MANIPULATIONS IN THE SCIENTIFIC ARTS.

PHOTOGENIC MANIPULATION:

CONTAINING

PLAIN INSTRUCTIONS

IN

THE THEORY AND PRACTICE OF THE ARTS OF

PHOTOGRAPHY,	CHRYSOTYPE,
CALOTYPE,	ANTHOTYPE,
CYANOTYPE,	DAGUERREOTYPE,
FERROTYPE,	THERMOGRAPHY.

BY

GEORGE THOMAS FISHER, JUN.

Illustrated by Wood Cuts.

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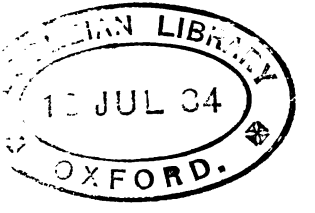

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SYNOPSIS OF CONTENTS.

PHOTOGENIC MANIPULATION.

Introductory Remarks.

1. It is not the intention of the author of this little treatise to enter into a philosophical detail of the laws on which the wondrous art of Photography is based, but rather to explain, clearly and distinctly, the various steps necessary to be taken by the experimenter in order to ensure success, dwelling more particularly on those minor points which so materially affect the result of all experiments, and without attention to which, failure will be the inevitable result. The work is written solely for the instruction of the amateur, and is therefore divested as much as possible of all technicalities, while at the same time care has been taken to recommend only those processes which are the most likely to be attended with success.

2. Photography,* or as it is also termed, photogenic † drawing, is, as its name indicates, the art of producing pictures by the agency of light, and may undoubtedly be ranked amongst the most pleasing and curious results of chemical philosophy, nor is it the least useful. Every one who has seen the pretty philosophical toy, the camera obscura, must needs have admired the minutely perfect reflection of the landscape or any other object brought within its view, although this admiration must have been accompanied by a

* From φως light, and γραφω to write, to depict.
† From φως light, and γενω to produce.

feeling of regret that it was only a shadow doomed but to last for a moment. Photography, however, and especially those modifications of it which we shall hereafter have to describe, the Calotype and Daguerreotype, enable us to fix the fleeting shadows as they pass, and to render permanent the pictures thus delineated by the magic pencil of light. To accomplish this end, no tedious or troublesome process is required; unlike the creations of the painter's art, the picture is not the result of long and tiring manipulation. In a moment all our work is done, our desires are fully accomplished.

3. Photography is an art of but recent date. True it is that it has been asserted, we fear upon questionable authority, that the jugglers of India were for many ages in possession of a secret by which they were enabled in a brief space to copy the profile of any individual by light. Be this however as it may, it is certain that they now have lost all record of the art. Passing over this mere legend, we find that the effects of the sun's rays upon metallic compounds were really noticed by the alchemists, and in many old works the following experiment is given:—

"Dissolve chalk in aquafortis to the consistence of milk, and add to it a strong solution of silver; keep this liquor in a glass decanter well stopped; then cutting out from a paper the letters you would have appear, paste it on the decanter, and lay it in the sun's rays in such a manner that the rays may pass through the spaces cut out of the paper and fall on the surface of the liquor; the part of the glass through which the rays pass will be turned black, while that under the paper remains white; but particular care must be taken that the bottle be not moved during the operation."

4. This experiment though so vaguely expressed and so doubtful of success that it was perhaps never tried, is nevertheless the first certain record of the art

we are about to describe. But although the alchemists had by this experiment actually stumbled upon the threshold of the discovery of Photography, yet so intent were they upon their absurd search after the philosopher's stone, that everything which did not promise them so hopeless a result was thrown aside as useless.

5. The first person who seems to have had any notion of Photography was Mr. Wedgwood, who in the year 1802 recorded an experiment in the Journal of the Royal Institution, to which his mind had been directed by observing that light blackened a solution of nitrate of silver, or as it is more usually called, lunar caustic. The experiment of Mr. Wedgwood was as follows:—A piece of paper or other convenient material was placed on a frame and sponged over with a solution of nitrate of silver; it was then placed behind a painting on glass, and the light traversing the painting produced a kind of copy upon the prepared paper, those parts in which the rays were least intercepted being of the darkest hues. Here however terminated the experiment, for although both Mr. Wedgwood and Sir Humphry Davy experimented carefully for the purpose of endeavouring to fix the drawings thus obtained, yet the object could not be accomplished, and the whole ended in failure.

6. It cannot then be a matter of wonder that, after the failure of such men as Davy and Wedgwood, the subject should have been dropped for some time. Indeed the art slumbered until 1814, when Mr. Niepce, of Chalons on the Soane, appears to have directed his attention to the production of pictures by light. He pursued his experiments on the subject alone for ten years, when chance having made him acquainted with Daguerre, they agreed mutually to consider the subject. In 1827 he presented a paper to the Royal Society of London on his method of taking pictures

by means of light, naming his discovery Heliography;* but as he kept his process a secret, it could not, agreeably to one of their laws, be printed by them. The memoir was accompanied by several designs on glass, copper plated with silver, and well planished tin plate. Daguerre had at the same time produced some specimens on paper saturated with chloride of silver, but the want of sensibility in the preparation had necessarily rendered them extremely confused.

7. On the 31st of January, 1839, Mr. Fox Talbot communicated to the Royal Society his photographic discoveries;† and six months afterwards, the French philosophers published to the world their process, termed Daguerreotype. Mr. Talbot's most recent discovery was accidental. He was trying some experiments on the relative sensitiveness of several kinds of paper by exposing them for very short periods in the camera; some papers which were taken from the instrument exhibiting no impressions, were thrown aside as useless in a dark room; after some time, they were again examined, and, strange to say, by a process of natural magic, pictures of the objects to which the camera had been pointed were found on them in the dark.

8. Previously, however, to the secret discovered by Daguerre and Niepce having been published, it was offered to the French Government, who entered into an arrangement with them, by which they undertook to make public their discovery, on the receipt of an annuity of 250*l.* to Daguerre, and 166*l.* to Niepce. In the former case, this annuity has been increased to 446*l.* From this time the progress of the photographic art has been rapid, and the improvements in it manifold, owing to the continued exertions of Herschel, Talbot, and others.

* From Ηλιος the sun, and γραφω to depict, to draw.

† Published in the London and Edinburgh Magazine, vol. xiv. p. 126.

Having thus briefly considered the history of this important and delightful science, we will proceed in the next place to consider the principle on which the art depends.

9. Light acts upon all bodies. To the existence of this subtle agent alone do we owe our sense of all the varied beauties which are around us.

> "Efflux divine!—Nature's resplendent robe!
> Without whose vesting beauty all were wrapt
> In unessential gloom."

Light is the garb of nature, clothing the garden and the meadow, glowing in the ruby and the emerald, sparkling in the diamond, and equally displaying its power in the animal and vegetable world.

10. But if its effects be thus visible in the animal and vegetable creation, equally apparent and equally wonderful are they upon inorganic matter. In one instance, we may observe that the action of light will induce the combination of bodies, while in another it will effect their decomposition. Thus, chlorine and hydrogen will remain in a glass vessel without alteration, if kept in the dark; while, on the contrary, if exposed to the rays of the sun, they enter into combination, and form hydrochloric acid. On the other hand, if colourless nitric acid be exposed to the sun's rays, it becomes yellow, afterwards changes to red, and oxygen is liberated by the partial decomposition effected by the solar rays.

11. But of the inorganic substances none are more readily acted upon by light than the various combinations of silver. Of these, some are more and others less sensitive. If chloride of silver, which is a white precipitate formed by adding chloride of sodium (common salt) to solution of nitrate of silver, be exposed to diffused daylight, it speedily assumes a violet tint, and ultimately will become black. With iodide of silver, bromide of silver, ammonio-nitrate of silver, and other salts of this metal, the results will be much the same.

12. Although it is utterly impossible, in a little work like this, to enter into a detail of the theories of light, still I deem it necessary to the clear apprehension of the subject, to allude briefly to the mode in which the chemical effects of light are accounted for on the undulatory theory. It is found by the prismatic spectrum that each ray of white light is made up of seven different kinds of light, of different colours, namely,—red, orange, yellow, green, blue, indigo, violet. Now, in the theory which supposes light to consist in the vibrations or undulations of a highly elastic medium, it is imagined that the waves of red light are longer than any of the others, and the length decreases from the red to the violet, which is the shortest; but the violet wave, in order to make up for this difference, is quicker in its travel,—that is to say, that it creates a greater number of vibrations in a given time. Now, the undulatory theorists further suppose that all chemical change depends upon the motion communicated to the particles of matter by the undulations of the ethereal fluid, and that the violet ray would, therefore, by its greater rapidity of motion, produce the greatest chemical change. And this is found to be the case. So late as the year 1801, Mr. Ritter, of Jena, discovered that the chemical effects of the spectrum resided at the violet end, and that the red ray had little or no chemical influence on the most sensitive preparations.

13. The knowledge of this fact has led M. Claudet to construct the windows of his photogenic apartment at the Adelaide Gallery of blue glass, and by this means he excludes all but the useful ray of light.

14. I shall now proceed to describe in due order the various photogenic processes. Before, however, doing this, it is necessary above all things to impress on the mind of the experimenter the necessity which exists for extreme care in every stage of the manipulation; for it is but natural to suppose that an art which involves the most delicate chemical changes, should

require that more than ordinary caution should be taken in selecting the materials used for photographic purposes.

Apparatus and Materials.

15. *Paper.*—The principal difficulty to be contended with in using paper, is the different rates of imbibition which we often meet with in the same sheet, owing to trifling inequalities in its texture. This is to a certain extent, to be overcome by a very careful examination of each sheet, by the light of a candle or lamp at night, or in the dark. By extending each sheet between the light and the eye, and slowly moving it up and down, and from left to right, the variations in its texture will be seen by the different quantities of light which pass through it in different parts; and it is always the safest course to reject every sheet in which such inequalities exist. Paper sometimes contains minute portions of thread, black or brown specks, and other imperfections, all of which materially interfere with the process. Some paper has an artificial substance, given to it by sulphate of lime (plaster of Paris); this defect only exists, however, in the cheaper sorts of demy, and therefore can be easily avoided. In all cases such paper should be rejected, as no really sensitive material can be obtained with it. Paper makers, as is well known, usually affix their name and the date of manufacture to one-half of the sheet; this moiety should likewise be placed aside, as the letters most frequently come out with annoying distinctness. A well sized paper is by no means objectionable, indeed, is rather to be preferred, since the size tends to exalt the sensitive powers of the silver. Unsized paper has been recommended by some, but experience would rather teach its impropriety. The principal thing to be avoided, is the absorption of the sensitive solution into

the pores; and it must be evident that this desideratum cannot be obtained by unsized paper. Taking all things into consideration, the paper known as *satin post* would appear to be the most preferable, although the precautions already recommended should be taken in its selection. As a general rule, the best paper for the purpose, is Whatman's satin post, sold by nearly all stationers. A very thin paper is frequently used where the transfer of the photograph is required; but by a process, elsewhere explained, this is not requisite.

16. *Brushes.*—The necessary solutions are to be laid upon the paper with a brush. Some persons pass the paper over the surface of the solution, thus licking up as it were, a portion of the fluid; but this method is apt to give an uneven surface unless great dexterity of manipulation be employed. At all events the brush is the most ready, and the most effectual means. They should be formed of camel or badger hair—should not have any metal in contact with them, and should be sufficiently broad and large to cover the paper in two or three sweeps; for if small ones be employed, it will be evident that many strokes must be given, which is very likely to leave corresponding marks. Many an otherwise good picture is spoiled by a neglect of this apparently trifling matter. It must further be remembered that each solution requires its distinct brush, which, after use must be immediately washed in distilled water.

17. *Distilled Water.*—All the water used both for washing the brushes, mixing the solutions, and washing the papers, must be distilled; clean rain-water, however, answers the purpose tolerably. Common water holds various substances in solution, which will infallibly ruin the whole operations. It must likewise be remembered, that distilled water should never be used but for one operation; thus, for example, we must not wash the sensitive calotype paper, hereafter to be described, in the same water as that in which the fixed paper is to

be placed, and vice versa. The best and surest method is to change the water after use.

Distilled water can be procured of most chemists; but in an economical point of view, this is not an advantageous way of obtaining it. The experimenter may distil it himself.

FIG. 1.

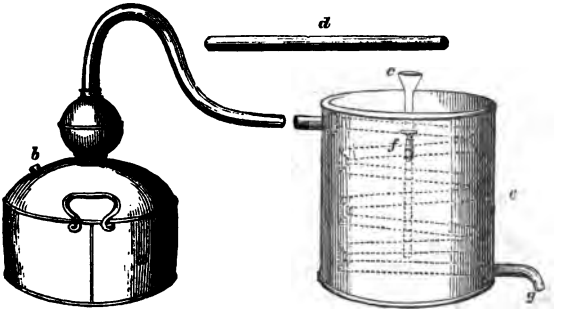


Fig. 1 represents a convenient and economical still for the purpose. The whole is made of tinned iron, and can be used on a common fire. *a* is the body holding one gallon of water, which is introduced at the opening *b*, which is then stopped by a cork. The tube *d* connects the neck of the still with the worm tub or refrigitory *e*, which is filled with cold water, a supply being kept up through the funnel *c*, the hot water being drawn off through the cock *f*; the different joints are rendered tight by lute, or in the absence of it, some stiff paste spread on a piece of broad tape, and put round them, answers very well. The distilled water is condensed in the worm, and passing off at the pipe *g*, is collected and preserved for use in a glass bottle.

FIG. 2.

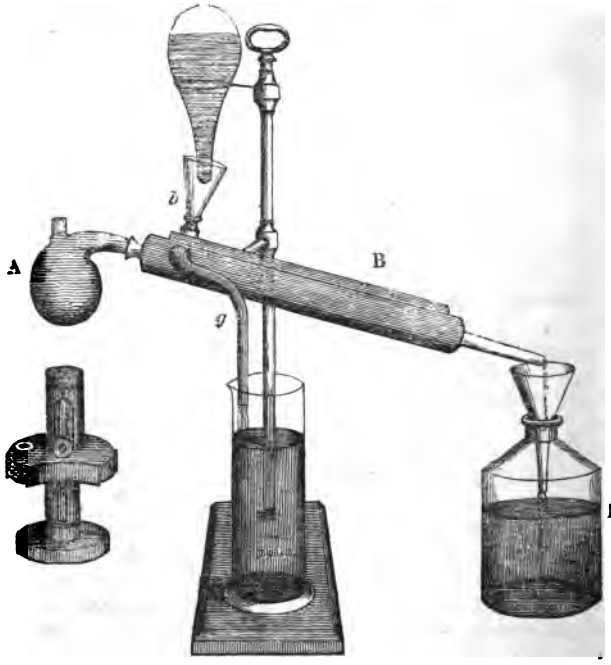


Fig. 2 represents another form of apparatus, which occasionally has its advantages. A is a glass retort, containing the water to be distilled; B, Liebig's condensing tube, a very useful piece of apparatus; it consists of a glass tube about $\frac{3}{4}$ inch in diameter passing through a metal cylinder $2\frac{1}{2}$ inches in diameter; a small tube attached to the funnel *b* passes to the bottom of the cylinder, and by this the cold water is supplied, the hot being carried off by the bent tube *g*; the cold water is conveniently supplied by an inverted

flask; the distilled water is collected in the bottle E; the retort may be heated either by a lamp or small chauffer.

18. *Blotting Paper.*—In many instances, the prepared paper requires to be lightly dried with bibulous paper. The best material of this description is the white paper, which may be obtained at most stationers. In each stage of the preparation distinct portions of bibulous paper must be used. If these be kept separate, and marked, they can be again employed for the same purpose; but it would not do to dry the finished picture for example in the same folds in which the sensitive paper had been dried. A very convenient method is to have two or three quarto-size books of bibulous paper, one for each separate process.

19. *Nitrate of Silver.*—In the practice of the photographic art much depends on the nitrate of silver. Care should be taken to procure the best; the crystallized salt is alone fit for the purpose, the variety sold in sticks, under the name of lunar caustic, not answering so well. While in the form of crystal it is not injured by being exposed, but the bottles containing the solutions of this salt should at all times be kept wrapped in dark paper, and excluded from the light.

Different Methods of Preparing the Paper.

20. *Preparation of the Paper.*—Dip the paper to be prepared into a weak solution of common salt. The solution should not be saturated, but six or eight times diluted with water. When perfectly moistened, wipe it dry with a towel, by which operation the salt is uniformly dispersed throughout its surface. Then brush over it on one side only a solution of nitrate of silver. The strength of this solution varies according to the colour and sensitiveness required. Mr. Talbot recommends about fifty grains of the salt to an ounce of distilled water. Mr.

Golding Bird advises twenty grains only to the ounce. I have been accustomed to use a solution of the strength of ninety grains to an ounce, and I have found it to make an excellent and very sensitive paper. When dried in a dark room, the paper is fit for use. To render this paper still more sensitive, it must again be washed with salt and water, and afterwards with the same solution of nitrate of silver, drying it between times. This paper, if carefully made, is very useful for all ordinary photogenic purposes. For example, nothing can be more perfect than the images it gives of leaves and flowers, especially with a summer's sun: the light, passing through the leaves, delineates every ramification of their nerves. In conducting this operation, however, it will be found that the results are sometimes more and sometimes less satisfactory in consequence of small and accidental variations in the proportions employed. It happens sometimes that the chloride of silver formed on the surface of the paper is disposed to blacken of itself, without any exposure to light. This shows that the attempt to give it sensibility has been carried too far. The object is, to approach as nearly to this condition as possible, without reaching it; so that the preparation may be in a state ready to yield to the slightest extraneous force, such as the feeblest impartition of light.

21. *Cooper's Method.*—Soak the paper in a boiling-hot solution of chlorate of potash (the strength matters not) for a few minutes; then take it out, dry it, and wet it with a brush on one side only with a solution of nitrate of silver, sixty grains to an ounce of distilled water, or, if not required to be so sensitive, thirty grains to the ounce will do. This paper possesses a great advantage over any other, for the image can be fixed by mere washing. It is, however, very apt to become discoloured, even in the making, or shortly afterwards, and is besides not so sensitive, nor does it become so dark as that made after Mr. Talbot's method.

22. *Daguerre's Method.*—Immerse the paper in hydro-chloric (or, as it is more commonly called, muriatic) ether, which has been kept sufficiently long to have become acid; the paper is then carefully and completely dried, as this is essential to its proper preparation. It is then dipped into a solution of nitrate of silver, and dried without artificial heat in a room from which every ray of light is carefully excluded. By this process it acquires a very remarkable facility in being blackened on a very slight exposure to light, even when the latter is by no means intense. The paper, however, rapidly loses its extreme sensitiveness to light, and finally becomes not more readily acted upon by the solar beams than common nitrate paper.

23. *Golding Bird's Method*—Is a modification of Mr. Talbot's. It consists in using 200 grains of salt to a pint of distilled water, soaking the paper in it, taking off superfluous moisture between the folds of bibulous paper, or by a cloth; and while still damp, washing the paper on one side with twenty grains of nitrate of silver in an ounce of distilled water. The paper is to be hung up to dry in a dark room. For all common purposes this paper is as good as can be made, producing a rich mulberry tint.

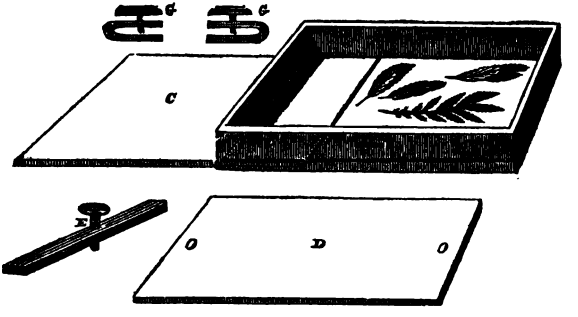
24. *Bromide Paper.*—Of all common photographic paper, the best, because the least troublesome in making, and the most satisfactory in result, is that which is termed the bromide paper, and which is thus made:—Dissolve 100 grains of bromide of potassium in one ounce of distilled water, and soak the paper in this solution. Take off the superfluous moisture, and when nearly dry, brush it over on one side only with a solution of 100 grains of nitrate of silver to an ounce of distilled water. The paper should then be dried in a dark room, and if required to be very sensitive, should a second time be brushed over with the nitrate of silver solution.

25. In preparing the papers mentioned above, there are two circumstances which require particular attention. In the first place, it is necessary to mark the paper. It will be seen in every one of the methods of which mention has been made, that the nitrate of silver solution is applied to one side only. In order, therefore, to be able to know the sensitive side, it is necessary to place a mark on its extreme edge. This answers two purposes: in the first place, it serves to inform the experimentalist of the sensitive surface; and secondly, it will be a guide as to which portion of the paper has been handled during the application of the solution, as the impress of the finger will probably come out upon the photograph. The second caution is that the application of the sensitive solution (nitrate of silver) and the subsequent drying of the paper, must be always conducted in a perfectly dark room, the light of a candle being alone used.

26. *To make the Drawings.*—The simplest mode is to procure a flat board and a square of plate glass, larger in size than the object intended to be copied. On the board place the photogenic paper with the prepared side upwards, and upon it the object to be copied; over both lay the glass, and secure them so that they are in close connection by means of binding screws or clamps, similar to G, G, Fig. 3. Should the object to be copied be at all in relief, such as a leaf, grass, &c., it will be necessary to place on the board, first, a soft cushion, which may be made of a piece of fine flannel and cotton wool. By this means the object is brought into closer contact with the paper, which is of great consequence, and adds materially to the clearness of the copy. The paper is now exposed to diffused daylight, or still better, to the direct rays of the sun, when that part of the paper not covered with the object will become tinged with a violet colour, and if the paper be well prepared, it will in a short time pass to a deep brown

or bronze colour. It must then be removed, as no good will be obtained by keeping it longer exposed; on the contrary, the delicate parts yet uncoloured will become in some degree affected. The photogenic paper will now show a more or less white and distinct representation of the object. Fig. 3 represents a more

Fig. 3.



convenient apparatus: it consists of a wooden frame similar to a picture-frame; a piece of plate glass is fixed in front; and it is provided with a sliding cover of wood, *C*, which is removed when the paper is ready to be exposed to the action of the light. The back, *D*, which is furnished with a cushion as just described, is made to remove for the purpose of introducing the object to be copied, and upon it the prepared paper; the back is then replaced, and by aid of the cross piece and screw, E, the whole is brought into close contact with the glass.

27. The objects best delineated on these photographic papers, are lace, feathers, dried plants, particularly the ferns, the sea-weeds, and the light grasses, impressions of copper plate and wood engravings, particularly if they have considerable contrast of light and shade—(these should be placed with the face downwards,

having been previously covered with wax as described in § 31), paintings on glass, stained windows, etchings, &c.

28. *To fix the Drawings.*—Mr. Talbot recommends that the drawing should be dipped in salt and water, and in many instances this method will succeed, but at times, it is equally unsuccessful. Iodide of potassium, or as it is more frequently called, hydriodate of potash, dissolved in water, and very much diluted (25 grains to 1 oz. of water), is a more useful preparation to wash the drawings with; it must be used very weak or it will not dissolve the unchanged muriate only as is intended, but the blackened oxide also, and the drawing be thereby spoiled.

29. But the most certain material to be used is the hyposulphite of soda. 1 oz. of this salt should be dissolved in about a pint of distilled water. Having previously washed the photogenic drawing in a little lukewarm water, which of itself removes a large portion of the muriate of silver which is to be got rid of, it should be dipped once or twice in the hyposulphite solution. By this operation the muriate which lies upon the lighter parts will become so altered in its nature as to be unalterable by light while the rest remains dark as before.

30. It will be evident from the nature of the process, that the colour of an object is reversed. That which is originally opaque will intercept the light, and consequently those parts of the photogenic paper will be least influenced by light, while any part of the object which is transparent, by admitting the light through it, will suffer the effect to be greater or less, in exact proportion to its degrees of transparency. The object wholly intercepting the light, will show a white impression, but in selecting such for example as a butterfly for an object, the animal being more or less transparent, leaves a proportionate gradation of light and

shade, the most opaque portion showing the whitest colours. It may be said therefore that the representation is not natural. This is admitted, and in order to obtain a just delineation, we must place our first acquired photograph upon a second piece of photogenic paper. Before we do this, however, we must render our photographic picture transparent, otherwise the opacity of the paper itself will mar our efforts.

31. To accomplish this object then, the back of the paper containing the negative or first acquired photograph should be covered with white or virgin wax. This may be done by scraping wax upon the paper, and then, after placing it between two other portions of paper, passing a heated iron over it. The picture being thus rendered transparent should now be applied to a second piece of photogenic paper, and exposed in the manner before directed, either to diffused daylight or to the direct rays of the sun. The light will now penetrate the whiter parts, and the second photograph be the reverse of the former, or a true picture of the original.

32. *Application.*—Mr. Talbot has recorded so many applications of the art of Photography, that little can be added to the list. They may be summed up briefly as follows:—

The copying of paintings on glass by the light thrown through them on the prepared paper. Imitations of etchings, suggested by Mr. Havell but since claimed by Mr. Talbot. These are done by painting a piece of glass with a thick coat of white oil paint; when dry, with the point of a needle, lines or scratches are to be made through the white lead ground, so as to lay the glass bare; then place the glass upon a piece of prepared paper, and of course every line will be represented beneath of a black colour, and thus an imitation etching will be produced. The delineation of microscopic objects, architecture, sculpture, landscapes, and external nature.

THE CALOTYPE.

33. But as the photographic paper already described is but moderately sensitive, and requires some considerable time before the image is sufficiently impressed upon it, it is advisable to make use of that, the sensibility of which is so extreme, that a single minute is sufficient to "catch the fleeting shadows as they pass." For this purpose none answers so well as the preparation discovered by Mr. Talbot, and to which he has given the name of Calotype.* The following abstract from Mr. Talbot's paper read before the Royal Society on this subject will be sufficiently explicit, especially as the manipulation requisite is precisely the same as in Photography.

34. *Preparation of the Paper.*—Dissolve 100 grains of crystallized nitrate of silver in six ounces of distilled water, and brush the paper selected with a soft brush on one side only with this solution, a mark being placed on that side whereby it may be known. When nearly dry, dip it into a solution of iodide of potassium, containing 500 grains of that salt dissolved in a pint of water. When perfectly saturated with this solution, it should be washed in distilled water, drained and allowed to dry. This is the first part of the process, and the paper so prepared is called *iodized paper*. It is scarcely sensitive to light, but nevertheless it should be kept in a portfolio or drawer until required: with this care it may be preserved for any length of time without spoiling or undergoing any change.

35. The next part of the process consists in preparing a solution to which Mr. Talbot has given the name of gallo-nitrate of silver, in the following manner:—Dissolve 100 grains of crystallized nitrate

* From καλος beautiful, and τυπος a picture.

of silver in two ounces of distilled water, to which should be added $\frac{1}{8}$ of its volume, (that is to say $2\frac{3}{4}$ drachms) of strong acetic acid. This solution should be kept in a bottle carefully excluded from the light. Again, make a saturated solution of gallic acid in cold distilled water: the quantity dissolved is very small. When it is required to take a picture, the two liquids above described should be mixed together in equal quantities, but it may be necessary to recommend that but a small quantity should be made at a time, as the mixture does not keep long without spoiling. This then is called the *gallo-nitrate of silver*. A sheet of the iodized paper should be washed over with a soft brush with this mixed solution, care being taken that it be applied to the marked side. This operation must be performed by candle-light. Let the paper rest half a minute, then dip it into water and dry it lightly with bibulous paper: it is now highly sensitive, and is ready to receive the impression.

36. The Calotype paper thus prepared possesses so high a degree of sensibility when exposed to light, as to require an almost inconceivably short period of time, varying from one second to five minutes, to receive an impression. We are thus provided with a medium by which we may effectually copy from nature landscapes, microscopic objects, architecture, &c., and by which we may take portraits or sillouettes from the shadows thrown on the paper by the living face. But for this process we require an instrument not hitherto described, viz., the Photogenic Camera. Most persons are conversant with the construction of the common Camera Obscura. The one suited for photogenic experiments differs slightly from it, but is equally simple in its construction.

37. *The Camera.*—This is the most important instrument required in the practice of the photogenic art, and it has consequently undergone several alterations and modifications. The simplest is represented by

FIG. 4.

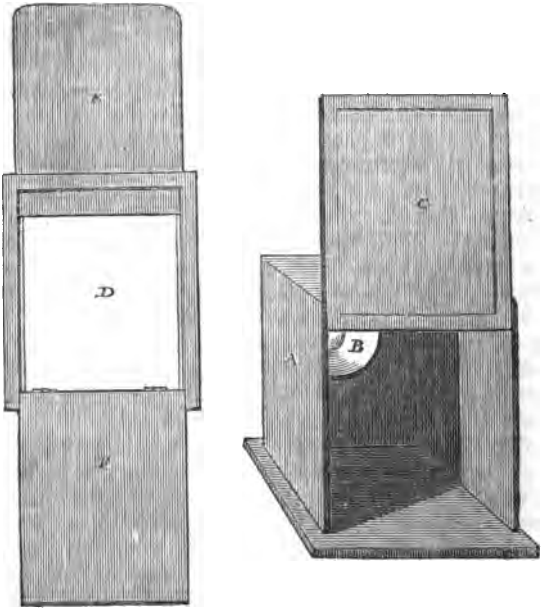
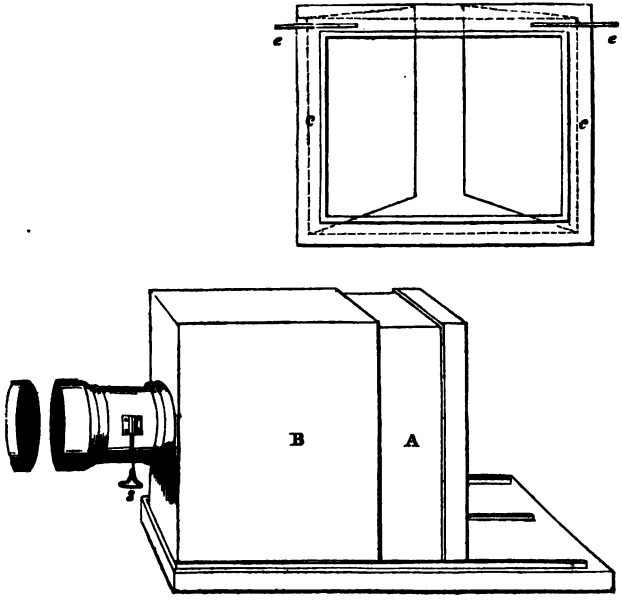


Fig. 4. A is a square wooden box, the bottom made to project an inch beyond the sides, for the purpose of fixing it by means of a clamp firmly to the table or other convenient support; the size is regulated by the diameter and focus of the lens. B is the lens, fixed in a brass tube, which is sometimes made to adjust with a rack and pinion, or else merely to slide in a second tube. In the better cameras achromatic lenses are adopted, but as these more than double the price of the camera, cheaper ones are frequently used, and

have been found to answer for ordinary purposes extremely well; these are known by the term Miniscus lenses, the one surface of which is convex, and the other concave, the concave being placed outward, or next the object. C is a piece of plate glass, one surface of which is ground, for the purpose of rendering it semi-transparent. This is fitted to a frame of wood, which slides in a groove, and forms the back of the camera, and is for the purpose of adjusting the lens to the proper focus, the object being delineated in the most beautiful manner on the ground surface, which should be the external one. D is a wood frame, the front of which E is made to slide out, and the part F to fold back; the prepared paper attached to a piece of card, thin board, or piece of metal, so as to keep it perfectly flat, is introduced, the prepared side next to E, the flap F being closed, the paper is preserved from all action of light; the ground glass C is next withdrawn, and the frame D put in its place, the slide E is then withdrawn by which the light is allowed to act on the prepared paper; when it has remained the proper time the slide is replaced, the frame itself is removed, and taken into a dark room, in order to submit the paper to the fixing operation.

Fig. 5 shows another form of camera better calculated for taking large and distant views. The body A B is made double, so as to render it longer or shorter as occasion may require; the focus is regulated by the screw *s* and rack work attached to the brass mounting inclosing the lenses; *c c* is the frame for holding the paper (or plate, if used for Daguerreotype, which process we shall presently fully describe,) and differs somewhat from the one just mentioned; the back is a fixture, and the front is provided with two doors, which, by means of the two brass quadrants *e e*, can be opened or shut when the frame is fixed in the camera.

FIG. 5.



But of all the cameras hitherto made for photogenic purposes, none perhaps are equal to that contrived by Dr. Petzval, Professor of Mathematics at the University of Vienna, and further improved by M. Voigtlander, of the same place. Fig. 6 represents this instrument; it is made entirely of metal, which greatly increases its accuracy, steadiness, and portability, so that when packed up in its box with all the necessary apparatus for practising either the Daguerreotype or Calotype, it occupies but very small space.

38. *Description and Method of Using Voigtlander's improved Photogenic Camera.*—The brass foot A,

FIG. 6.

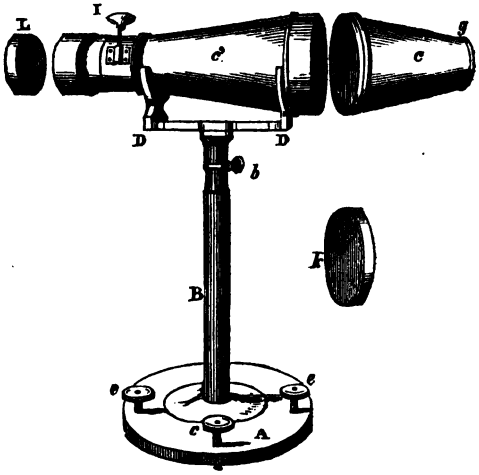


Fig. 6, is placed on a table, or other firm support, and the pillar B screwed into it; the body of the camera C C is laid into the double forked bearing D D. The instrument is now properly adjusted by means of the set screws *e e e* in the brass foot, or it may be raised, lowered, or moved from one side to the other, by the telescope-stand, and when correct fixed by the screw *b*. The landscape or portrait to be delineated is viewed either through the small lens *g*, or with the naked eye on the ground glass plate H, the focus being adjusted by the screw I. The optical part of the instrument consists of two separate achromatic lenses; the first, or external one, has a free aperture of $1\frac{1}{2}$ inches; the second $1\frac{5}{8}$ inches; and both have the same focus, viz. $5\frac{3}{4}$ inches. By these means the light is reflected with consi-

derable intensity, and the clearness and correctness of the delineation are truly surprising. The success of this plan is evident from the general adoption of these cameras in taking of portraits, where the greatest perfection is required. When the view or portrait to be taken is delineated on the ground glass to the entire satisfaction of the operator, the brass L cap is placed over the lens, and the entire body is removed away into the dark, taking care not to disturb the position of the stand. The body is now detached at the part H, and the prepared paper or plate inclosed in the brass plate K introduced in its place; the whole is again placed on the pedestal, the brass cap L is removed by which the paper or plate is exposed to the full influence of the light, after which the cap is again replaced. We shall have occasion to refer to this camera when describing the Daguerreotype process.

39. *Time.*—With regard to the time which should be allowed for the paper to remain in the camera, no direct rules can be laid down; this will depend altogether on the nature of the object to be copied, and the light which prevails. All that can be said is, that the time necessary for forming a good picture varies from thirty seconds to five minutes, and it will naturally be the first object of the operator to gain by experience this important knowledge.

40. *Bringing out the Picture.*—The paper when taken from the camera, which should be done so as to exclude every ray of light, bears no appearance of the picture which in reality is formed. The impression is latent and invisible, and its existence would not be suspected by any one who was not acquainted with it by previous experiments. The method of causing the impression to become visible is extremely simple. It consists in washing the paper with the *gallo-nitrate of silver*, prepared in the way already described, and then warming it gently. In a few seconds the part of the paper upon which the light has

acted will begin to darken, and finally grow entirely black, while the other part of the paper retains its original colour. Even a weaker impression may be brought out by again washing the paper with the gallo-nitrate, and once more gently warming it. When the paper is quite blank, as is generally the case, it is a highly curious and beautiful phenomenon to witness the spontaneous commencement of the picture, first tracing out the stronger outlines, and then gradually filling up all the numerous and complicated details. The artist should watch the picture as it developes itself, and when in his judgment it has attained the greatest degree of strength and clearness, he should stop further proceedings by washing it with the fixing liquid.

41. *The Fixing Process.*—"In order to fix the picture thus obtained, first dip it into water, then partly dry it with blotting-paper, and wash it with a solution of bromide of potassium containing 100 grains of that salt dissolved in eight or ten ounces of water (distilled). The picture is again washed with water, and then finally dried. Instead of bromide of potassium a strong solution of salt may be used, but it is less adviseable.

42. *Artificial Light.*—"It was at one time supposed that terrestrial or artificial light possessed no chemical rays, but this is incorrect. Mr. Brande found that although the concentrated light of the moon, or the light even of olefiant gas, however intense, had no effect on chloride of silver, or on a mixture of chlorine and hydrogen, yet the light emitted by electrized charcoal blackens the salt. At the Royal Polytechnic Institution pictures are daily taken by means of sensitive paper, acted upon by the Drummond light. The longest time required is thirty seconds, and the paper is sensibly darkened in one second. Nor is there any attempt made in this case to concentrate the rays; no reflector is used.

43. "The Calotype picture, like the Photographic one which we first described, is negative, that is to say, it has its lights and shades reversed, giving the whole an appearance not conformable to nature. But it is easy from this picture to obtain another which shall be conformable to nature, viz., in which the lights shall be represented by lights, and the shades by shades. It is only necessary for this purpose to take a sheet of photogenic paper, (the bromide paper is the best), and place it in contact with the calotype picture, previously rendered transparent in the manner before recommended, § 30. Being then placed in sunshine or daylight for a short time, an image or copy is formed upon the photogenic paper. The calotype paper itself may b used to take the second picture, but this Mr. Talbot does not recommend, for although it takes a much longer time to take a copy on the photographic paper, yet the tints of such copy are generally more harmonious and agreeable. After a calotype picture has furnished a good many copies it sometimes grows faint, and the subsequent copies are inferior. This may be prevented by means of a process which revives the strength of the calotype pictures. In order to do this, it is only necessary to wash them by candle-light with gallo-nitrate of silver, and then warm them. This causes all the shades of the picture to darken considerably, while the white parts are unaffected. After this the picture is of course to be fixed a second time. It will then yield a second series of copies, and a great number of them may frequently be made."

44. In order to take portraits from the life, it is better to use for the object glass of the camera, a lens whose focal length is only three or four times greater than the diameter of the aperture. The person whose portrait is to be taken, should be so placed that the head may be as steady as possible, and the camera being then pointed at it, an image is received on the sensitive calotype paper. The process should be conducted in

the open air under a serene sky, but without sunshine. If sunshine be employed, a sheet of blue glass should be used as a screen to defend the eyes from too much glare, because this glass does not materially weaken the power of the chemical rays to affect the paper. The portrait thus obtained on the calotype paper is a negative one, and from this positive copies may be obtained in the manner already described in § 30.

45. Having thus fully and it is hoped clearly considered the process, it may be necessary before entirely dismissing the calotype from notice, to make one or two remarks for the guidance of the young experimentist in the conduct of his experiments. Dr. Ryan, the lecturer on this subject at the Polytechnic Institution, has observed, that in the iodizing process the sensitiveness of the paper is materially injured by keeping it *too long* in the solution of iodide of potassium, owing to the newly formed iodide of silver being so exceedingly soluble in excess of iodide of potassium, as in a few minutes to be completely removed. The paper should merely be dipped in the solution and instantly removed.

46. There is another point, too, in the preparation of the iodized paper, in which Mr. Mitchell, Dr. Ryan's assistant, suggests a slight deviation from Mr. Talbot's plan. In the first instance, he recommends the paper to be brushed over with the solution of the iodide of potassium, instead of the nitrate of silver, transposing, in fact, the application of the first two solutions. The paper having been brushed over with the iodide of potassium in solution, is washed in distilled water and dried. It is then brushed over with nitrate of silver, and after drying is dipped for a moment in a fresh solution of iodide of potassium of only one-fourth the strength of the first, that is to say, consisting of 125 grains of the salt dissolved in one pint of water. After this it is again washed and dried. The advantage derived from this method is a more sensitive paper, and

a more even distribution of the compounds over the surface.

47. Mr. Collen, who has devoted much of his time to perfecting the process originally devised by Mr. Talbot, has succeeding not only in improving but in simplifying the original plan. His process is as follows:—Brush the paper over with a solution of nitrate of silver, containing 100 grains of that salt to 1 oz. of distilled water. When nearly but not quite dry, dip it into a solution of iodide of potassium of the strength of twenty-five grains of the salt to one ounce of distilled water, drain it, wash it in distilled water, and again drain it. Now brush it over with the ammonio-nitrate of silver, made by dissolving fifty grains of nitrate of silver in one ounce of distilled water, to which is added one-sixth of its volume of strong acetic acid. Dry it with bibulous paper, and it is now ready for receiving the image. When the impression has been received, which will require from one to five minutes according to the state of the weather, it must be washed with a solution of gallic acid, to which a few drops of the ammonio-nitrate of silver, made as above, have been added. The image will thus be gradually brought out, and may be fixed with hyposulphite of soda. To obtain the positive picture, Mr. Collen uses paper brushed over with an ammonio-nitrate of silver, made thus:—forty grains of nitrate of silver is to be dissolved in one ounce of distilled water, and liquid ammonia cautiously added till it re-dissolves the precipitate.

48. In preparing the calotype paper, it is necessary to be extremely careful, not only to prevent the daylight impinging on it, but also to exclude, if possible, the strong glare of the candle or lamp. This may be effected by using a shade of yellow glass or yellow gauze, which must be placed around the candle or lamp. Light passing through such a medium will scarcely affect the sensitive compounds, the yellow glass intercepting the chemical rays. At the Poly-

technic Institution, the strong glare of the Drummond light is employed during the preparation of the paper without any injury accruing, merely by covering the flame with a shade of yellow glass, although without such a medium the paper would be completely spoiled in half a second.

49. *Apparatus necessary for the Calotype.*—In preparing the paper according to Mr. Talbot's plan, the operator will find that, previously to commencing his experiments, he will have to provide himself with the following apparatus:—

Two large shallow dishes, A A Fig. 9, for holding distilled water, and here it may be necessary again to repeat the caution already given, never to use the same water for two operations.

A large glass vessel for holding the bromide of potash solution.

Bibulous paper, camera, wooden frame, Fig. 3, a shade of yellow glass, and several camel or badger-hair brushes. These have already been mentioned; all that need be added is a repetition of our former advice, to keep each brush for its own particular solution. The brush used for the gallo-nitrate is soon spoiled, owing to the rapid decomposition of that preparation.

A graduated measure, in which to mix the solutions forming the gallo-nitrate of silver.

50. It will be seen that in one portion of the calotype process, it is necessary to warm the paper, in order to bring out the picture. Mr. Talbot directs a gentle fire; but as this is inconvenient, the following will be found a more useful mode. One of the flat shallow dishes before-mentioned, and seen at Fig. 9, is fitted into a metal frame, which is filled with hot water, forming a very convenient drying apparatus, the heat from the hot water being quite sufficient; the flat surface also drys the paper very equally.

CHRYSOTYPE.

51. A modification of Mr. Talbot's process, to which the name of Chrysotype* was given by its discoverer, Sir John Herschel, was communicated in June last to the Royal Society by that distinguished philosopher. This modification would appear to unite the simplicity of Photography will all the clearness and distinctness of Calotype. This preparation is as follows :—the paper is to be washed in a solution of ammonio-citrate of iron ; it must then be dried, and subsequently brushed over with a solution of the ferro-sesquicyanuret of potassium. This paper, when dried in a perfectly dark room, is ready for use in the same manner as if otherwise prepared, the image being subsequently brought out by any neutral solution of gold. Such was the first declaration of his discovery, but he has subsequently found that a neutral solution of silver is equally useful in bringing out the picture. Sir John Herschel observes that photographic portraits taken on this paper are distintinguished by a clearness of outline foreign to all other methods.

CYANOTYPE.

52. So called from the circumstance of cyanogen in its combinations with iron, performing a leading part in the process, is likewise a discovery of the Philosopher Herschel. It has also been termed FERROTYPE. The process is a simple one, and the resulting pictures are blue. Brush the paper with a solution of the ammonio-citrate of iron. This solution should be sufficiently strong to resemble sherry-wine in colour. Expose the paper in the usual way, and pass ery sparingly and evenly, a wash of the com-

* From χρυσος gold, and τυπος a picture.

mon yellow ferro-cyanate of potass. As soon as the liquid is applied, the negative picture vanishes, and is replaced by a positive one, of a violet blue colour on a greenish yellow ground, which, at a certain time, possesses a high degree of sharpness, and singular beauty of tint.

ANTHOTYPE.

53. The expressed juice, alcoholic, or watery infusion of flowers or vegetable substances, may be made the media of photogenic action, and the discovery of these interesting facts are, as in the former case, due to Sir John Herschel. The papaver hybridum, the double ten-week stock, the rose, guiacum, and many other plants, have given results which, although in a practical point of view almost useless, tend nevertheless to the explanation of facts which were heretofore somewhat obscured. Thus, the flowers which, imbued with the principle of vitality, whatever that may be, resist the influence of all exterior agents, bud, bloom and flourish in beauty and fragrance, become subject, when the vital energy is exhausted, to these very influences, especially to that of light; the colour vanishes or is changed; in fact, a photogenic process has taken place.

DAGUERREOTYPE.

54. We come now to consider and describe that beautiful process of photogenic manipulation, known by the term Daguerreotype; so called from its discoverer Daguerre, who, together with M. Niepce, were rewarded by the French government, and the process given to the world. Still this has not prevented, as before stated, its being patented in this country.

Daguerreotype differs essentially from the other pro-

cesses of the photogenic art, in as much as the production of the image is effected on plates or surfaces of silver; in other words, silver plated on copper; the silver employed should be as pure as possible; the thickness of the two metals together need not exceed that of a card, the silver being of sufficient substance to bear the cleaning and polishing, is all that is required.

To practise the Daguerreotype with success, requires only a little patience and a due attention to the directions here given.

The entire process is comprised in five distinct operations; which may be thus briefly described—

1. Cleaning and polishing the plate.
2. Applying the sensitive coating or film of iodine.
3. Submitting the plate to the influence of light in the camera.
4. Bringing out the picture; in other words, rendering it visible.
5. Fixing the image, so that the light shall no longer act upon it.

These five processes we shall now fully explain; and we shall endeavour to do so as simply as possible, at the same time entering into all necessary detail; and we must once more impress upon our readers the necessity of proceeding with patience through each different operation, which, after a little practice, will be found very easy, but which, if not attended to, failure will inevitably be the result.

55. First operation, *cleaning and polishing the plate.*

The apparatus and materials required are, a small quantity of the finest carded cotton, olive oil, spirits of wine, nitric acid diluted with about ten or fifteen parts of water, prepared lamp black, calcined tripoli, or rotten stone, velvet buff, spirit lamp, and a stand for the support of the plate; also, some cement and a block of wood, something in the form of a dice-box, will be found very convenient.

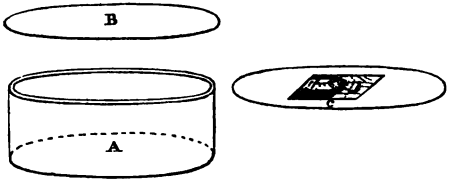
The first thing to be attended to is to procure good and well manufactured plates, as should there be any imperfection in them, no care or pains taken in the polishing will be of the slightest avail. If the plate be a new one, and properly manufactured, it will probably possess a sufficient degree of polish; in this case all that is necessary will be to buff it over with some of the prepared lamp-black; this is done by first fixing the plate by means of cement to the wood block, by which contrivance all the edges of the plate are left quite free, and the plate can be held firmly in the left hand. Some of the prepared lamp-black, which for convenience is enclosed in a muslin bag, is now dusted on to the plate, and rubbed over the surface with the velvet buff, taking care to use it across the plate, and not from top to bottom; this operation should take place, if possible, immediately before the plate is used. Should the plate, however, not possess a sufficient degree of polish, or should it have been used, and the imperfect image have to be removed, the plate, after being fixed on the wood block, must be dusted over in the same manner as before, but with the prepared rotten stone, or tripoli; now take a small pellet or knob of cotton, moisten it with spirits of wine, and rub the plate over with it by a continuous circular motion, commencing from the centre of the plate. Occasionally change the cotton, and add fresh rotten stone, and finish by substituting distilled water for the spirits of wine. This operation must be continued for at least a quarter of an hour or longer, according to the state of the plate; it must then be cleaned off with a pellet of dry cotton, and finished with the buff and prepared lamp-black. Should the first operation appear not to succeed, instead of the water, olive oil must be used, and having continued the operation sufficiently long, wipe off the oil with dry cotton, and when it is all apparently removed, place the plate on the brass stand *h h* Fig. 8, and heat it by means of the spirit-

lamp to about 300° Fah.; then remove the lamp, and apply by the aid of a fresh piece of cotton some of the dilute nitric acid evenly over the whole surface of the plate, not suffering it to run into drops, which it will be very liable to do if the plate has not been sufficiently heated; now dust a little dry rotten stone or tripoli over it, and dry the acid off with fresh cotton, the final finish being then given with the buff and prepared lamp-black.

56. We next proceed to the second operation, viz. applying to the surface of the plate *the sensitive coating or film of iodine.*

The apparatus requisite is shown at Fig. 7. A is

FIG. 7.



a box of sufficient size to take in the largest plate required; it is best if made in glass or porcelain, the edge being ground smooth, so that the cover B, formed of a piece of plate glass, shall fit it perfectly close. C is a second cover, to the under side of which is attached the plate to be iodized. Into the box A pour a sufficient quantity of a solution of iodine to well cover the bottom; the polished plate attached to the cover c is now placed over it, and is speedily coated with a film of iodine, which must be of a decided golden yellow colour, neither more nor less, and this will depend entirely on the time the plate remains in the iodizing box; we are not able to state any definite period, as it depends on many circumstances, such as the temperature of the apartment, &c. This operation

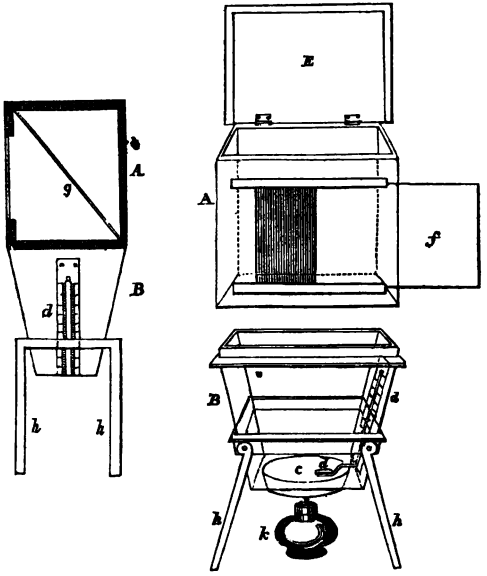
must of course take place in the dark, the only light being that of a candle, which must be used cautiously, when taking a hasty glance at the plate. The yellow tint is the one most sensitive to light; should the plate not be left long enough, it will be of a pale colour, and the picture afterwards produced consequently faint and ill defined in its parts; should it be left too long, it will assume a violet tint; it had better then be considered useless, and the whole process commenced again from the beginning. A little practice will soon give the time required. Iodine in the solid form can be used in the place of the solution; it must be spread evenly over the bottom of the box, and covered with a piece of muslin, which allows the vapour to rise, but prevents particles of iodine impinging on the plate, which would occasion spots. Bromine is also frequently used in conjunction with iodine; the mixture termed *bromide of iodine* is formed by adding bromine to a solution of iodine. The sensitive coating given by this preparation is a decided rose tint, and the plate must be removed before it changes to a purple colour. The plate is now to be removed from the iodizing box and placed in the camera, and the greatest possible caution is necessary that not a ray of light impinge on it; for this purpose the box K, Fig. 6, is provided, in which the plate is placed till all else is ready.

55. Third operation, *submitting the plate to the influence of light in the Camera.*—We will suppose the instrument being used is the one described at page 29, Fig. 6. Everything has been adjusted, and the portrait or view delineated on the ground glass to the entire satisfaction of the operator. The cover L is now placed over the lens, and the camera removed from its forked bearings, D D is taken into a dark room, and the iodized plate contained in the box K fixed in the place of the ground glass; the camera is now replaced on its stand, and the cover removed from the lens; judgment

formed by experience alone can teach the necessary time the plate should be left exposed to the influence of the light, but a good impression may generally be calculated upon in from ten to sixty seconds. The cover L is now replaced, and the camera removed into an apartment, from which every ray of day-light has been carefully excluded; the only light used must be from a candle, and even that should not be suffered to fall directly on the prepared plate, which is now removed from the camera and placed in the mercury box, in order to its undergoing the fourth process, or *that by which the image already impressed on the plate is rendered visible.*

Fig. 8 represents the apparatus for this process.

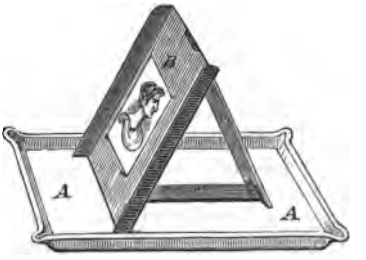
FIG. 8.



A B is a wooden box made in two separate parts; in the bottom is fixed a small cup C, which may be of Berlin porcelain or of sheet iron; this is for holding a small quantity of mercury, sufficient to cover the bulb of the thermometer *d d* which dips into it; the sides of this half of the box are made to slant towards the bottom, the upper half A is square, and provided with a lid E and glass front, with flap of cloth or wood slide *f*; the plate is supported in this box at an angle of 45°, as shown at *g*. The box is best coated in the inside by hard black varnish; the whole is supported on the four-legged stand *h h*, so as to allow room for the spirit-lamp *k*. The plate being placed on the supports, the box is carefully closed, the spirit-lamp is applied to the cup containing the mercury till the thermometer indicates a temperature of 140° Fahr.; the lamp is now withdrawn, and care should be taken that the temperature is never carried beyond 170°. The operator can observe the progress of the picture through the glass. When the thermometer has sunk to 113° Fahr., the operation has generally been carried far enough; it may now be removed from the box.

58. We now come to the fifth and last operation, viz. *Fixing the image so that the light no longer acts upon it;* and for this purpose the apparatus shown at Fig. 9, will be found extremely convenient. *A A* is a flat porcelain dish, which will be found useful in many of the processes of this interesting art. *B* is a metal, or what is still better, a porcelain plate, supported at an angle of 45 in the

FIG. 9.



dish *A*; the Daguerreotype plate is placed on the rest, and cold distilled water is poured over it. After which it is washed with a weak solution of hypo-sulphite of soda, and then with warm distilled water. But the following is a more approved method of fixing, by which the image acquires additional beauty and force:—immediately after being washed with the hypo-sulphite solution, the plate is placed on the brass stand *h h* Fig. 8, and covered with a solution of chloride of gold (15½ grains to a pint of distilled water); the flame of a powerful spirit-lamp is then applied underneath, the image soon becomes very clear and acquires considerable force. When this effect is produced the liquid must be poured off, and the plate again washed as before on the inclined plane; any drops of water that hang on the plate, should be removed by blowing; as otherwise, on drying, they occasion stains. The picture is now finished, and nothing remains but to mount it in such a manner that it shall be perfectly preserved from dust or damp. The following will be found a ready method: — procure a piece of glass the size of the silver plate, take a piece of cardboard of the same size, and with a pen-knife cut out the centre of the size the picture is to be; place the card on the plate and over it with the glass, the card preventing the glass from coming in absolute contact with the plate. Some slips of paper are now gummed or pasted round the edge, and the whole is finished.

59. The following are a few hints to which the experimentist would do well to attend:—

It is of great moment that the glasses of the camera be perfectly clean.

The camera must never be so placed that the sun shines into the lenses.

If a portrait is being taken, the sitter should fix his or her eyes on some object above the camera; take care that the hands and feet, in whatever position, are not too forward or backward from the face when that is

in good focus. If any large surface of white is present, such as a shirt front, lady's collar, handkerchief, &c. a piece of black stuff should be thrown over it and quickly withdrawn when the process is about two-thirds finished; smaller parts of the dress, as the shirt-collar, wristbands, &c. need not be interfered with.

Should the picture be faulty and not worth the fixing, rub off the mercury as soon as possible, as it is apt to injure the surface of the plate.

60. A pretty effect has lately been given to the portraits taken by the Daguerreotype, by M. Claudet, the operator at the Adelaide Gallery, which consists in the introduction of most appropriate back-grounds, by simply placing the sitter in front of a painting, or rough sketch of a landscape, interior of an apartment, &c. This adds much to the picture, which heretofore was dull, cold, and inanimate.

61. Mr. Goddard, who has in America experimented much on the subject of photography, has recently found that a plate of gold, iodized and treated in the same manner as we have described for the silver, receives a far better impress than the silver plate; but the expense of the former metal must preclude, of a necessity, its free use. Mr. Hunt,* however, states that, notwithstanding his numerous experiments, he has never been able to produce with the salts of gold any paper which would be sufficiently sensitive for use in the camera.

62. *Colouring Daguerreotype Portraits.* — Many efforts have been made to give the advantage of colour to Daguerreotype pictures; but as yet none have been perfectly successful. The best method at present known is that for which a patent has been obtained by Mr. Beard.† This method consists in the deposition of

* A popular Treatise on the Art of Photography. — Griffin, Glasgow.

† The specification of this patent will be found in the April number of the Repertory of Patent Inventions.

various colours, in the state of impalpable powders, on different parts of the picture in succession, the outline and extent of each colour being regulated by a pattern or screen, somewhat resembling a stencil plate. The process may be thus briefly described:—In the first place, the picture to be coloured is placed upon a frame, a little larger than itself, provided with a projecting edge, about the twentieth of an inch above the surface of the plate; on this edge a thin sheet of glass or mica is placed, and with a camel-hair brush and a little colouring material, a tracing is made upon the glass or mica, corresponding to the part of the picture it is intended to colour; this original tracing is again copied on to some tracing-paper, and the paper between the lines so traced is then cut out. When the tracing-paper is applied to the picture it will be evident that all its parts will be covered, with the exception of that exposed for colouring. The colours used are those usually employed in the arts, and are carefully ground in a weak solution of gum arabic (30 grains to a quart of water). When ground to an impalpable powder, they are dried in a stove, at a temperature below 212° Fahrenheit; subsequently they are sifted through very fine sieves, and must be carefully preserved from the slightest moisture. The colour is then put into a box, a fine dust is raised in the interior by beating with a soft brush; the picture, covered with the tracing-paper, is introduced, and the colour gradually allowed to settle on it. When withdrawn, by gently breathing on the plate, the colour attaches itself with firmness to the metal.

63. Mr. Hunt, to whose work on the photogenic art we have here referred, describes therein a method of which he himself was the discoverer, by the which the Daguerreotype may be rendered applicable to paper. His description is as follows:—"Placing the paper carefully on some hard body, wash it over on one side, by means of a very soft camels'-hair pencil,

with a solution of 60 grains of bromide of potassium in two fluid ounces of distilled water, and then dry it quickly by the fire. Being dry, it is again to be washed over with the same solution, and dried as before. A solution of nitrate of silver (120 grains to an ounce of distilled water) is to be applied over the same surface, and the paper quickly dried in the dark. In this state the papers may be kept for use. When they are required the above solution of silver is to be plentifully applied, and the paper placed *wet* in the camera, the greatest care being taken that no daylight—not even the faintest gleam—falls upon it until the moment when we are prepared, by removing the screen, to permit the light, radiated from the objects we wish to copy, to act in producing the picture. After a few seconds the light must be again shut off, and the camera moved into a dark room. It will be found, in taking the paper from the box, that there is but a very slight outline (if any) yet visible. Place it aside in perfect darkness, until quite dry; then place it in the mercurial vapour box Fig. 8, and apply a very gentle heat to the bottom. The moment the mercury vaporizes, the picture will begin to develope itself. The spirit-lamp must now be removed for a short time, and when the action of the mercury appears to cease, it is to be very carefully applied again, until a well-defined picture be visible. The vaporization must then be suddenly stopped, and the photograph removed from the box. The drawing will then be very beautiful and distinct; but much detail is still clouded, for the development of which it is only necessary to place it cautiously in the dark, and allow it to remain undisturbed for some hours. There is now an inexpressible charm about the pictures, equalling the delicate beauty of the Daguerreotypes; but being still very susceptible of change, it must be viewed by the light of a taper only. The nitrate of silver must now be removed from the paper, by well

washing in soft water, to which a small quantity of salt has been added, and it should afterwards be soaked in water only. When the picture has been dried, wash it quickly over with a soft brush dipped in a warm solution of the hyposulphite of soda, and then well wash it for some time in distilled water, in order that all the hyposulphite may be removed. The drawing is now fixed, and we may use it to procure positive copies, many of which may be taken from one original."

"The action of light on this preparation does indeed appear to be instantaneous. The exquisite delicacy of this paper may be imagined, when I state that *in five seconds*, in the camera, I have, during sunshine, obtained perfect pictures; and that when the sky is overcast, *one minute* is quite sufficient to produce a most decided effect."

"This very beautiful process is not without its difficulties; and the author cannot promise that, even with the closest attention to the above directions, annoying failures will not occur. It often happens that some accidental circumstance (generally a projecting film or a little dust) will occasion the mercurial vapour to act with great energy on one part of the paper, and blacken it before the other portions are at all affected. Again, the mercury will sometimes accumulate along the lines made by the brush, and give a streaky appearance to the picture, although these lines were not at all evident before the mercurial vapour was applied. I have stated that the paper should be placed wet in the camera: the same paper may be used dry, which is often a great convenience. When in the dry state a little longer exposure is required; and instead of taking a picture in four or five seconds, two or three minutes are necessary."

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64. It may perhaps be deemed necessary, ere this little work be brought to a conclusion, to notice a process lately discovered, connected in some degree with the art discussed in the preceding pages. For this dis-

covery we are indebted also to Mr. Hunt, who has given to it the name of Thermography.* The process is thus described by its inventor:—

"A well polished plate of copper is to be rubbed over with nitrate of mercury, and then well washed in distilled water, to remove any nitrate of copper which may be formed; when quite dry, a little mercury, taken up on soft leather or linen, is well rubbed over it, and the surface worked to a perfect mirror.

"The print or sheet to be copied is placed smoothly over the mercurial surface, and a sheet or two of soft clean paper being placed upon it, is pressed in equal contact with the metal, by a piece of glass or flat board; in this state it is allowed to remain for an hour or two. The time may be considerably shortened by applying a very gentle heat, for a few minutes, to the under surface of the plate. The heat must on no account be so great as to volatilize the mercury. The next process is to place the metal in a closed box prepared for generating the vapour of mercury. The vapour is to be slowly evolved, and in a few seconds the picture will begin to appear. The vapour of mercury attacks those parts which correspond to the white parts of the printed image or engraving, and gives a very faithful, but somewhat indistinct image. The plate is now removed from the mercurial box, and placed into one containing iodine, to the vapour of which it is exposed for a short time: it will soon be very evident that the iodine vapour attacks those parts which are free from mercurial vapour, blackening them. Hence there results a perfectly black picture, contrasted with the grey ground formed by the mercurial vapour. The picture being formed by the vapours of iodine and mercury, is of course in the same state as a Daguerreotype picture, and is readily destroyed by rubbing. From the depth to which I find the im-

* From θερμος, heat; and γραφω, to write.

pression made into the metal, I confidently hope to be enabled to give to these singular and beautiful productions a considerable degree of permanence, so that they may be used by engravers to work on."*

It has been the object of the author, in this little work, to lead the experimentist step by step to the proper understanding of the Photogenic art,—commencing with its simplest form, and thus preparing the way for its more complex manipulation. Of the ultimate applications of an art which is daily making new and gigantic strides, it is impossible to venture a prediction. In the language, however, of a high authority, it may be said "that a process by which the most transient actions are rendered permanent—by which facts write their own annals, in a language that can never become obsolete, forming documents which prove themselves — must interweave itself, not only with science, but with history and legislature."

"Solem quis dicere falsum audeat?"

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* Transactions of the Royal Polytechnic Society, No. I.—Thermography, by R. Hunt, Esq.

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