PHOTOGENIC MANIPULATION:

PART II.

CONTAINING

THE THEORY AND PLAIN INSTRUCTIONS

IN THE ART OF

PHOTOGRAPHY,

OR

THE PRODUCTION OF PICTURES THROUGH THE AGENCY OF LIGHT.

COMPRISING

DAGUERREOTYPE, THERMOGRAPHY, ELECTRICAL AND GALVANIC IMPRESSIONS.

BY

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PHILADELPHIA:

CAREY AND HART.

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PHOTOGENIC MANIPULATION

PART II.

I. -- DAGUERREOTYPE.

58. In the first portion of this treatise we have spoken at length of all the photogenic processes applicable to paper, and it remains for us, in this second part, to describe fully and accurately the Daguerreotype and its manipulation. And in order to render this little manual more complete, the mode of procuring impressions, which appear identical in character with those obtained by the action of light on paper and metal, but which are dependent on heat and electricity for their existence, is described in the latter part of the work.

59. We come then first to the consideration of that beautiful process of Photogenic Manipulation, known as the Daguerreotype, so called from its discoverer, M. Daguerre, who, together with M. Niepce, were liberally rewarded by the French Government, as before mentioned in our Introductory Remarks (§8); this exquisite art was thrown open to the world,- France taking to herself *" the glory of endowing the world of science and art with one of the most surprising discoveries that honour the land;"* M. Arago shortly after, in the Chamber of Deputies, styling it *"a gift to the whole world*."

60. Nevertheless, the Daguerreotype has been patented in his country. Wether such patent would stand investigation, is a question not yet proved. Ceratain it is, that if England be excluded from its free use, France must be content to resign the laurels otherweise her due.

61.The Daguerreotype differs essentially from the other processes of the photogenic art, inasmuch 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.

62. To practice the Daguerreotype with success, requires only a little patience and a due attention to the directions subsequently given.
The entire process is comprised in six distinct operations; which may be thus briefly enumerated-

1. **Cleaning and polishing the plate.**
2. **Applying the sensitive coating.**
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 no longer acts upon it.**
6. **Covering the finished picture with a film, or thin coating of gold, which not only protects it, but greatly improves its distinctness and tone of colour.**

These processes we shall now fully explain; and we shall endeavour to do as simply as possible, at the same time entering into all requisite detail; and we would impress upon our readers the necessity of proceeding with patience through each different operation, which, after a little practice, will be found very easy, while, if they be not attended to, failure will inevitably be the result.
And here we may observe also, that it is of the utmost importance to procure good and well-manufactured plates, as, should there be any imperfection in them, no pains or care taken in the polishing will be of the slightest avail.
63. *1st Operation; Cleansing and Polishing the Plate*. --- In some of the Daguerreotype establishments the plates are polished in a lathe, --- this method having the advantage of being more expeditious; but the amateur, for whom this little treatise is principally intended, can seldom resort to this plan. The apparatus and materials he will require for the operation are the following:---
Plate-holder,
Spirit-lamp,
Stand for supporting the plate,
One or two polishing buffs,
Finest washed emery,
Olive-oil,
French Tripoli,-- or, in its absence, finely-powdered rotten-stone, free from all grit,
Nitric acid, diluted with fifteen parts of water,

Finishing powder,
And a quantity of the finest carded cotton wool, This should be carefully excluded from all dust and dirt.

Figs. 6 and 7 represent two forms of plate-holders or instruments for supporting the plate, while being cleaned and polished.

Fig. 6. Fig. 7.

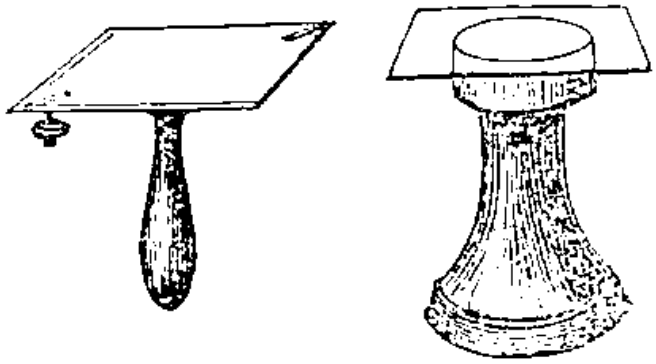


Fig 6. is the French pattern. It consists of a flat board, a trifle smaller than the plate, so as to allow the edges of the latter to project about one-sixteenth of an inch all round. The plate is secured by two small pieces of brass, one of which is movable, and fixed by a screw attached to the opposite angels of the board. It is provided with a handle, by which the whole is conveniently held in the hand. In place of a handle a small clamp is sometimes substituted, by which it may be fixed to a table. Fig. 7 is another very ingenious, and at the same time simple and efficient, plate-holder. It consists of a block of wood, somewhat in the form of a dice-box, on one end of which is fixed a piece of Indian rubber, the surface of it being melted by applying to it a hot iron. This renders it permanently adhesive, so that the back of the plate, when pressed against it, adheres firmly; at the same time, when removed by a little force, the back is left perfectly clean.
The amount of cleaning a plate requires, greatly depends upon the state it is in. We will suppose one in the worst condition --- not only dirty, but with scratches and mercury-spots on its surface; and this latter is an accident which very frequently occurs. The plate is placed horizontally on its stand, with its silvered side upwards, and the flame of the spirit-lamp applied,

being more particularly directed beneath the mercury-spots, which will soon exhibit a dull appearance. The lamp is now removed, and the plate allowed to cool, when it is attached to the plate-holder. The readiest method af removing the scratches, is to have recourse to the emery and oil. Holding the plate-holder firmly in the left hand, take a small knot or pellet of cotton, with a little oil and emery, and rub the plate over with a continous circular motion, till all traces of scratches are removed; then wipe off the oil and emery with a clean piece of cotton, adopting a light circular motion; at the same time wiping the edges of the plate. Even the back should not be entirely neglected, but for this a small piece of fine emery paper will be found very convenient. Now mix, to the consistence of thick cream, some of the Tripoli with the dilute nitric acid. It is convenient to keep this ready for use in a bottle with a glass stopper. Then take a pellet of cotton, and well polish the plate with this mixture, in the same manner as with the oil and emery; the process must be continued till, on removing the Tripoli with aa clean pellet, the plate exhibits a smooth bright surface, free from all spots or scratches. The finishing polish is now to be given with the buff and finishing powder. The buff is formed of a piece of wood, about nine inches long, and from two and a half to three inches broad, slightly convex from and to end. This is covered with cotton velvet, being first padded with some soft flannel. A handle may be fixed at one end.

64. *The Finishing Powder*. – This is prepared by well calcining lamp-black and intimately mixing it with about an eight part of the finest rouge (plate powder). This should be kept for use either in a muslin bag, or wide mouthed bottle, over which is tied a piece of muslin; a little of the powder being dusted on to the buff, the plate receives its final polish; the circular motion is changed for a straight one across the plate, which, if intended for a portrait, should be buffed the narrow way; but if for a view, the length way of the plate. The operation of cleaning the plates at first appears very tedious, and has deterred many from attempting this interesting art; but it is much more simple in practice than in description, and with a little patience and observation all difficulties are readily overcome. Great care should be taken to keep all extraneous matter from the buff, and when not in use it is better to wrap it up in some tissue paper. The plate should be buffed immediately before the sensitive coating is given (the next process to be described); particles of dust are thus effectually

removed; the temperature of the plate is also slightly elevated by the friction, and the required tint is more readily obtained.

65*. 2d Operation; Applying the Sensitive Coating.* – The apparatus and materials required, are an Iodine box (which, however, is sometimes dispensed with),

A bromine pan,

Iodine,

Bromine, or other sensitive mixture.

In the early days of the Daguerreotype, iodine alone was used in preparing the plate; and though it still plays a very important part, other preparations are used, called accelerating solutions, the discovery of which has alone enabled us to apply the Daguerreotype successfully to portrait-taking. For whereas, when first described by Daguerre, it took from five to ten minutes to produce a tolerably good view; now, under favourable circumstances, splendid impressions can be obtained in the fraction of a second.

If the plate is to be iodized, it must be placed, immediately after being buffed, in the iodine box. This consists of a square box, which may be made of any hard wood, and lined with common crown glass; small frames of wood suited to the different sized plates are made to fit on the top, and over them rests the lid. The box may be about two inches deep. Some iodine is scattered evenly over the bottom, and covered with a piece of cotton wool; over this is sometimes placed a piece of card. The plate being dropped into the frame with its face downwards, the lid is put on, the bright surface of the plate is very soon coated with a film of iodine of a fine yellow colour; it is then removed and placed over the accelerating solution. The iodine operation need not be done in the dark, though a bright light should be avoided. Not so the next part of the process, viz., giving the plate its extreme sensitiveness: here great caution to prevent the slightest ray of light impinging directly on the plate must be used, and in examining the colour reflected light should always be used. A convenient method of examining the plate is to make a hole about one inch square in the window shutter, which is then covered with a piece of tissue paper; by quickly turning the plate so that the paper is reflected on to it the colour is very distinctly shown. The key-hole of a door, where there is a light on the outside, will frequently answer the purpose.

66. Various have been the different forms and contrivances suggested for the bromine pan, or vessel in which the sensitive

mixture is applied; we shall describe three, each of which has its advantages.

Fig. 8. represents an earthenware or glass pan; and here we may observe, that the bottoms of all these vessels should be as flat as possible, so as to allow the solution to be of an equal depth; the edge is round flat, by which means a piece of roughened plate glass fits air-tight, and this may be fixed inside a wooden cover.

Fig. 8.

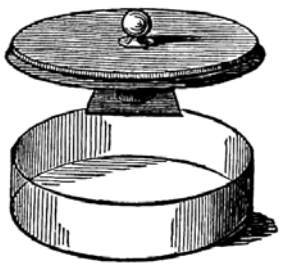
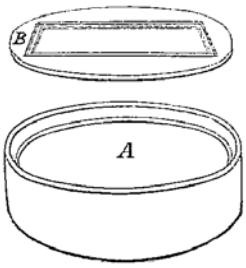


Fig. 9.

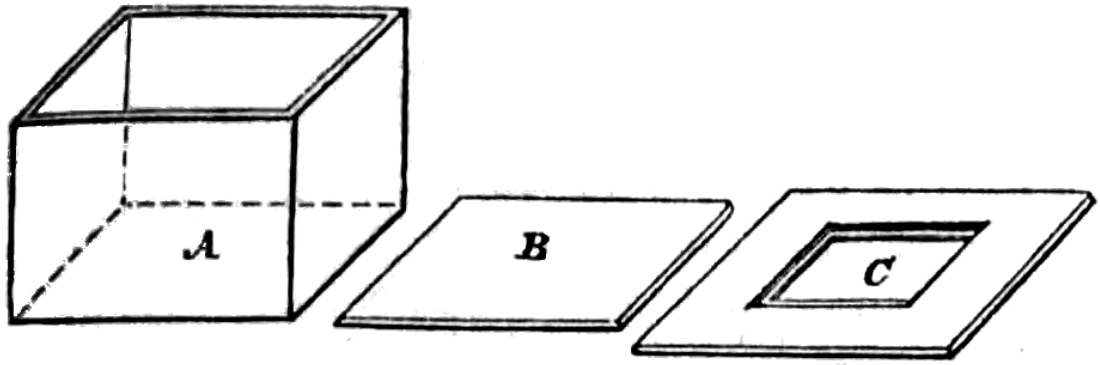


In the centre of the under side of the glass lid, is cemented a small block of wood, to which is attached a piece of sheet Indian rubber, the surface of which is prepared as described for the plate-holder (Fig. 7); the plate is then attached to it in a similar manner. When not in use, a glass cap is placed over the Indian rubber, which effectually prevents any action going on between the vapour from the solution and the Indian rubber.

Fig.9. represents another form of apparatus; it consists of a porcelain pan, which may either be square or round; its edge is ground flat, and it is provided with a ground glass cover fitting it air-tight. About three-eights of an inch below the top is a ledge, on which rests a shelf, B, made either of hard wood, slate, or glass; in the centre of this a square hole is formed, with a shoulder, in which the Daguerreotype plates rest during the time they are submitted to the action of the sensitive solution contained in the pan.

Fig. 10. represents the last form of bromine pan which remains for us to describe; it is, in our opinion, the most convienient of the three.

Fig. 10.



A, is a square glass vessel about three or four inches deep, and of sufficient size to receive the largest plate required; the edges are ground perfectly smooth, and it is provided with a cover of plate glass, B, which fits it accurately, and effectually prevents any escape of the bromine, or other accelerating solution contained within it. C represents a second lid, made either of a piece of slate, ground perfectly flat, or plate glass; in the centre is cut out a square hole, the size and form of the plate, with a shoulder similar to the one last described, on which the plate rests; the edge of C being placed against that of B, the latter is gradually slid away, the former occupying its place, and exposing the plate to the vapour without allowing any escape. The changing colour of the plate may be viewed through the side of the glass, which is polished for the purpose, and when it has remained the proper time, the lid B is slid on again in the same manner, without having once opened the glass. The whole may be enclosed in a frame of wood, which greatly facilitates the sliding away of the lids.

67. *The Accelerating Solutions*. ---These differ both in composition and action, some acting very quickly, other giving a finer tone of colour, though they are not so expeditious in their operation, that is to say, not so sensitive to the action of light. They are all applied in a similar manner, and the glasses or pans we have described are applicable to all.

68. *Bromine Water.*--- This solution has been much used in France, and we shall therefore give its preparation and the method of using it, in the words of M. Figeau. "Put into a bottle of pure water, a large excess of bromine; shake the mixture well, and before using it, let all the bromine be taken up" An

ascertained quantity of this saturated is then diluted in a given quantity of distilled water, which gives a solution of bromine that is always identical. M. Figeau recommends one part of the saturated solution to thirty parts its bulk of water; but M. Lerebour finds it more manageable if diluted with forty times. In case pure distilled or rain water cannot be procured, a few drops of nitric acid, say six to the quart, should be added to the common water.

Method of use. **---Put into the bromine pan a given quantity of the bromine water, sufficient to well cover the bottom: the plate having been iodized to a deep yellow is placed over it; the time the plate should be exposed must be ascertained by making a few trials; it averages from twelve to forty seconds. When once ascertained, it is the same for any number of plates as the solution, which of course would become weaker and weaker, is changed after every operation, the same quantity being always put into the pan.**

69. *Chloride of Iodine*. --- This is prepared by introducing into a glass vessel containing iodine, chlorine gas; the iodine is liquefied, and the above-named compound is the result. This is diluted with distilled water, and the plate submitted to it in the bromine pan till it is of a rose colour.

70. *Bromide of Iodine*. --- Make a solution of iodine in alcohol, into which add, drop by drop, bromine, till the solution is of a bright red colour. This is then diluted with water till the colour is reduced to a bright yellow. It is used in a similar manner as the before-mentioned preparations.

71. *Chloride of Bromine*. --- M. Bisson, a French experimentalist, has found that bromine associated with chlorine, prepared in a similar manner to the chloride of iodine described before (§69), a solution of bromine being substituted for the iodine, is a very sensitive solution. By means of it Daguerreotype proofs are obtained in half a second, and thus very fugitive subjects are represented – for instance, the smile of an infant, a funeral train, nay, even men and horses in the act of walking.

72. The publishers of this little work have a preparation which they sell under the name of Knight´s Sensitive Solution, which is used without the plate being previously iodized. Though it does not act quite so quickly as some of the other preparations, it gives a beautiful tone of colour to the Daguerreotypes. The method of using it is as follows: --- a sufficient quantity of water is poured into the bromine pan as will well cover the bottom. This quantity being then measured, 30 drops of the solution are added

to every half ounce of water; a violent action takes place, and iodine is precipitated; the plate is exposed till it attains a rose colour.

73. The only other solution that we shall mention is the Hungarian Liquid, the composition of which is not generally known. It is a very favourite mixture, acts quickly, and with considerable certainty. The method of using is, to dilute it with from 10 to 15 times its bulk of water, putting a sufficient quantity into the pan to cover the bottom. The plate being previously iodized to a light yellow, it is submitted to the Hungarian mixture till it attains to a light rose tint.

74. The processes we have been describing are, as we have before started, carried on in the dark; and great caution must be used in examining, even by the feeble light (§ 65) allowed the colour of the plates, which, when attained, the plate is to be immediately placed in one of the dark frames belonging to the camera.

75*. 3d Operation; Submitting the Plate to the Influence of Light in the Camera*. --- Experience alone will guide the operator as to the time the plate must be exposed to the action of the light, this being dependent on a variety of circumstances, as clearness of the atmosphere, time of the day, object to be taken, and degree of sensitiveness of the solution which has been employed, &c. He should be careful to see that the interior of the camera is clean and free from dust, for the small particles flying about attach themselves to the plate, when the slide is removed, and thus cause the little black spots, by which an otherwise good picture is frequently spoiled. Care should likewise be taken to withdraw, as gently as possible, the dark slide in front of the plate, so as not to set any of these particles, which might be at rest, in motion. The lens is the last thing to be uncovered. When, according to the judgment or experience of the operator, the plate has remained long enough, the cap is replaced on the lens, and the dark slide over the plate, which is then removed from the camera. If now examined, no picture will be found on the plate. The rendering this visible is the object of the next process.

76. *4th Operation. --- Bringing out the picture, in other words, rendering it visible*. --- The only apparatus required for this is the mercury box.

Fig. 11.

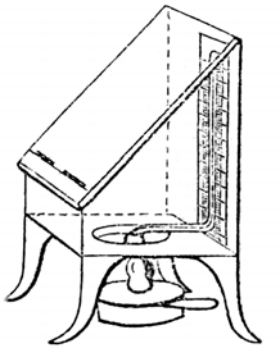


Fig.11 represents one of a very convenient construction. The box is of wood, of the form represented in the figure. The bottom is made of sheet-iron, slightly dished in the centre; this is for containing a small quantity of mercury. The bulb of the thermometer dips into this, the stem being bent in such a manner that the scale comes outside the front of the box, the mercury being heated by the spirit-lamp. The thermometer indicates to the operator the temperature obtained. The plates are supported in a groove, placed for the purpose, inside the lid. This process is usually carried on in a dark room; but the box may be so contrived as not to render this necessary, the dark frame fitting the camera, and containing the plate, being made so as to adapt itself to the top of the mercury-box, so that when placed in, the slide may be withdrawn as in the camera. When required to be very portable, the legs are made to fold beneath the box. It is a very convenient plan, especially in travelling, to tie up the mercury in a piece of muslin: it can be placed just as readily over the bulb of the thermometer, and answers equally well. The temperature should never be raised above 170° Fahrenheit. The plate may be examined, from time to time, by simply raising the lid of the mercury-box, and viewing it by a subdued light. Some boxes are fitted up with a small window of yellow glass (§88) for this purpose, but it is unnecessary. Mr. Constable, the proprietor of the photogenic establishment at Brighton, a most successful operator, has contrived a very useful sliding scale,* (*The scales may be obtained of the publishers). by which, at a single glance, the operator may at once see the time the plate should be exposed to the mercury, regulated by the temperature both of the apartment and mercury. The picture, being fully developed, is now taken out and examined: it must not, however, be exposed to too strong a light: if any glaring defect be perceived, it is better not to proceed with

it, but place it on one side, to be repolished: if, on the contrary, it appear perfect, we may advance to the next step.

77. *5th Operation. ---Fixing the image, so that the light no longer acts upon it:* --- For this the following are required: ---

Two or three porcelain vessels, for small plates, the form is not material, and evaporation-dishes answer very well; but for large plates the form A, Fig.12, will be found most convenient.

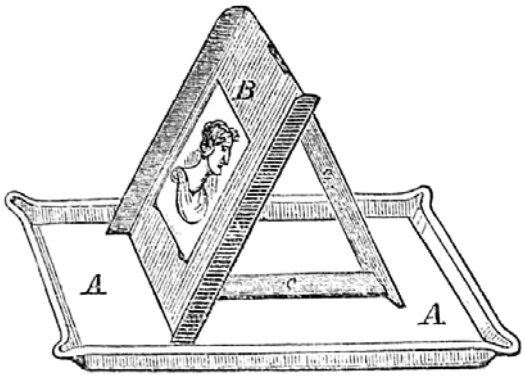
Plate support B.

Pairs of pliers.

A drying apparatus, Fig. 13, is also convenient; though, for small plates, it can be dispensed with.

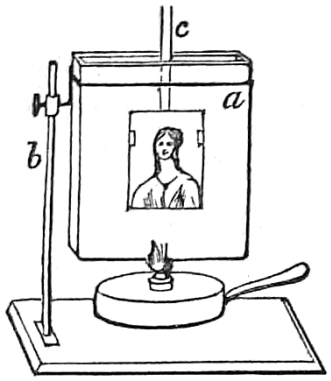
***Hyposulphite of Soda, --- Distilled Water, and some contrivance for heating it.* --- Having made a solution of hyposulphite of soda, the strength is not material, (about half an ounce of the salt to the pint of distilled water,) pour it into one of the porcelain vessels, put into another plain, and into a third distilled water. The plate being immersed with its face upwards in the hyposulphite, the whole of the sensitive coating is immediately removed. The light has now no further action upon the plate; it is then to be removed from the hyposulphite and immersed in the plain water, or placed on the support B, Fig.12, and water poured over it.**

Fig. 12.



It is then washed in a similar manner with distilled water, and well examined, to see that not the slightest particle of dust rests on the surface. We now proceed to dry it.

Fig. 13



78. Fig.13 represents a convenient and simple apparatus for the purpose. A is a vessel of sufficient size to take the largest plate, but not more than half an inch wide; it is best made of copper or brass, tinned or plated inside, which must be kept perfectly clean. Hot distilled water is poured into it, and the temperature kept up by the spirit-lamp. The plate supported by the holder c is immersed, and then gradually withdrawn; at the same time the operator should gently blow upon the surface; it may, by this method, be brought out perfectly dry. Small plates are readily dried, by holding them with the pliers by one corner, and pouring distilled water over them (if the water is hot it will be all the better). Apply the spirit-lamp to the back, at the corner held by the pliers, at the same time facilitating the operation with the breath; pass the lamp gradually downwards, finishing at the extreme corner. The last drop may be removed by a little bibulous paper; a single drop even of distilled water allowed to dry on any part of the surface is certain to leave a stain, which no ultimate process can remove.

The Daguerreotype may now be said to be finished; still it is so much improved by the sixth and last process, that it can hardly be considered complete without it.

79*. 6th Operation --- Covering the finished picture with a film or thin coating of gold.* --- This process, for which we are indebted to M. Figeau, may take place either before the plate is dried, or at any subsequent period of time. The only apparatus required, is the spirit-lamp and stand. The solution of chloride of gold is thus prepared: --- Dissolve, in a pint of distilled water, 15 grains of crystallized chloride of gold; the solution will be of a golden tint. In another pint of distilled water dissolve 45 grains of hyposulphite of soda; pour gradually, in very small quantities, the gold into the hyposulphite, stirring the solution at intervals; when

finished, the mixture should be nearly colourless. Place the plate on its stand in a perfectly horizontal position, and with its edges quite free; wet the surface with alcohol, letting any superfluous quantity drain off. Now pour on, carefully, as much of the preparation of gold as will remain on the plate. The alcohol is of no further use than to facilitate the flowing of the gold mixture over the surface. The under part of the plate is now to be heated as uniformly as possible with the spirit-lamp. Small bubbles will rise, and the appearance of the view, or portrait, will very visibly improve; the process must not be carried too far, but as soon as all the bubbles disappear, the lamp should be removed, and the fluid poured off the plate immersed in distilled water, and dried by the method described before (§78).

80*. Colouring Daguerreotypes.* --- Neither the Daguerreotype, or any other photogenic process, has yet arrived at that state of perfection as to enable us to represent objects in their natural colours. Various beautiful tints are frequently obtained, these depend upon different circumstances; but hitherto, decided colour is wanting. If we wish for colour we must resort to mechanical means to obtain it. Mr. Beard patented a process* (Repertory of Patent Inventions, April, 1843). For colouring Daguerreotypes; but it is very troublesome, and seldom, if ever, resorted to. The best and certainly the simplest method appears to be the brush, which of course must be very fine. The colours, which are applied in the state of a fine impalpable dry powder, are prepared and sold for the purpose. They should not be applied by any one who is not something of an artist; and, after all, it is entirely a matter of opinion whether the pencillings of nature can be improved by the hand of man.

81. A very pleasing effect is given to portraits and figures from life, and was first suggested by Mr. Claudet. It consists in the introduction of appropriate back-grounds, by simply placing the sitter in front of a painting, or rough sketch of a landscape, the interior of an apartment, &c. This adds very much to the interest of the picture, which otherwise is frequently dull, cold, and inanimate.

82. The following are a few hints, which may be useful to the experimentalist. The glasses of the camera should be perfectly clean. We have before alluded to the necessity of removing all dust from this instrument (§75). The camera should never be so placed that the sun shines into the lenses. If a portrait is to be taken, the sitter should be placed with his head resting against something, no matter how slightly, but just sufficient to keep it

perfectly steady. The eyes should be fixed on some object a little above the camera, and care should be taken 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.

The process should be conducted in the open air under a serene sky, but without sunshine. If sunshine be employed, a screen of blue glass should be used to defend the eyes. This coloured glass does not materially weaken the power of the chemical rays (§12). The best of all situations is a raised terrace, or the flat roof of a house. Of all weather a damp state of the atmosphere is to be avoided.

83. A ready method of marking short intervals of time is very important to the Daguerreotypist. We will describe an instrument, which will be found very useful for that purpose; it was contrived by Mr. Constable, a gentleman we have before had occasion to name (§76); he calls it a sand-clock, or timekeeper. It consists of a glass tube, about 12 in. long by 1 in. diameter, half filled with fine sand, similar to that used for the ordinary minute-glasses, and like them it has a diaphragm, with a small hole in the centre, through which the sand runs.

The tube is attached to a board, which revolves on a centre-pin; on the side is a graduated scale, divided into half-seconds; the tube is also provided with a movable index. The instrument is attached to the wall, either of the garden or apartment where the operator requires it. The glass tube being revolved on its centre, the index is set to the number of halfseconds required, and the sand running down, the required time is marked without the possibility of error. In practice, it will be found a far more convenient instrument for the purpose than either a clock or seconds-watch, and is applicable both for the camera and mercury-box.

84*. Paper Daguerreotypes*. --- Mr. Hunt, in his work on the photogenic art, describes therein a method of which he himself was the discoverer, by 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 camel´s-hair pencil, with a solution of 60 grains of bromide of potassium in 2 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. 11), and apply a very gentle heat to the bottom. The moment the mercury vaporizes, the picture will begin to develop 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 it 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 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.”

85. *Durability of Photographic Impressions*. --- Some time since an idea originated, and gained considerable ground, to the effect that all photographic impressions, more particularly, perhaps, Daguerreotypes, were not durable. Immediately after the great fire at Hamburgh, M. Bion, a skilful artist, took Daguerreotypes of all the most interesting points of those parts of the town destroyed by the fire, and which were historically valuable. The Historical Society of the town endeavoured to obtain possession of the whole of them, amounting altogether to forty-six photographic impressions. But on the eve of the conclusion of the purchase, one of its members started a doubt as to the durability of these impressions. Might not, it was argued, these productions of the sun´s rays be also gradually destroyed by the action of light; and another generation, eager to form an idea of the destruction occurring at a former period, and reverting to these impressions, discover, with disappointment and dismay, that such impressions, once the true picture of a painful reality, with the most distinct and circumscribed outlines, had been converted into some dozens of mere unsightly metal plates, covered with black oxide.

This opinion was further confirmed by the professor of chemistry. He argued that the substances employed for the production of photographic impressions unite so as to form very weak combinations, which may as easily undergo entire decomposition; that the quicksilver which serves for producing these impressions may become the cause of their ultimate destruction, by the amalgamation thereof with the silver plate, and thus the outlines become obliterated or indistinct; that a

polished plate of silver is in a short time blackened by the sulphuretted hydrogen gas contained in the atmosphere, and that a photographic impression must be considered as exposed to precisely the same influence and change, and thus, from all these circumstances put together, such impressions are in the highest degree perishable.

86. To ascertain whether such opinion was founded in truth, M. Ulex of Hamburgh, undertook a series of experiments, chiefly in relation to Daguerreotypes. In the first place, a Daguerreotype was carefully wrapped in thick bands of paper so as to cover one-half of the impression only. In this state it was hung up so as to afford a direct southern aspect, and when, after an exposure of many weeks, the protecting cover was removed, not the slightest difference was observed in the two several halves of the impression. We may add that we are still possessed of one of the earliest Daguerreotypes, this has been constantly exposed to daylight and the direct rays of the sun, and it is now as perfect as when it was first taken. This goes far to prove that they are but little affected by the action of light. M. Ulex then exposed an impression in the water-bath to the temperature of 167 deg. Fah., without its undergoing the least alteration.

With regard to the destructive effect of the mercury itself, M. Ulex makes the following observations:---

"If we examine a good Daguerreotype under the microscope, we are unable to distinguish any perceptible globules of quicksilver; the plate appears punctuated or dotted like a chalk drawing. If a silver plate be coated with some leaf-gold, and then brought into the mercury-box, the mercury being heated to 167 deg. Fah., and the plate left therein for the space of ten minutes (and to obtain a good photographic impression no longer time is necessary), the gold will still preserve its golden-yellow colour, and this proves how exceedingly slight the quantity of quicksilver-fumes must be which are deposited on the plate. It was ascertained too, some time ago, that an iodized silver plate taken from the camera obscura, and placed for two hours over quicksilver of not more than 54 deg. Fah., yields a perfect and distinct impression. The mercury, therefore, would not be able to destroy the impressions."

Other photographs were exposed to the action of carbonic acid, ammonia, and even for a short time to the action of sulphuretted hydrogen, without, however, losing in the slightest degree the distinctness of their outline, or being destroyed. A pure silver plate in contact with the air, if only for a short time exposed to

sulphuretted hydrogen, is rapidly blackened by the action of sulphuretted hydrogen.

If however, the oxygen of the air be excluded, silver may be kept for a long time in sulphuretted hydrogen without being effected. And if it be remembered that these impressions are almost invariably kept covered with glass, it is almost impossible that they can be destroyed. At the present time too, almost all these impressions are gilt, according to the method of Figeau (§79).

We arrive then, at this result; that the preference, as regards durability, must justly be given to photographic impressions over paintings in oil, and we may confidently discharge the fear that they will soon undergo destruction.

***87. Etching Daguerreotypes*. --- Soon after the beautiful photographs of Daguerre became public, attempts were made to engrave or etch the imressions so produced. Dr. Berres of Vienna was the first to publish a process for etching Daguerreotypes, his process consisted in covering the plates with the mucilage of gum Arabic, and then immersing them in nitric acid of different strengths.**

In 1841, Professor Grove made known a method of etching Daguerreotypes by means of electricity. The plan he adopted was to make the Daguerreotype the anode of a voltaic combination, in a solution which did not of itself attack either silver or mercury, but which, when electrolized, would act on the metals unequally. The solution used was dilute hydrochloric acid. As this process is fully described in the valuable little manual on Electrotype Manipulation, by Mr. C. V. Walker, we need do no more than merely refer to it.

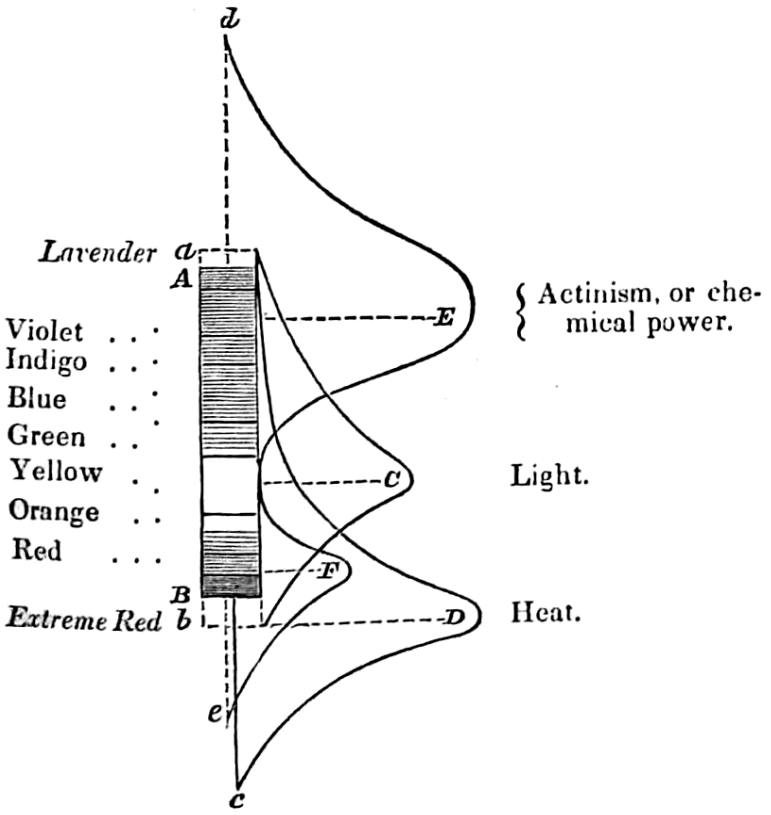
M. Figeau, of whom we have already had occasion to speak, likewise discovered a process for the engraving of Daguerrotypes; and founded on the belief that the lights of a Daguerreian plate consist of unaltered silver, while the darks or shadows consist of mercury or an amalgam of mercury with silver. He finds that a compound acid consisting of a mixture of nitric, nitrous, and muriatic acids, or of nitric acid mixed with nitrate of potass and common salt, has the property of attacking the silver in presence of the mercury without acting upon the latter. Bichloride of copper answers the purpose also, but less completely.

When the clean surface of a Daguerreian plate is exposed to the action of this menstruum, particularly if warm, the white parts or lights are not altered, but the dark parts are attacked, and

chloride of silver is formed of which an insoluble coating is soon deposited, and the action of the acid then ceases. This coat of chloride of silver is removed by a solution of ammonia, and then the acid applied again, and so on, until the depth of *biting in* is sufficient. However, it is not possible, by repeating this process to get a sufficient force of impression; a second operation is required, in order to obtain such a depth as will hold the ink, to give a dark impression; for this purpose the whole plate is coated with drying oil; this is cleaned off with the hand exactly in the way a copper-plate printer cleans his plate. The oil is thus left in the sinkings or dark bitten in parts only. The whole plate is now placed in a suitable apparatus, and the lights or prominent parts of the face are gilt by the electrotype process. The whole surface is now touched with what the French engravers call the "Resin Grain," (*graine de resine*) a species of partial stopping out, and is at once bitten in to a sufficient depth with nitric acid, the gilding preserving the lights from all action of the acid. The resin grain gives a surface to the corroded parts suitable for holding the ink, and the plate is now finished and fit to give impressions resembling aquatint. But as silver is so soft a metal that the surface of the plate might be expected to wear very rapidly, the discoverer proposes to shield it by depositing over its whole surface a very thin coat of copper by the electrotype process; which when worn may be removed at pleasure down to the surface of the noble metals beneath, and again a fresh coat of copper deposited; and so an unlimited number of impressions obtained without injury to the plate itself.

II--- ACTING CHEMISTRY .

88. Before concluding this portion of the work, we deem it necessary to make some few remarks relative to the theory recently propounded, by which all these photographic phenomena are supposed to depend upon some secret power, which invariably accompanies, but is in a great measure independent of, light. This supposed power had received from Dr. Draper the name of Tithonicity, and from Mr. Hunt that of Energia; but at the last meeting of the British Association at York, it was generally agreed that the name of Actinism, * or Actino-Chemistry, should be substituted, as being less likely to mislead. To explain the experiments which have led to such a conclusion, the annexed wood-cut will enable the reader more readily to understand us.



* From ακτιν, a ray.

It represents the prismatic spectrum, --- the colours of the spectrum being represented in their regular order, between the points A and B. We have already said (§12) that the violet ray produces the greatest chemical change, while at the red ray the greatest degree of heat is detected. Under ordinary circumstances no light or colour is detected beyond these limits; but at B another red ray is discovered, and at A a lavender ray has been observed. The curved line *c* shows the extent to which the luminous effects of the spectrum extend, the maximum of light being at the yellow ray, from whence it declines till at *a* and *b* all light is completely lost. Sir William Herschel found that the greatest heat was given by the rays beyond the visible red rays, and which in the diagram is represented by D, from which spot it declines, until at the violet end of the spectrum, it is completely lost. At an earlier period of our knowledge, it was believed that the chemical power of the sunbeam was confined to the spaces within and above the blue rays, but the recent researches of philosophers have shown that this influence is far more extensive. The maximum of chemical action is somewhere about E; for if we place a prepared photographic paper in such a position that a well-defined coloured spectrum shall fall upon it, it

will be found to darken with the greatest rapidity, and acquire the most intense colour at that point; this darkening will go on upwards, beyond all the visible rays, to *d*, where it entirely ceases. It extends downward to the luminous ray c, where a negative influence is exerted, the paper remaining white, after passing which, it again darkens, and a second maximum is found at F, ---the red rays usually giving a red impression, ---this chemical power ceasing entirely at e. Here, then, are three distinct phenomena, Light and Colour, Heat, and chemical power, or Actinism. Now, it is argued that Light and Actinism are distinct forces, --- for, by reference to the diagram, it will be observed that the largest amount of chemical effect is produced where there is the least light, --- and conversely, that where there is the largest amount of light at c, there no chemical effect is observed. Again, by causing a sunbeam to permeate a deep purple solution (copper in ammonia), we deprive it of nearly all its light, --- but the chemical, or actinic, effect is not at all diminished. On the other hand, if we take a solution of bichromate of copper, which is of a bright yellow colour, all the light passes it freely, but scarcely any of the chemical principle. Such are the arguments in favour of the existence of three distinct principles in the solar rays; the truth or error of the theory, time and future discoveries can alone determine.

III.---- Thermography.

89.We have deemed it necessary, ere this little work be brought to a conclusion, to notice a process connected in some degree with the art discussed in the preceding pages. For this discovery we are indebted to Mr. Hunt, who has given to it the name of Thermography.* (* From heat; and to write) The process is thus described by him;---

90.“ A well- polished plate of copper is 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 on it, and the surface worked to a perfect mirror.

“ The print drawing to be copied is placed smoothly over the mercurial surface, and a sheet or two of soft clean paper being placed upon it, it is pressed into 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 adapted for generating the vapour of mercury(Fig.11). 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 in 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 gray 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, and is readily destroyed by rubbing. From the depth to which I find the impression 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,"*(*Transactions of the Royal Polytechnie Society,No.1.—Thermography, by R.Hunt,Esq.)

91.But to produce impressions of this nature, a process so complicated as that described by Mr. Hunt is not absolutely necessary. Impressions of coins, perfect even to the minutest detail, may be obtained on metallic plates with much less trouble and in much less time. For this purpose the highly-polished plates employed for the Daguerreotype answer extremely well. The coin from which an impression is required (gold coins are the best for the purpose), should be rendered perfectly clean, and should be smeared with a little sweet-oil, which should subsequently be wiped completely away with a small pellet of cotton. We say *completely*, although this is not absolutely the case, for an invisible film of oil adheres to the coin and thus assists in producing the impression. The coin should now be placed carefully on the highly-polished metallic plate, and a gentle heat cautiously applied to the coin or to the plate, so as in fact to render the two metals of a different temperature. A ready method of doing this is to coil a stoutish copper wire into a circular form, so that it may entirely cover the coin. If this wire be now heated and applied to the back of the coin, it will have the required effect of increasing the temperature of the coin itself without injuring the plate. When cold, a more or less perfect impression is the result.

92.In a lecture* *(Reported in the Literary Gazette, January 21, 1843.) delivered in 1843 at the London Institution, Professor Grove expressed his belief that ”these impressions were caused by a radiation and condensation of whatever vapour exists between the metals, and which, by being condensed unequally (in the case of different metals by their different conducting and radiating powers), produce an impression according to the unequal distance of the different parts of the stamp on the coin. Thus, for example, taking a sovereign placed on a silver or copper plate, the effect is very visible if the coin be breathed on before being brought into contact; it is still more increased if the coin be rubbed with oil, and wiped apparently dry; and it is still further improved if it be held for an instant over the vapour of a substance capable of chemically acting on the juxtaposed plate; as, for instance, over ammonia before being placed on copper.

There are other circumstances with regard to these metallic thermographs, which are worthy of remark. Thus when two portions of the same metal are juxtaposed at the same temperature, no effect is produced. When at a different temperature, a slight effect is perceptible. When the metals are different at the same apparent temperature, a greater effect is perceptible; and further, when both metals and temperature are different, the greatest effect is visible. It occasionally occurs, too, that the impression made is latent, that is to say, it does not become visible until breathed on, or until some vapour is condensed upon the plate.

93. Some curious effects, apparently resulting from the approximation of bodies, had been observed on many occasions, and by different individuals. Professor Faraday repeatedly noticed the impression of an engraving on the glass, under which it was framed, when separated from the picture. M. Brequet of Paris has recorded a somewhat similar phenomenon; “It is known,” he says, ”that modern watches are often furnished with a double case (*cuvette*), on one side of which the name of the manufacturer is engraved. The interstice between occupying, at the utmost, not more than the tenth of a millemetre.
Now, I observed frequently on the inside of the plain half, a reversed but very distinct image of the name, as engraved on the other. I have observed, too, on different parts of machines, arranged very near each other, that they presented more or less distinct representations of marks placed on the opposing parts.” These phenomena are in every way analogus to those we now know under the name of Thermographs.

An analogous fact was also observed by a philosophical instrument maker, Monsieur Oertling, in grinding parallel glasses. The brass plates, which were placed immediately over the glasses and attached to their side by cement, were provided for a certain purpose with circular furrows. Some of the glasses treated in this manner afforded images of these furrows; but in most cases the eye was incapable of distinguishing the least spot; if, however, they were breathed upon, the image appeared with great distinctness, and thus those parts which were in contact with the brass appeared of a darker tinge. This peculiarity could not be removed from the glasses by washing with spirits of wine or oil of turpentine; but required a repetition of the grinding.

94. Professor Moser, whose researches on this subject have added much to our knowledge of these interesting phenomena, makes the following statements in reference to them;---

All bodies radiate light even in complete darkness.

This light does not appear allied to phosphorescence, for there is no difference perceived, whether the bodies have been long in the dark, or whether they have been just exposed to daylight, or even to direct solar light.

The rays emanating from different bodies act as light.

Two bodies constantly impress their images on each other even in complete darkness.

In order, however, that the image should be appreciable, it is necessary, because of the divergence of the rays, that the distance of the bodies should not be very considerable. To render an image visible, any vapour may be used; for instance, the vapour of water, of mercury, of iodine, of chlorine, or bromine.

As the rays which bodies emit thus spontaneously have a grater refrangibility than those yet known, they ordinarily begin the action on other substances with the greater intensity.

There exists latent light as well as latent heat.

When a liquor becomes vapour, light, which corresponds to a certain extent of oscillation, becomes latent, and is set free again when the vapour is condensed into liquid drops. It is for this reason that the condensation of vapours produces in some degree the same effects as light, and thus may be explained the operation of vapour.

The condensation of vapours upon plates acts as light, whether the vapour in excess adheres simply as the vapour of water in most substances, or permanently as that of mercury; or even combines chemically with the body, as, for instance, the vapour of iodine with silver. Such are the means by which Moser

seeks to explain these most interesting phenomena; and as a proof of the existence of latent light in mercury he has, during the past year, published the following experiment.

Iodize a silver plate, and then heat it over a common spirit-lamp for about a minute. The iodine of silver first becomes darker, and then milk white. This white substance is very sensitive to light, and is in this respect little inferior to any known. By exposure to light, and indeed by all of its colours, it is converted into a steel-gray. The plate must, therefore, be protected from the direct light of the sun, and the experiment carried on in the back part of the room. When cold, it is placed behind a cut-out screen, which may be the distance of a line from the plate over mercury, which is heated to 60° R., and the temperature allowed to fall to 30° R. When the plate is now removed, it has become steel-gray wherever the vapour of mercury had access; and in this manner the image of the aperture of the screen is obtained precisely as if ordinary light had fallen on to the plate. Although the condensed vapour of mercury is white, yet the action of its latent light preponderates in this case, and determines the colouring.

Heat acts no part here, for it has not the power of rendering the white substance steel-gray; nor can there be any question of chemical rays with this white substance, for all the rays of the spectrum convert it into steel-gray.

95. *Paper Thermographs*. --- I have myself produced on paper some impressions which I believe to be of a similar nature to those already described above. The manner in which these impressions were obtained may be thus briefly stated:---

Evaporate to dryness chloride of gold, and dissolve the residue in distilled water. Whith this solution wash the paper, which must have been previously submitted to considerable pressure in contact with the picture to be copied for one or two days. The impression may thus be supposed to be latent. When the paper, after being brushed with the solution, is dry, it must be passed through distilled water, and exposed to the sun´s rays or to diffused daylight. The paper will soon darken, and ultimately assume a mulberry colour, leaving, however, a white impression of the picture or marks with which it has been in contact.

IV.----ELECTRICAL IMPRESSIONS.

96. The analogy which exists between many of the effects of heat and electricity induced continental philosophers to endeavour to ascertain whether impressions similar to those produced by light and heat might not be obtained by electricity. Dr. Reiss was the first, we believe, to publish* *(Repertorium der Physick, vol. vi. P. 180.) the successful results of such experiments, which were afterwards carried out to a much greater extent by M. Karsten. † †(Published in Poggenddorff´s Annalen, No.2, 1842.) The results of these experiments appearing to us to be of much importance, we propose to lay them before our readers.

The first impressions obtained by M. Karsten were on glass in the following manner. A coin was placed on a piece of plate glass, which being supported by a plate of metal not insulated, and the sparks from the conductor of an electrifying machine were made to strike on the coin, thereby causing them to pass simultaneously through the coin and the metallic plate. After one hundred turns of the machine, the coin was removed: the glass plate appeared perfectly unaltered, but when breathed upon, a perfect impression of the coin in its most minute details became visible. Much of the success of this experiment appears to depend on the quality of the glass: the impressions appear as distinct on thick as on thin glass, with the exception, that if coins are placed on both sides of the glass plates, they are then acted upon and affected in the same manner as the surface of the plate. If thin plates are used, several sheets may be placed one above the other, which then yield impressions, indeed, gradually less distinct, but still quite perceptible. It is immaterial wheter the ball of the conductor touches the coin, or whether the electric fluid passes in the shape of sparks; on the other hand, it is very material to the distinctness and accuracy of the impressions, whether sparks are made to strike from the coin to the exterior metallic foil; in cases where the electric fluid slowly escaped from the coin, the impressions were less distinct.

Impressions of a like character were obtained on metallic plates, and they were much more distinct when a piece of oiled paper was placed between the coin and the plate, although impressions may likewise be obtained when the coin is in immediate contact with the metallic plate. The metallic quality of the coin appears to have some influence, the coins fabricated from the better conducting metals appearing to yield better

impressions. Powerful shocks from a jar or battery do not appear to produce the same effect.

M. Karsten has hitherto been unable to fix these impressions, for although the impressions on glass plates become visible during the action of fumes from quicksilver and iodine, they disappear immediately on being removed from the apparatus.

M. Karsten makes the following reflections on these curious phenomena:---

First. Is the impression produced by traces of the electric fluid remaining adherent to the glass plate? This question is negatived, for the reason that the impression still remains with great disinctness after all traces of electricity have disappeared, after the glass has been wiped with a handkerchief. And again, these impressions are neither destroyed nor even weakened by passing a stream of the opposite electricity over them. And in the case of the metallic plates, partial adhesion of electricity is quite out of the question.

Another question is, wheather they are produced by an action which is similar to that which has produced the impressions observed by Moser? or, whether they may be ascribed to peculiar electric action? The fact that this process is finished in a very short time, as compared with that required for the formation of thermographs, does not admit of this interference being correct. A few turns are sufficient to produce outlines of the coins on the glass plate.

97. But an experiment recently published by Mr. Hunt, to whose name in the course of these pages we have had so often occasion to refer, appears to militate against this last opinion of M. Karsten. It having been suggested to him that electricity might be engaged in the production of the spectral figures of thermography, he made the following experiment, with a view to ascertain the fact; the result of which shows the probability of this element being involved in some way in these very complicated phenomena. "I arranged," says he, "four electro-positive metals --- nickel, bismuth, cadmium, and silver, --- and two electro-negative ones, arsenic and antimony, on a copper plate, and they were allowed to rest upon it for three hours. Being removed, the plate was submitted to the vapour of mercury. The space covered by nickel was marked by being left free of vapour; that on which the cadmium lay was still more decidedly marked in this way; where the bismuth was placed the image was exceedingly faint, but still it was observable by a deficiency of vapour, and the silver was more decidedly outlined by vapour,

but none on the spot it covered. On the contrary, the space occupied by the antimony was covered in a most remarkable manner with vapour, presenting a perfectly white spot, which, in all positions, distinguished it from the other parts of the plate, whilst the arsenic left no trace behind.

98. *Galvanic Impressions*. ---The observation that a weak insulator should intervene for the purpose of securing good impressions on metal (§96), led to the interference that the galvanic current might be employed for producing such impressions. Such impressions were obtained by M. Karsten, but not with any degree of distinctness.

99. It has been the object of the author, in this little work, to lead the experimentalist 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 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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