate for it by addition of bromide,

the management is not so easy or the result so good as when the strength of the developer may be increased by slight degrees. The best plan with alkaline developer is first to apply the the hypo. alone, and if the image appear readily we know that the exposure is enough, or too much; if not, we ought to be able to use the alkali cautiously. If any dry plate does not admit of this its working will be liable to danger of comparative failure when over-exposure has been given, from which danger no quantity of bromide will save us, unless over-exposure is known and provided against before the development is commenced. At least, this is my experience. Bromide applied before the developer will certainly reduce the effect of the exposure, and an iodide is still more powerful. But how shall we determine before applying the developer if the plate require checking or pushing? This is a problem not to be solved by exposing a plate intentionally for twice the time necessary, and then applying bromide. Experiments, where all the conditions are known and can be calculated for, are no guide to experience where the initial condition may, and in most cases must, be only ascertainable by the practical test.

Appendix E.

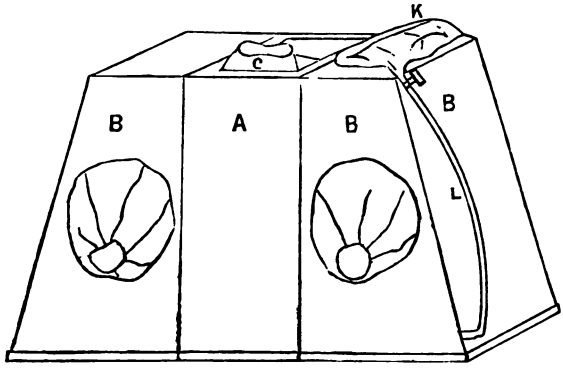
FIELD AND TROPICAL PHOTOGRAPHY.

The course of several years' rough-riding and hard travelling with photographic material can hardly leave a man of the most ordinary ingenuity without some contrivances which are worth putting into the repertory of field-work.

In the East, where there are few facilities for transportation, every pound of weight saved is a marked gain; while the question of facility in getting to work and packed again after work, keeping clear of dust, working in heat, &c., &c., are of no small importance; and no season during my residence there passed without some new contrivance to gain these objects. I have made six tents and dark boxes, each one an improvement in portability and rapidity of action combined on anything I had seen previousiy, and shall describe that which I have finally settled on as the most satisfactory; and, as it has received the endorsement of several practical photographers of excellent judgment—amongst whom I may name Mr. Gordon, Mr. Buxton, Mr. Blanchard, Mr. W. Brooks—who have tried it, I am the more confident in my recommendation of it.

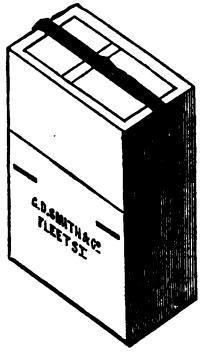
In its very last shape my box for a 10 × 8 plates measures, when open, twenty-eight inches in width by sixteen in height and eighteen in depth from front to

back; when closed, nine inches in width, the other measurements being the same. Its weight, without bath



A. Box of wood. B. Black cloth. C. Mask. K. Water verge.
L. Constructing tube.

or chemicals, is thirteen pounds. When closed it is, as appears by the diagram, a narrow box, easily to be carried



by a common leather strap. The sides open up and down, the lower flaps, continuously with the bottom of the box

proper, forming the tray, and being covered with india-rubber fabric, which comes up to form the sides when open. A hole for water escape is provided at the corner opposite the bath. The flaps, up and down, are kept in their position by braces of brass. The hands enter at the sleeves as shown, and the mask, which is black cloth on a slight wire frame, is set in the door, having a plate of white glass under it to keep the vapour of the collodion from the eyes and lungs, and a sliding board under the glass to keep out the light when the face is withdrawn. The bath is placed at the left. The window, of yellow glass, is in the side of the box opposite the operator, and under it, in the side, are two silver hooked wires, which turn out to hold the plate while it drains, and shut in when the box is closed.

There is another form which I have had made also, not in any important particular different from this when in operating form, but in some slight matters more convenient, and a little more ready in opening. It is a larger box, with the sides shutting after the manner of a telescope, and these, when closed, forming a double box for packing the chemicals; &c. It is, when closed, 14 × 17 × 18, with no more working room than the other, but the bath is between the sleeves, and the slide is buttoned to the side of the box above the bath, the lighting and sleeve arrangements being the same. It is, however, more than twice as heavy.

The water supply is kept, in both forms, in an india-rubber bag made for the purpose, with a stopcock and tubing, which enters at the lower right-hand corner, just

where the hand can take it most easily. The bath is covered during the development by a flap of rubber cloth or a close-fitting gutta-percha cover, at the pleasure of the operator.

The comfort of such a box as this in a windy and sandy country is only appreciable when using it. As it stands on a low tripod there is no danger of its being blown over, and the dust can never enter and hang in the folds of drapery. The head is out of it and free at a second's notice. The vapours are not only kept in and escaped from, but, by the fact of their being shut in so small a place, the evaporation does not go on so rapidly, and you can coat the plate more deliberately, which in hot climates is a very great consideration. Then there is another advantage—that as the breath cannot condense on the plate in coating it, the film is less liable to slip or show water marks, which in some cases of wet work perplex operators so.

If you want to move the box a short distance without closing it, keeping all things *in situ*, you have only to put the top of your bath on, and carry it, tripod and all, by the carrying strap at the top.

So much for the dark room. The bath for field work is of wood lined with pure sheet rubber, or saturated with wax. I have had one made with a partition, so that I can carry distilled water in one side for washing plates when long exposure is needed, and for avoiding bath stains and pinholes from various causes, and the general consequences of an old or dust-filled bath, which it may not be convenient to filter. Or one side may contain a new

bath kept free from impurities, and of a low strength, for cleaner working on all occasions, Or it will enable those who adopt Mr. Sutton's idea of using bromides only in the wet collodion process to work with a strong bath, washing afterwards in distilled water. This bath is not so heavy, *unfilled*, or so large as an ordinary glass bath in the case, while it is absolutely indestructible except by great crushing force.

The want of water is sometimes a great annoyance in those dry and wild countries, and to economise in the use of it I employ a simple device which, for all ordinary circumstances, dispenses with washing altogether. I pour over the plate, as soon as the development has reached the right point, a solution of acetate of soda prepared as follows :—

Water.....	6 parts.
Saturated solution of acetate of soda.....	1 part.
Common methylated spirit.....	1 ,, (more or less).
Glycerine, diluted with equal measure of water.....	1 ,,

Care should be taken that the water contains no chlorides ; other impurities common in water are of no consequence. The action of the acetate of soda (potash answers equally well) is to arrest development by converting the silver and iron solutions into acetates of iron and silver with sulphate and nitrate of soda, none of which have the least effect on the film even when exposed to direct sunlight. The glycerine keeps the film moist until it can be fixed and intensified, which latter operation I always

prefer to perform at home after fixing, in any case whatever. The solution should flow freely after the developer, and more or less alcohol might be required for this. One portion should be poured over and thrown off, and another poured on, drained, and left until finishing. I have even dried a plate before the fire after flooding with acetate of soda without glycerine, and found no markings of any kind, though the film was more likely to wash off under the tap than when it was washed without being dried.

In this way of working no water is required except to rinse the fingers between plates.

In these long excursions, away from one's base of operations, filtering becomes a great nuisance, and is almost invariably attended with loss of bath fluid and fouling of the bath. To avoid this I carried with me, even into the field, one of "Hart's Economical Filters," which serves as bath-bottle and filter as well; and as one must have a bottle to filter into, it may as well be this as another. Many times when at work in the field, finding pinholes to appear suddenly in the negatives, I have poured my bath solution into this filter, filtered it back into the bath, and in five minutes was at work again with a clean solution.

When puzzled to get distilled water I have employed the following means (not a new device, perhaps, but a good one, and better than chance distillation):—I add to the ordinary spring or river water enough of nitrate of silver solution to leave a slight excess, sun it until clear, filter, and then drop into it a little alcoholic solution of iodine

enough to leave a faint tinge, and then stand the bottle in the sun with the stopper out until the colour is all gone—generally in two or three hours.

For emptying the double bath (and indeed any other vertical bath with safety) a syphon is necessary. For this, in field work, the little india-rubber syphon, with a bulb in it for starting the flow, is invaluable; it goes into a corner, is not to be broken by any ordinary usage, and no field equipment would be complete for me without a couple of these.

My dark box will contain all these things and a plate-box with a dozen and a-half 8 × 10 plates, the water-bag serving as a cushion to prevent shaking or breaking. In the most difficult countries it will go in a packing-case on one side of your horse's or donkey's pack saddle, while the camera and extras make a balance on the other, and your assistant rides between and makes no more comical figure than the majority of Eastern travellers at that. The only point in the arrangement important to be understood is that one donkey will carry all that is needful for a photographic trip of several days in the sandiest and most desiccated country in creation, and that you may work with less annoyance from dust or heat than the dwellers or workers in tents can appreciate.

But it becomes altogether a moot point, in view of the remarkable enlargements by the Autotype Company with their new method, if any apparatus need be carried into these difficult countries larger than will give 8 × 5 negatives; and, if these are of a sufficiently good quality, prints of 15 × 24 may be made from them which cannot

be distinguished from prints from direct negatives, with the additional advantage that your original negatives are never injured by printing from them, so that the weight and bulk of the dark box may be henceforward much diminished from those which I have given above of my apparatus.

Appendix E.

LENSES.

I am under obligations to Mr. Dallmeyer for permission to make from his valuable *brochure* on the choice and use of photographic lenses an abstract of the information most needed by the amateur; if he wish to study photographic optics thoroughly, he should procure one of the treatises devoted to it.

"View Lenses.

"The right choice among the many existing forms of view lenses requires the determination of the following points:—

"1st. The size of the picture.

"2nd. The angle of view, or amount of subject to be included in it.

"3rd. The kind of picture, whether landscape or architectural, or both.

"As regards the first point, viz., 'the size of picture, the professional photographer needs no information—he being guided by commercial considerations—but a few remarks addressed to the amateur on this head may be of service.

"The beginner will find a small-sized plate, such as a $7\frac{1}{4} \times 4\frac{1}{4}$ up to 10×8 inches, quite sufficient, being convenient for practice, and enough for producing artistic

effects. The former of these sizes has the advantage of being adapted alike for a stereoscopic or for one single picture.

"In recommending the smaller-sized plates it may be well to remind the amateur that, not only do the difficulties of manipulation greatly increase with any increased dimensions of plate, but that the quantities, weight, bulk, &c., of all the other necessary appliances become augmented also, and this in the proportion of more than the *square* for every increase of size of plate.

"Secondly: 'The angle of view' to be included in the picture. This depends upon the relation of its size to the focal length of the lens; that is, the shorter the focus, the larger the angle, and *vice versâ*. The base line, or the longest side of the picture, is the measure of the angle included in it.

"One of the principal and rightful claims of photography is its perfect truthfulness of delineation; and yet, how frequently do we meet with pictures representing well-known objects or scenes, which at first sight are not even recognised! This fact has been observed more frequently of late, *i.e.*, since the introduction of the wide-angle or short-focus lenses. The cause of these *apparently* distorted views really turns upon the amount of angle included in them. Hence there arises this question—What is the proper amount of subject or angle to be included in a picture?

"The reply to this necessarily involves a consideration of the laws of perspective—a subject well worthy the attention of every photographer.

"The following two propositions are sufficient for my present purpose, viz. :—That the human eye itself is a miniature photographic camera, inasmuch as the several rays proceeding from objects, upon entering the eye, are refracted by its lens, and thence proceed to form a most perfect image or picture on the smooth screen of nerve called the '*retina*;' and that it is by this picture the mind is enabled to judge of the dimensions, brightness, colour, &c., of external objects. The angular extent of the picture formed upon the retina does not exceed 60° without some movement of the eye or head. Hence, for a photograph to convey to the mind a correct idea of the objects represented, it should, when viewed at the normal distance of from twelve to fifteen inches, excite the same impressions. Now, the distance at which a picture is generally viewed will be found to be about equal to its base or longest side; or, in other words, the angle it subtends for vision will be from 50° to 60°. This angle, therefore, should not be exceeded; for if more be included in the picture, the perspective will appear exaggerated, *i.e.*, objects in the foreground will be too large and the distance become dwarfed.

"To render it obvious that distortion of this nature is really no fault of the lens, such pictures need only be viewed at a distance equal to the focus of the lens with which they are taken, when all apparent distortion at once vanishes. This rule holds good in all cases, *i.e.*, every picture should be viewed at a distance equal to the focal length of the lens with which it is taken. Thus a 12 × 10 picture taken with a seven-inch focus wide-angle

rectilinear lens should be looked at, not at twelve or fifteen inches, but at seven inches distance from the eye.

"From the above it is obvious that the only legitimate use of wide-angle lenses is landscape photography; or, in other words, for such subjects in which absolute truth is made subservient to beauty; but for architecture, and the like such lenses should be used only in cases of necessity, *i.e.*, when the situation is so *confined* as to preclude the use of a longer focus lens.

"As regards the choice of a *landscape lens*, all the most eminent landscape photographers are unanimous in recommending the 'single combination' for simple landscapes, from the obvious reason that this lens, having but *two* reflecting surfaces, the rest being cemented, produces the most brilliant pictures; and, on account of its form, it has more depth of focus than a double combination lens. Further: the wide-angle single combination landscape lens produces an evenly-defined picture with a comparatively large aperture. Hence, it is more rapid in action than the wide-angle double combination lens, which it surpasses, moreover, in equality of illumination throughout the entire extent of the picture.

"The only drawback to this form of lens is a slight amount of perceptible distortion when used for objects bounded by straight lines, such as architecture, where the marginal lines will be slightly curved, *i.e.*, barrel-shaped. Hence, to avoid this in a landscape with buildings the latter should not be made to occupy the extreme margins of the picture.

"Among the several kinds of single combination view-lenses extant, other things being equal, the *smaller* its diameter, the better the lens.

"As regards focal length, it has already been stated this should not be less than the base line of the picture; that is, for a 10 × 8 inch plate a ten-inch focal length lens, rather longer than shorter, should be chosen.

"For *architecture* a rectilinear lens must, of course, be chosen, and for general use one of moderate angle is to be preferred.

"The rapid rectilinear is the best lens for that purpose, as it is free from distortion and flare, and works with a larger opening than any other kind of double lens. It is invaluable, therefore, for dark interiors, instantaneous effects, &c. Mr. Bedford has produced the most charming pictures with this lens, both of interiors and landscapes with buildings.

"For *special* purposes, as for objects in confined situations, the wide-angle rectilinear lens becomes indispensable; but here it may be observed, for the reasons already given, that it should be used only in cases of necessity. More than ordinary care, moreover, is requisite in the adjustment of the camera when wide-angle lenses are used. The camera should always be placed perfectly *level*, and, if required, the rising front should be used; but on no account should the camera be tilted, for in that case perpendicular lines of the object will no longer appear perpendicular in the picture. If, however, the camera must be tilted, then a swing-back becomes indispensable, in order to restore parallelism between the

object and the screen or collodion slide—always a necessary condition for the production of a picture free from distortion. Observe, it is the better plan not to *tilt* the camera, but, if more be required in the picture, to raise the camera-front or to get on higher ground, if practicable. Of double combination-lenses that one is always to be preferred which with the *smallest* diameter of lenses really works with the largest aperture or stop, and covers the widest angle.

"For copying purposes the rapid rectilinear lens is without a rival. It has already been supplied to all the Government topographical establishments in Europe, India, and Australia. The two combinations composing this lens being perfectly *identical* it is alike suitable for copying of equal size or for reducing or enlarging.

"PORTRAIT LENSES.

"Success in portraiture will always depend, in a great measure, upon the *right choice* and the *proper use* of the lens. A few hints on these two points may prove of service to the photographer.

"Portrait lenses are either more or less rapid in action, as their diameters are larger or smaller, or as their focal lengths are shorter or longer. The 'diameter of a lens' here always implies its *actual* working aperture, and the 'focal length' its *equivalent* focal length.

"The focal length of a lens regulates the *size* of the picture, and the diameter expresses its speed or *rapidity* of action. Having fixed upon the size of the picture required to be taken, the next thing to be determined

is the most suitable focal length of the lens. This, however, involves the prior determination of the *distance* at which to place the subject; for, as every photographer knows, the placing of the lens nearer to the subject increases the size of the picture, and *vice versâ*. The question then arises—What is the proper distance at which to place the subject from the lens? In answer, it may be safely asserted that it should, as a rule, be not less than twelve feet, nor perhaps more than twenty-four feet; for if less than this, the resulting picture will generally be defective both in definition and perspective, because the lens producing it will be of too short a focus, and if the distance be greater the resulting picture will probably be deficient in relief or roundness. This, because the atmosphere in our towns is seldom quite clear from fog or haze, and the greater the distance between the lens and subject the more obviously will this haze be reproduced in the picture.

"A medium distance, therefore, of from sixteen to twenty feet should be chosen. Card portraits are generally taken with lenses of such focal lengths as to require this distance, and to this circumstance may be attributed the generally pleasing appearance of these portraits, as compared with the old quarter-plate pictures, which were mostly taken with lenses of much shorter focal lengths.

"Having determined the *focal length* of the lens for a given-sized plate, the next thing requiring consideration is its *diameter*, or its rapidity of action. As a matter of course, every photographer wishes to possess a quick-acting lens, and not only this, but flatness of field and great 'depth' of focus or definition, forgetting all the while

that these qualities are almost diametrically opposed to each other; for rapidity can only be had at a corresponding sacrifice of flatness of field and depth of definition. Thus, of two lenses of the same focal length, and both perfectly corrected for spherical aberration, the one of two inches will have twice the depth of another of four inches in diameter; whilst the latter, in turn, is four times quicker in action than the former.

"Again, of two lenses of the same rapidity (*i.e.*, having the same ratio of aperture to focal length), the one double the focal length of the other will only have one-quarter its 'depth.' Thus, for example, a card lens of nine inches focal length and two and three-quarter inch aperture, producing a card picture at twenty feet distance, will sufficiently define accessories twelve inches in front and twelve inches behind the figure, or the point focussed upon, or will have a depth of two feet; whereas, another lens of double the above dimensions, *i.e.*, of eighteen inches focus and five and a-half inches aperture, and worked at the *same distance*, will only have a depth of six inches, viz., three inches before and three inches behind the point focussed upon. This sufficiently explains that really quick-acting lenses only produce satisfactory results when used for the smaller sized-plates; but that they are useful, when so restricted, is sufficiently evidenced by the charming instantaneous portraits of children by Mr. Faulkner, Mr. H. C. Heath, and others, taken with No. 2 c—perhaps the quickest-acting lens extant.

"The fewer the number of reflecting surfaces, other things being equal, the greater the brilliancy of the resulting picture.

"The smaller the diameters of double combination lenses, and the nearer they are placed together, other things being equal, the greater the freedom from flare."*

"Keep the lenses as much as possible in a *dry* atmosphere, and guard against sudden changes of temperature, otherwise some kinds of glass are liable to tarnish or, what is technically termed, to 'sweat.' Whenever any moisture becomes visible upon any surface at once remove it by wiping with a *soft* cambric or old silk handkerchief: otherwise resort to wiping *only* when particles of dust adhere so firmly to the glass that they cannot be removed with a camel's-hair brush. Never attempt to polish the lenses with any kind of powder whatever."

So-called instantaneous photography is entirely a misnomer. All photography for practical purposes requires an appreciable time of exposure; but in favourable situations—as by the waterside, and in early summer or peculiarly bright days—with the use of very powerful lenses, and chemicals in the best condition, the exposure may be reduced to the fraction of a second. In scientific experiments this fraction may be reduced to the 100th, but, for real use of photographers, the third to fifth will be shorter than ordinarily can be employed.

This will require quick lenses, a new bath solution of about forty grains per ounce, with a trace of acid, and developer about sixty grains per ounce.

* Since the above was written Ross & Co. have sent me for trial a doublet, which, in the two points above noted, certainly surpasses everything hitherto produced, the lenses being the smallest I have ever seen, and having only room between them for the turning of the diaphragm.

Appendix F.

PRINTING POSITIVES.

The quality of the prints from any given negative will be very much affected by the nature of the light, a strong one—as direct sunlight—having a tendency to make a print with less brilliancy; and the weaker the light the more are the oppositions in the negative brought out. The best prints will be those made in the shade from negatives rather thin than dense; but if a negative print too black and white in the shade it must be printed from in the sun; and, *vice versâ*, if one print too flat in the sun, it must be printed from in the shade.

Skies from separate negatives are sometimes printed into landscapes which have none. For this the sky of the landscape must be painted out carefully with jet varnish, and, a print being taken of this, the sky must be cut away, leaving the landscape portion as a mask, which must be laid on the landscape print to protect it while the sky is being printed from the other negative. The mask so made should not be fixed on wet, as it will shrink in drying and may not fit the landscape exactly.

LONDON:
PRINTED BY H. GREENWOOD, 2, YORK STREET, COVENT GARDEN, W.C