
HAND BOOK
OF
HELIOGRAPHY
2/-

THE

Hand-Book of Heliography.

THE

Hand-Book of Heliography;

OR,

THE ART OF WRITING OR DRAWING BY THE EFFECT OF SUN-LIGHT.

WITH

THE ART OF DIORAMIC PAINTING,

AS PRACTISED BY

M. DAGUERRE.

"L'admirable decouverte de M. Daguerre est un immense service rendu aux arts."—DELAROCHE.

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ADVERTISEMENT.

The following little work has been carefully compiled from the now numerous treatises on the new and important science of Heliography. It is hoped that the attempt will not only satisfy a rational curiosity respecting unquestionably the most novel as well as applicable discovery of the present day, but also enable any one of ordinary intelligence to practise the art with little expense and trouble.

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Hand-Book of Heliography.

HISTORY OF THE SCIENCE.

To whom the honour of discovering this new and important science belongs does not clearly appear. It has been claimed by natives of both France and England, and with such apparent justice that it is difficult to assign the priority to either. Indeed it would seem that the minds of the respective individuals, who put in a plea for reputation on this score, were engaged so much about the same time on the matter, that the three principal candidates appear all equally entitled to it; the distance from each other being so great that a supposition of collusion

amongst them cannot for a moment be entertained. These individuals are MM. Niepce and Daguerre, in France, and a gentleman of the name of Talbot, in England. But, if the latter be indeed entitled to the credit of an inventor of this beautiful art, the productions of the former evince so much more proficiency and perfection that we cannot but concede to them the palm of superiority.

Our own countryman, the celebrated Dr. Ure, author of the Cyclopædia of Manufactures, in his excellent but frequently unjustly abused work on geology, published some years since, laid down in an admirable but apparently too abstruse chapter on *light*, which he prefixed to the body of his work, the law of the effects of coinciding rays, and clearly showed, by an experiment familiar to the comprehension of all, and easily made by any one, that its effect is to produce darkness, just as certainly, and just as palpably, as the effect of parallel rays from the sun is to produce light. But he was not

probably aware at the time that the darkness resulting from coincident rays was not only a mechanical consequence, if we may so speak, but that rays of light possessed and evinced a *chemical* property—that of rendering the darkness permanent upon any substance which was fitted to receive and competent to retain it. We do not say that the doctor was the first to discover the faculty of light of which he speaks, but he was the first to make it popularly, and, therefore, generally known, and too much praise cannot be ascribed for the singular perspicuity by which he has made it evident.

Giovanni Baptiste Porta, a Neapolitan physician, about two centuries since, discovered that, if light were admitted through a small circular aperture into a closely shut room, all the objects without from which reflected rays reached the hole would be painted on the opposite wall, in strength and size according to their distance, with their forms and relative situations, as in an extended picture, with the most precise exact-

ness. He subsequently found that the hole need not be very small, but that in fact it might be of any size, if covered with a lens. This was, however, only doubling the contrivance; for the increased quantity of light, which the larger hole afforded, was of course condensed by the centralizing power of the lens. But the images produced by these simple means were faint and somewhat confused, while those effected by aid of the lens were proportionably intense and properly defined. This plainness became remarkably increased after the discovery of the achromatic lens; and, still more, when subsequently the periscopic lens was applied, the additional force of the effect in consequence of its focalizing power was truly astonishing.

Porta had several dark chambers constructed of a cylindrical form of any particular length, with a lens at one end and a white card or paper at the other, so placed as to be within the focus of the glass upon which the external images were depicted. This plan he intended for such

persons as knew not how to draw; so that we have here the almost perfect design of the instrument of *Daguerre.*

He conceived that to obtain perfect representations of the most complicated sets of objects, it was only necessary to follow the focal light, with the trace of a crayon. In this idea, however, he was not precisely correct; for painters and designers, especially those who were engaged on large works, such as panoramas and dioramas, and who used the dark chamber, found that it was only useful for defining objects in the mass, to give them the respective sizes and positions according to the rules of linear perspective; but to the effects of what is called *aerial perspective* they found the dark chamber completely incompetent. Nor could their utmost efforts avail them to any requisite extent, or render what they did accomplish of permanent use. This object, however, has at length been attained, and he who, perfectly ignorant of the art of drawing, is destined to wander to the

remotest corners of the earth, may now, without the aid of an artist, carry with him the true and faithful delineation of the home of his youth, and of the objects most dear in his earliest recollections, with a truth and fidelity that no manual operation could imitate.

Alchemists, in those fruitless attempts after the *elixir vitæ*, and the transmuting stone, which formed the foundation of the present invaluable science of chemistry, succeeded in uniting silver with a marine salt, and produced a combination called *lune* or *argent cornè*. In the work of Fabricius, *De rebus metallicis*, published in 1566, a substance of this kind is especially noticed. It had the colour and transparency of horn, and the fusibility and softness of wax, but, if exposed to the light, changed nearly to violet, and by the continued action of the same influence, became nearly black. This was the natural *argent corné, or lunar caustic.*

The salt produced by the alchemists possessed the remarkable property of turning black, and

the blackness was vivid just in proportion as the rays which occasioned it were powerful. Cover a sheet of paper with a coating of *argent corné*, or, as it is now called, *chloride of silver*. Obtain by the aid of the lens the form of some object upon this coating, and the parts occupied by the figure will change to a dark colour, while the remainder of the paper, or rather its coating, will continue white. The parts which have a strong cast of light upon them will become quite black, the half tints and shades being formed by grey, through a less forcible luminence.

Place an engraving upon the paper covered with chloride of silver, and expose it altogether to the sun's rays, the engraving being uppermost, and that part of the paper covered by the engraving will remain white, in consequence of the interception of the rays, which cannot, on that account, reach the coating of chloride ; while all the rest will be tinged with black. Where the paper on which the engraving is printed has retained its semi-transparency, the saline

coat will be obscured accordingly; the result being that the coating on which the operation creates its effect will have its forms and shades in an inverse manner; the darkest parts of the engraving being whitest on the chloride, and the lightest parts of the print the darkest on the paper.

It might have been supposed that in the possession of so complete a knowledge of the effects of light upon this chloride, the alchemists would in the course of time have carried it out to some real practical purpose. But the minds of those men were too abstract, were too much occupied in the absorbing pursuit of the high, and, to them, incomparably more interesting and important design of realizing a most facinating though visionary object. They thought that if they could attain this great good, all other benefits would naturally follow; and, if their premises had been correct, their conclusion would have been both wise and sound. They were lifted above all the considerations of ordinary life and common objects, and it therefore remained for

the nineteenth century to conceive and accomplish the photogenic art.

M. Charles, a Frenchman, succeeded in obtaining *silhouettes*, or black profile portraits, but he never made known the nature or steps of his process, and his secret died with him. The first authentic intimation of this new art was contained in a memoir of Mr. Wedgwood, the celebrated improver of the manufacture of porcelain in this country, whose paper appeared in the June number of the Journal of the Royal Institution in 1802. The author was desirous of obtaining by the assistance of paper, prepared with chloride or nitrate of silver, the representations of church windows, as well as of engravings, for his pottery ; and, though he appears to have adopted a very close approximation to the present practice, he failed in his chief design. He says, "the images formed by means of a camera obscura have been found to be too faint to produce, in any moderate time, an effect upon the nitrate of silver."

Wedgwood's celebrated commentator, the il-

lustrious Sir Humphry Davy, did not contradict the assertion relative to the camera obscura. He added that he attempted to copy very small objects by a solar microscope, but only at a very short distance from the lens. Neither Wedgwood nor Sir H. Davy discovered an expedient for preventing the borders of their drawings from turning black. Their copies in consequence never could be examined in broad daylight, for, as soon as they were exposed to its strength of action, the whole of the paper began to assume one uniformly dark tinge.

After these imperfect and insignificant results, nothing was attempted until the researches of MM. Niepce and Daguerre. The former of these two gentlemen was a retired man of business in the neighbourhood of Chalons-sur-Saone, who devoted his leisure to scientific inquiries, and his first experiments in photography, or making permanent marks by the aid of light, appear to have been made as early as 1814; but his first connection with M. Daguerre took place in the

month of January, 1826. Through the indiscretion of an optician at Paris, he became apprised that M. Daguerre was endeavouring to accomplish the same object as that to which he had devoted his attention; having only to fix the images of his design in the dark chamber to make his plan perfect. These facts are verified by letters, still in existence, which attest that the earliest works of M. Daguerre were effected in 1826.

In 1827, M. Niepce came to England, and in December of the same year he presented a memoir upon this subject to the Royal Society of London. His paper was accompanied by many illustrations upon metal produced by the methods which he had discovered. These illustrations, which are still in good condition, might be gathered from the several scientific collections of distinguished Englishmen, and prove, without the possibility of contradiction, that engravings could be copied, and were so, by means of photography, in 1827. They

present the appearance of advanced sketches produced by means of a graver. M. Niepce knew, in 1827, how to make shades correspond to shades, half-tints to half-tints, and lights to lights; and, above all, he knew, when he had accomplished his object of copying an engraving, how to make that copy insensible to the subsequent and blackening rays of the sun; thus resolving, as his self-lauding countrymen phrase it, a problem which had defied the sagacity of Wedgwood and the genius of Davy.

The registered deed of partnership between MM. Niepce and Daguerre is dated 14th December, 1829; and they thenceforward prosecuted their photographic inquiries together. Subsequently, the son of M. Niepce took the place of his father in the engagement. In the body of this document, the several portions of the discovery are accorded to the respective parties to the contract, and it contains the remarkable assertion that the discovery of M. Daguerre had elicited a process which "repro-

duced images with sixty or eighty times the force of the previous plan."

In speaking all along as we have done of the proceedings of M. Niepce, it is particularly necessary to observe the words of the contract, "*pour la copie photographique des gravures*"—the photographic copy of *engravings;* for, after a number of fruitless essays, M. Niepce had nearly renounced the attempt of producing images from nature. He could not *create* a design. He could copy engravings, but he could not transfer the images of natural objects. The preparations of which he made use failed to render the dark marks sufficiently strong under the influence of the light. He succeeded in giving parts of a scene or of a landscape with sufficient power, but there was nothing complete. Here and there every thing was boldly portrayed, but in other places there was a poor and insufficient representation ; and, between, were places, comparatively of considerable size, exhibiting gaps which entirely destroyed the effect or rather the

appearance of a picture. On the other hand, we ought to give an enumeration of the discoveries which after many *minute* and painful and varied efforts M. Daguerre had made.

M. Niepce dissolved some dry bitumen of Judea in oil of lavender, and, after evaporation, the remainder was a thick varnish, which he spread upon a polished metallic plate, as, for instance, of plated copper, or upon a plate of silver. The plate, after being submitted to a gentle heat, remained covered with a white and adhering powder, which was bitumen in powder. The plate, thus prepared, was placed upon the hearth of the camera obscura. After a certain time, the feeble lineaments of an image might be perceived. M. Niepce ingeniously conceived that these traits, so little perceptible, might be materially strengthened. In fact, after plunging the plate into a mixture of oil of lavender and rock oil, he observed that the portions of the covered plate which had been exposed to the light remained nearly untouched, while, on the others

the covering rapidly dissolved and left the plate almost naked. After having washed the plate with water, he had the image formed in the camera obscura, the lights corresponding to the lights, and the shades to the shades. The lights were formed by the diffused light proceeding from the whitened matter and not cleared from the bitumen; the shades, by the parts polished and become denuded, which was, it should be observed, so skilfully managed that parts of the sombre objects reflected themselves in a glass; provided also, that they were placed in such a position that they were not directly opposite to the mirror, but aslant, with an oblique aspect and a faint light upon them. The half tints, where they were perceptible, or existed at all, resulted from that part of the varnish where a partial penetration of the dissolvent had rendered it less solid than those parts which were untouched.

The bitumen of Judea, reduced to an impalpable powder, had no clear whiteness about it: it

would indeed be almost exceeding the truth to call it grey. Contrast between the lights and shades of these designs of M. Niepce's was consequently far too weak for the desired, and, we ought to say, necessary effect; and, to increase it, he thought of strengthening the blacks in the plate by an after-influence, obtained either by sulphuret of potash or iodine. But he does not appear to have known that the latter of these two substances, when exposed to the light of day, would have been subject to continual change. He could not pretend to preserve so sensitive a thing as iodine; he only wished to apply it to the surface of the blackening substance, and that, too, after the formation of the image in the dark chamber. In such an operation what would have become of the half tints!

To the number of these great inconveniences of the method of Niepce's should be added the circumstance that, if the dissolvent were too strong, it would sometimes raise the varnish in places; after a little, indeed, entirely; if too

weak, it would not sufficiently disengage it from the image. Success was never certain.

M. Daguerre conceived a method which he called Niepce's plan completed. He at first substituted the residuum of the distillation of oil of lavender in bitumen, on account of its greater whiteness and sensibility. That residuum was dissolved in alcohol, or in ether, and the liquid was deposited in a very thin layer upon the metal laid horizontally, and prepared to receive it; and it left, in evaporation, a uniform pulverulent covering, a result which was not obtained by the process of Niepce.

After the exposure of the plate, thus prepared, to the heat, and in the dark chamber, M. Daguerre placed it horizontally, and at a distance, above a vessel containing essential oil at the ordinary temperature. The vapour proceeding from the oil left the particles of the pulverulent plaster which had experienced the action of the strong light untouched. It penetrated partially, and more or less, the portions of the same covering

which in the dark chamber corresponded to the dark tints. The parts remaining in shade were penetrated entirely. Here the metal did not show naked in any part of the design; but the lights were formed by the agglomeration of a multitude of white and macerated particles; the half tints by particles equally condensed, but in which the vapour had more or less weakened the whiteness and destroyed the closeness; the shades by particles always in the same number, but become entirely transparent.

More of effect, a greater variety of tones, more regularity, certainty of success in the process, as well as of avoiding carrying away any portion of the image, were the advantages of M. Daguerre's modified method. Unfortunately the oil of lavender, which is more sensible to the action of light than the bitumen of Judea, is yet so slothful in its action that the design does not begin to form until after a very long time.

The kind of modification which the residuum of the oil of lavender receives by the action of light, and in consequence of which the vapour

of the essential oil penetrates its substance with more or less facility, is still unknown to us. Perhaps we should regard it as a simple detachment of particles, perhaps as a new arrangement of molecules of the matter. This double hypothesis would explain how the modification is gradually weakened and at length disappears.

Through a long course of observation Daguerre saw the reasons of his repeated failures, and, by indomitable perseverance and the exercise of ingenuity, he at length so far overcame them as to bring his invention to a practical state.

He put upon the surface of a metallic plate, the tablet which receives the images, a coat of gold yellow, and then, turning it downwards, placed it horizontally in a box at the bottom of which there was a little iodine undergoing spontaneous evaporation. When this plate comes out of the dark chamber, not a trace can be seen upon it. The yellow coat of the iodine of silver, which, has received the impress of the figure, is one uniform dark shade without any mark.

Next, the plate is exposed, in a second box, to

an ascending mercurial vapour which raises a capsule, when the liquid is coming upwards, by the action of a spirit lamp, and this vapour immediately produces a most curious effect. It becomes attached in abundance to the parts of the surface of the plate which have been exposed to a strong light, while those parts which have been left in the shade remain untouched; at length it begins to work upon the space occupied by the half tints, and in a greater or less degree makes its impression upon the plate, and according to the intensity of the light on the precise spot makes it either more or less dark. When the feeble light of a candle is used, the operator can follow the gradual formation of the image step by step. He will be able to perceive the mercurial vapour, like a delicate graver, mark each part of the plate with the proportionate depth.

The image being thus produced in the camera, what should hinder its alteration when exposed to the light of day was a question that

very naturally proposed itself to the mind of the inventor. This he accomplished by immersing the plate upon which the design had been effected in hyposulphate of soda, and afterwards washing it with hot distilled water.

M. Daguerre says that the image is obtained better on a surface of plated metal, *i.e.*, upon a plate of copper covered with silver, than upon one of silver alone. Should such be the case, it seems to prove that electricity plays a considerable part in the operation.

The plate should be first rubbed with pumice stone, and then cleaned with nitric acid diluted with sixteen parts of distilled water. The influence which the acid exercises in this part of the process is both singular and useful: it raises little molecules of copper on the surface of the silver.

Although the thickness of the slight coat of iodine, as the several considerations of M. Dumas show, would not be more than the millionth part of a millemetre, it is necessary for

the due proportion of light and shade that it should be perfectly even in every part. He prevented a greater deposit of the iodine upon the borders than upon the centre of the plate, by putting round it a slight frame of the same metal, which he affixes by nails to the tablet of wood which bears the whole. But as yet we are unable to explain the mode of physical action of that plate satisfactorily.

There is another circumstance not less mysterious. If it be desired that the image should produce the maximum of effect in the ordinary vertical position of the tables, it is necessary that the plate should be placed at an angle of 45 deg. to the ascending vapour. If the plate is horizontal at the moment of the precipitation of the mercury, it would be necessary, on the formation of the image, to look at it in an angle of 45 deg, in order to obtain the best view of the representation.

In attempting to explain the singular process of M. Daguerre, the idea is immediately pre-

sented to the mind that light in the camera occasions the vaporization of the iodine, wherever it has come in contact with the gilt plate; that the metal becomes denuded, and that the mercurial vapour acts freely on the naked metal, during the second operation, and produces a white and pasty amalgam; that the washing of the hyposulphate is intended to raise the parts of the iodine which the light has not disengaged, and, speaking artistically, to make those parts of the plate bare which should produce the shadows.

The plate is not apparently increased in weight by the yellow covering of iodine, while, on the contrary, it is so, very perceptibly, under the action of the mercurial vapour. M. Pelouze, an ingenious Frenchman, who has taken considerable pains in this invention, asserts that, notwithstanding the presence of a little of the amalgam on the surface, the plate weighs less after the operation than it did before. It would consequently appear that the hyposulphate dis-

perses part of the silver, and a chemical examination confirms the correctness of the supposition.

To assign a reason for the effect of light on the designs which M. Daguerre submitted to its effects, it seems sufficient to admit that the plate of silver becomes covered, during the operation of the mercurial vapour, with spherules of the amalgam; that these spherules, very close in the lights, gradually diminish in the half tints towards the dark parts, where there ought not to be any.

The supposition of the philosopher has proved correct. M. Dumas discovered, by the microscope, that the light and half tints are really formed by spherules, the diameter of which appeared to him, as well as to M. Adolphe Brogniart, to be almost invariably about the eight-hundredth of a millemetre, but still the necessity of presenting the plate on the precipitation of the mercurial vapour at a *dip* of 45 deg. remains to be accounted for. It has been ratio-

nally supposed, that is, conceiving this inclination to be indispensable, to indicate the presence of points or prisms of crystallization, which solidify and group themselves vertically in a complete or semi-liquid, and thus have an inclination relative to the position of the plate to such an extent as renders that inclination of the plate necessary.

Our uncertainty respecting this matter only shows how far as yet we are from understanding the mode of action and the nature of this beautiful and highly important instrument of art.

We have thought it better to follow the invention from its rise through the several stages of its practical process, in order to make the reader clearly acquainted with the nature of the science, or, at least, as clearly as established facts can exhibit it. The matter itself was of such a curious and recondite character that few had ever imagined its existence. On this side of the Channel there was but one person who appears to have had any correct apprehension of

the action of light, and the results which he obtained were so faulty and incomplete that they were not to be compared with the draughts of the French artists.

Mr. Talbot had submitted a description of his operation to the Royal Society of London, of which he is a fellow, some short time previous to the art of Heliography being publicly talked of in France, and he has given good evidence to show that he had been acquainted with the principles for nine or ten years before. Some attempt has also been made by the Americans to arrogate the honour of the discovery to themselves, but these were but coldly received, and have at length, apparently, altogether died away. Mr. Talbot, with a generosity that does him high honour, exposed the whole of his plan to the public, and explained every part of it, so sufficiently, indeed, as to enable Messrs. Ackermann, of the Strand, to fit up boxes whereby any person of only common intelligence might make photogenic drawings for himself.

M. Daguerre, in the meantime, had submitted his designs and explanations to the Chamber of Deputies, with a view to obtain from the French Government a compensation for making the whole process of his invention public, in order to render it of general and immediate utility, and a commission was appointed to examine the project of law for this purpose. After sufficient inquiry, a report was made to the Chamber of Deputies by the celebrated philosopher M. Arago, and another to the House of Peers by M. Gay-Lussac; by which it appears that, after having had every opportunity of testing the certainty of the process, they were convinced of its capability to effect that which the inventor said it would accomplish. During the inquiry, M. Daguerre operated in the presence of one of the members of the commission, and made that gentleman as well acquainted with it as himself. In consequence of their reports a resolution was passed granting to M. Daguerre a pension of 6,000 francs per annum,

for life, and another of 4,000 francs to the son of M. Niepce, who had been joined with M. Daguerre in the attempt to bring the invention to a satisfactory issue since 1829, he having at that period taken his father's interest in the affair. The pension to M. Daguerre was afterwards increased to 10,000 francs, and the law received the royal assent on the 15th of June, last year.

How far M. Daguerre might have gone on in the improvement of his plan it is impossible to say, for, when on the high tide of successful operation, his diorama, with the whole of his plans and means of operating, were unfortunately reduced to ashes by an accidental fire. But he has already a very eminent degree of success, and not only himself produced surprising results, but by his proceedings has called the attention of many able and scientific men to the subject, and thereby insured the certainty of progressive improvement.

It remains perhaps that we should say some little of the inventor of photogenic drawing. M. Daguerre, then, is an artist of considerable

celebrity as a painter, and has long been an esteemed member of the French Academy of Fine Arts, and of the Academy of St. Luke, as well as of other institutions of a similar character in his own country, and stood high in France long before his discovery of the science of which we treat extended his reputation beyond the bounds of France. He is much regarded for his natural goodness as well as his artistical powers, especially for that surest indication of true genius, modesty.

When, on the 19th of August, 1839, in accordance with his agreement with the Chambers of Legislature, the discovery was to be made known, no inducements could prompt him to make his own explanations; and M. Arago, of whom we have spoken above, as being one of the reporters on the commission, was obliged to undertake the task of making the public acquainted with the secret of the process. In stating these circumstances to the assembly who attended on the occasion, this great man,

as all Europe acknowledges him to be, with a feeling that does him infinite honour, after reporting his endeavours to induce M. Daguerre to appear in that place, said, "a little too much modesty, a burden which is generally so lightly borne, suggested obstacles which I was not so happy as to surmount." His substitute, however, as might have been expected, proved satisfactorily competent to the task he had undertaken.

As it may be interesting to our readers, and will serve to complete this hasty sketch of Heliography, we subjoin the royal ordinance to the Chambers, which runs as follows:—

"Louis Philippe, King of the French, to all to whom these presents shall come.

We have ordered, and do order, that the bill which shall be presented to the Chamber of Deputies by our Minister, Secretary of State for the Interior, in our name, be explained by him and supported in the discussion.

Art. I. The agreement concluded on the 14th June, 1839, between the Minister of the

Interior, acting in behalf of the State and MM. Daguerre and Niepce, jun., is added to the present law, and approved.

Art. II. There is granted to M. Daguerre an annual pension, for life, of 6,000 francs, and to M. Neipce, jun., an annual pension, for life, of 4,000 francs.

Art. III. These pensions shall be entered in the book of civil pensions of the public Treasury, with an enjoinment that they shall be published with the present law. They shall not be subject to the prohibitive laws of accumulation. Reversions of one half shall be settled on the widows of MM. Daguerre and Niepce.

Given at our palace of Tuileries, on the 15th June, 1839.

Signed. LOUIS PHILIPPE.

Witnessed. DEUCHATEL."

In compliance with this ordinance, a law was passed, founded upon and embracing the following agreement.

" Between the undersigned, M. Deuchâtel

Minister, Secretary of State for the Department of the Interior, on the one part, and MM. Daguerre, (Louis Jacques Mandé), and Niepce jun., (Joseph Isidore), on the other part, the following has been agreed upon.

Art. I. MM. Daguerre and Niepce, jun., have ceded to M., the Minister of the Interior, acting on behalf of the State, the process of M. Niepce, sen., with the improvements of M. Daguerre, and the later process of M. Daguerre, for fixing the images of the camera obscura. They engage to deposit in the hands of M., the Minister of the Interior, a sealed packet containing the history and exact and complete description of the said processes.

Art. II. M. Arago, Member of the Chamber of Deputies, and of the Academy of Sciences, who has taken a knowledge of the said processes, has verified beforehand all the portions of the said processes, and has testified to the correctness of the representations.

Art. III. The packet shall be opened, and

the description of the processes published, after the adoption of the Bill, which is spoken of above. M. Daguerre will then, if it is required of him, operate in the presence of a commission named by the Minister of the Interior.

Art. IV. M. Daguerre engages, besides, to give a description of the peculiarities which distinguish his painting of the diorama.

Art V. He shall be bound to make known all the improvements which he shall make, from time to time, in any or all of these inventions.

Art. VI. As the price of these concessions the Minister of the Interior engages to require of the Chambers, for M. Daguerre, who accepts it, an annual pension of 6,000 francs for life, and for M. Niepce, who agrees also to accept it, an annual pension of 4,000 francs for life.

These pensions shall be entered in the Civil Pension Book of the Treasury. They are not to be subject to the laws which prohibit accumulations; and a reversion of a moiety of each pension, respectively, is settled upon their several widows

Art. VII. In the event of the Chambers not adopting, during the present session, this project of law granting these pensions, this agreement shall be null and void, and MM. Niepce and Daguerre, shall have their packet returned to them unopened.

Art. VIII. The present agreement shall be registered on payment of one franc.

Made triple at Paris, 14th June, 1839.

Signed by M. Deuchâtel, M. Daguerre, and M. Niepce.

An exact copy of the original has been annexed to the project of law.

Signed. DEUCHATEL.

Secretary of State for the Interior."

NATURE AND OBJECTS OF THE SCIENCE.

THE several names which this new science has received are so correctly indicative of its nature that they may be said to be definitions of it. It was first called *photography*, from two Greek words, signifying, writing by light; it was then called the art of *photogenic drawing*, or drawing produced or occasioned by light; and, at length, M. Daguerre gave it the equally expressive, though not more appropriate, name of *Heliography*, or, *writing by the sun;* the two last appellations, like the first, being derivatives from the Greek.

An idea had long been entertained that there was some method by which the fleeting representations of outward objects might be retained and made steadfast, but it seemed too flimsy to be held by a rational philosopher. The researches of late years into the chemical combinations

of light, however, and the observation of its effects upon the colours of natural objects, had confirmed the notion that there was a possibility of fixing its impress, and it was known that wherever light had fallen upon the substance designated *nitrate of silver,* or upon any thing rubbed over by it, a black mark was left.

The object of this science, then, is to fix the figures and colours of objects upon a prepared surface by the reflection of light alone. By the well known and beautiful invention, the *camera obscura,* the appearance of objects external to the box or place which contains the apparatus is beautifully exhibited on an horizontal plane, in their just proportions, colours, and perspective. Every portion of the scene, however minute or obscure, is faithfully depicted and retained as long as the observer may choose. Here then was a means by which the representation was secured for any desirable length of time, so that if there was a power in light to leave the trace of the physical things which it

clad in beauty, it might by this means be secured. The substitution of a substance which, when submitted to the action of light, retained its impress, for the plain glass of the camera, sufficed to accomplish the purpose of a retention of the image depicted.

But something more than this was required, for either the drawing must be kept in the dark, or the whole of the surface prepared would, on exposure to open daylight, equally partake of the same dark hue. Instead of exhibiting all those objects of every form, variety, and character, of which the human mind is cognizant, by the tracing of characters upon the black paper, it would be smearing the whole surface with one unseemly blotch. The means, however, adopted by Daguerre, for securing the permanency of the marks, prevented this fatal fault, and rendered the science truly what it is called, *Heliography*. Such is the simple nature of one of those important discoveries which are occasionally promulgated to the world. The full power and

utility of the science of Heliography may not be developed until the present generation has passed to their last resting places, and a longer period will assuredly elapse before its universal adaptation to the several purposes for which it is fitted.

But of its capacity for service, no small prospect may now be obtained, and it appears to have been well appreciated by the enlightened individuals who constituted the commission of the French legislative chambers. Their thoughts are so happily expressed that we cannot do better than transcribe them, especially as the important matters to which they refer are such apt illustrations of the benefits of the science that better could hardly have been selected.

"Your Commission have made the necessary dispositions for the day of discussion of the law (of granting a pension to the inventors), for all the members of the Chamber, if they think convenient, may appreciate the results of the Da-

guerrotype, and form for themselves a notion of the utility of such an apparatus. Every one will be able, upon an examination of many of the pictures which will pass under your eyes, to judge of the immense advantages which would have been derived during the expedition in Egypt, from so prompt a means of drawing such exact representations; and each will be struck by the reflection that, if photography had been known in 1798, we should to-day have possessed faithful depictions of a good number of those emblematic pictures of which the cupidity of the Arabs and the Vandalism of others have deprived the world.

"To copy the millions upon millions of hieroglyphics which cover even the exterior of the great monuments of Thebes and Memphis, of Carnac, &c., would require scores of years, and legions of designers. By the assistance of the Daguerrotype a single man could finish that immense work. Supply the institute of Egypt with two or three of the apparatus of M. Da-

guerre, and upon most of the great plates in that celebrated work (the fruit of our immortal expedition) of the vast extent of real hieroglyphics, these instruments would replace these fictitious or invented representations; and the designs would surpass, above all conception, in fidelity, and peculiarity of tint, the works of our most able painters. The photographic images, being subject in their formation to the rules of geometry, would through the aid of a small number of data admit of coming at the exact dimensions of the most elevated and inaccessible parts of those edifices.

"These reminiscences in which the savans and artists, so zealous and celebrated, who were attached to the army of the east, could not, without strange mistake, find the shadow of blame, will without doubt recall the thoughts to the works which are at present executed in our own country, under the control of the commission of Historical Monuments. At one glance any one will perceive the immense and im-

portant influence which the photographic processes are destined one day to exercise upon that great national enterprise; each will comprehend how much these novel modes of proceeding are distinguished by economy, a species of merit which rarely advances with the arts in the perfecting of their products.

"If it should at length be asked, if the art, defined in its very appellation, can bear the examination of its productions, those productions which are formed by the most subtle and delicate agent that nature offers, rays of light, M. Paul Delaroche shall answer.

"In a note replying to our request, that celebrated painter declares, concerning the process of M. Daguerre, that it so far contains the perfection of certain conditions essential to art that they would become, even to the most accomplished painters, a subject for observation and study! That which struck him in the designs is an *inconceivable precision*, nothing that disturbs the tranquillity of the masses, no-

thing that in any manner obscurates the general effect.

"'The correctness of the lines, besides,' says M. Delaroche, 'the precision of the forms, is as complete as possible in the designs of M. Daguerre, while, at the same time, there may be recognised a model of a large object, forcible and like, as rich in tone as effect. The painter would find in the process a prompt means of making a collection of studies, which he could not obtain otherwise but with the expenditure of much time, with much labour, and in much less perfection, setting aside the necessity for his own talent.' After having combatted, by excellent arguments, the opinions of those who imagine that photography would be injurious to our artists, and especially to our engravers, M. Delaroche concludes his note with this remark, 'To resume, the admirable discovery of M. Daguerre is an immense service rendered to the arts.'

"We can commit no error in adding nothing to such evidence."

Nor can we; for a better illustration of the object of the Daguerrotype than the whole of this extract furnishes could not have been given. But as one circumstance, which beautifully proves the *necessity*,—for such we may call it,—that exists for the exceeding delicacy of the designs produced by this instrument, we may state that the exceeding thinness, the almost inconceivable tenuity of the coating of nitrate of silver, to speak simply, *obliges* a remarkable fineness in every part of the product; a coarse representation could not be produced at all, there must be either a *fine* design or none; for a coarse representation could not but become no picture or representation, for it must evince such confusion in the details that the outline of no object whatever could be perceived.

But one of the greatest advantages of the Daguerrotype consists in this, that it acts with a certainty and extent to which the powers of human faculties are perfectly incompetent. Not only does it delineate every object presented

to its operation with perfect truth in their proportions, perspective, and tint—an attainment to which artists could never quite arrive, though which some of them of first-rate genius, after long and indefatigable labour, might perhaps so closely imitate as to satisfy, if not deceive, the casual observer—but it lays down objects which the visual organs of a man would overlook, or might not be able to perceive, with the same minuteness, with the same particularity, with the same nicety, that it depicts the most prominent feature in the landscape. The leaf of a rose, the blades of grass, the neglected weed, the time-stained excrescences on the knarled oak tree trunk in the landscape, and the smallest filament of tracery in the entablature, or in the representation of human passions on the loftiest point of a carved pediment of a temple, could be traced with the same accuracy, in every respect, as the varied workings of the soul in the countenance of the hero of the piece; and thus, by a cool ob-

server, scenes of thrilling interest in the progress of life may be transcribed and conveyed to posterity, not as they seem to the imagination of the poet or the painter, but as they actually are.

Nothing indeed but close application to discover all the principles of the Daguerrotype, —who indeed can say when they shall *all* be discovered,—is necessary to its universal use in examining, analyzing, modifying, and applying to the benefit of society, that most universal of all the agents which God has given for the beauty and advantage of his creation.

Were there uncertainty in its operation, we should esteem the value of this new instrument at a very much lower rate, but such is not the case. The objects themselves are, in one sense, their own delineators, and perfect accuracy and truth, —strange that we should have to say so of any thing earthly,—are necessitated. It has indeed been observed by an acute philosopher, that it is no improbability that we may obtain an accurate

chart of the lunar world by the moon herself. It says nothing to object to all this, that the action of the Daguerrotype is at present incomplete, for the faculty of accomplishing all is evidently there, and it requires only the skill of mental power to develop it.

A very short time suffices to make an intelligent person, altogether ignorant of the instrument, well acquainted with its nature and use; and, after but few trials, any one must succeed in obtaining perfect specimens of art. M. Arago, for instance, one of the reporters on the Commission of Inquiry to the French Chamber of Legislature, after he had been made acquainted with the process, executed a beautiful piece on his very first attempt.

The very high price at which the instruments have been sold in Paris has prevented the art from progressing in the way that the well-wishers of science could desire. But this is an evil which time will surely rectify, and very shortly it may be confidently anticipated that an efficient instru-

ment may be obtained for the expenditure of 10*l.* or 12*l.* and even less.

The more generally the science is diffused and practised, the more useful must it become, and it is hoped that this little manual will be in some degree beneficial in promoting both of these desirable objects.

MATERIALS USED IN THE ART.

THE first thing necessary is the plate on which the drawing is to be made. M. Daguerre found a leaf of copper, plated with silver, both metals together not being thicker than a card, the best receptacle or receiver for the rays of light; and as he has been the most successful draughtsman by the aid of Heliography, we will in the first place follow him in describing the implements used as laid down in exposing his process to the French Legislative Chambers, and then make our readers acquainted with the other materials which have been employed for the purpose.

The object of the copper is simply to support the silver, which must be the purest that can be procured. But, though the copper should be no thicker, if possible, than to serve the purpose of support, it is necessary to be thick

enough to prevent the plate being warped, and thus distorting the images traced upon it.

The plate has to be polished; and, for this object, there is required,

A phial of olive oil.

Some very fine cotton.

A little pumice powder, ground till it is almost impalpable, and tied up in a piece of fine muslin that is thin enough to suffer the powder to pass through without touching the plate when the bag is shaken.

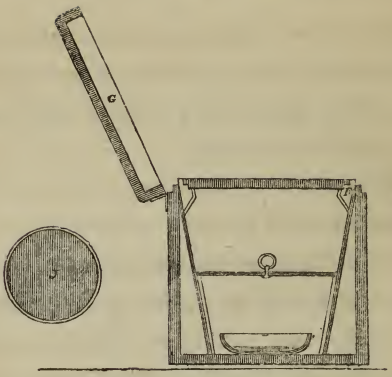
A little nitric acid diluted with sixteen times, by measure, its own quantity of water.

A frame of wire, on which to place the plate when being heated.

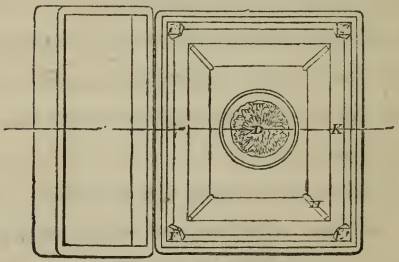
A spirit lamp, to make the plate hot.

A small box with inclined sides within, and having a lid to shut it up close, as represented in *figures* 1 and 2.

A square board large enough to hold the drawing, and having catches at the side to keep it steady, as shown in *figure* 3.



BOX FOR IODINE COATING.



DITTO INTERIOR VIEW.

FRAME FOR PLATE

Four metallic bands, to meet the catches of the board, the form of which is represented in the plate under the preceding figure.

A small handle.

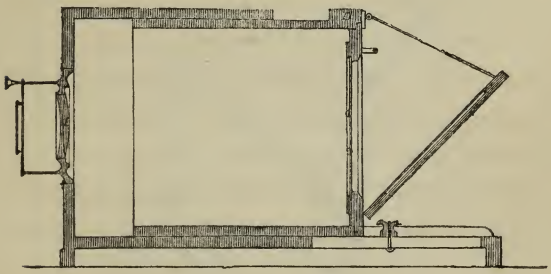
A box of small tacks.

A small bottle of iodine.

A Camera Obscura large enough to admit the plate of the largest drawing intended to be used. The nature of this amusing apparatus is so well known that we need not here attempt to describe it. But as the object of this little treatise is, not only to make the invention known, but to induce a more general application of the art and science of Heliography to useful purposes, the writer of these pages may as well observe that, when a boy, he manufactured a very effective camera, at, he believes, no greater charge than eighteen pence. It was about eight inches long, as many deep, and about six inches wide. Take a box of the requisite dimensions, with a rising lid; attach to the interior of the lid, on the front and two sides, a

piece of thick basil leather, all in one piece, so managed that when the lid is raised the light will be excluded from the interior of the box. This will be done if the leather be so adjusted to the lid that it work closely on the outside of the box, and checked that the lid cannot be raised beyond an angle of 45 degrees. When the lid is raised, cut an aperture in the front of the leather, only large enough to enable the spectator to obtain easy sight of the interior of the box. The hinge, or front part of the lid must also be so covered as to exclude the light. In front of the box itself, a round hole should be cut about half way down, into which a tube must be fixed about $2\frac{1}{2}$ inches long, having two lenses in it, one at the extremity, and a second about $1\frac{1}{2}$ inches within it. The tube must be so fixed in the box as to exclude all light from the box, except that which is transmitted through it. Inside the box, about half an inch above the tube, a little ledge must be fastened; on this ledge a piece of ground glass must be laid, as large as the box will hold. The Camera is

then complete, and, apart from its use in the purpose which has led us to speak of it, we may say that a more pleasing addition cannot be made to the sources of innocent gratification which the reader may possess. A machine more artlike in its construction, but not a whit more efficient, is represented in the accompanying figure.



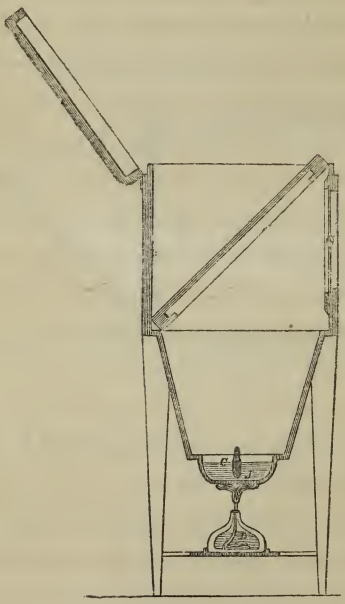
CAMERA OBSCURA.

A phial of mercury, containing about 3 oz.

A lamp and spirit of wine.

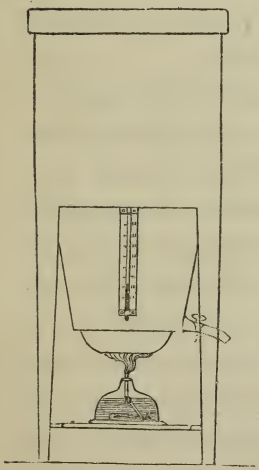
A deep box or black iron vessel, represented below, with a cup attached to its lower part, and a black iron frame, inclined at 45 degrees in the upper half, on which to lay the plate for

the disengaging process, to be described hereafter. It should have a lid to cover it completely, and the front be formed of glass with a shutter to it.

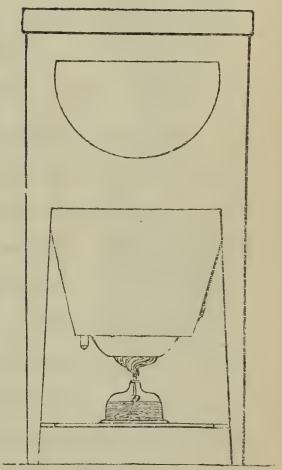


BOX FOR DISENGAGING PROCESS.

A large cup or open vessel to be put underneath the bottom of this box, with a thermometer fixed upright within it, to ascertain the degree of heat. The whole apparatus is faithfully represented in the figures below.



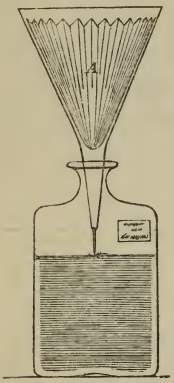
BOX WHEN CLOSED.



SECOND VIEW.

A glass funnel with a long neck, to pour the mercury into the vessel beneath the bottom of the box.

A solution of common salt in clear water, in the quantities of one of salt and three of water. When thoroughly dissolved, this solution should be filtered through thick paper, and then kept in corked bottles.

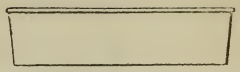


FILTERING PROCESS.

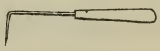
A covered jug, having a beak to pour out of, filled with distilled water.

An inclined plane, fixed upon a frame with catches to hold the drawing. The object of these catches is, to prevent the fingers touching the plate. The purpose of the inclined plane is, to support the drawing, whilst hot distilled water is poured over it, in order to free it from any particles of the iodine which has been used in the disengaging process.

FRAME FOR INCLINED PLANE.



INCLINED PLANE, SIDE VIEW.



Lastly, a handle or hook, wherewith to take hold of the drawing when in the cleansing trough.

These, we believe, are all the requisites described as necessary for the photographic art by M. Daguerre; but it has been discovered that other substances, much more convenient for the purposes of the art, are almost equally, if not quite, as fitted for them as metallic plates. Our countryman, Mr. Talbot, F.R.S., who was, if not the prior inventor, at least contemporaneous with M. Daguerre in attaining a knowledge of Heliography, has given the following directions for the making of photogenic paper, which we extract at length on account of the importance of the matter they contain.

"*To prepare Photogenic Paper.*

"The paper, being cut to the required size, is to be dipped into a solution of salt in water, in the proportion of half an ounce of salt to half a pint of water; let the superfluous moisture drain off, and then, laying the paper upon a clean cloth, *dab* it gently with a napkin, so as to prevent the salt collecting in one spot more than another. The paper is now to be pinned down by two of its corners on a drawing board, by means of common pins, and one side washed or wetted with the Photogenic fluid, using the brush prepared for that purpose, and taking as much care to distribute it equally as if you were laying in a sky in a water-colour drawing: dry the paper now, as rapidly as you can, at the fire; the paper will be fit for use for most purposes. If, when the paper is exposed to the sun's rays, it should assume an irregular tint, a very thin extra wash of the fluid will render the

colour uniform, and, at the same time, somewhat darker.

"Should it be required to make a more sensitive description of paper, after the first application of the fluid, the solution of salt should be applied, and the paper dried at the fire; apply a second wash of the fluid, and dry it at the fire again; employ the salt a third time, dry it, and one more application of the fluid will, when dried, have made the paper extremely sensitive. If greater sensibility is required, a fourth application of the fluid will effect the purpose. In the next place, write a number or a letter on the back of each piece of paper, and cut a narrow slip from the edge of each, marked in a corresponding manner. Expose these slips to the action of the daylight, not the sunshine, and notice the order in which they become dark. Those which are soonest affected by the light are the best prepared, and the sheets from which they were cut should be preserved for the most particular purposes.

"It is needless to observe that the paper must be kept away from daylight.

"*Cautions to be strictly observed in preparing and using the Photogenic Paper.*

"1st. Remember that if the Photogenic fluid falls upon any substance, it will make an indelible black stain, and cannot even be removed from the hand until the skin peels off.

"2nd. Be particularly careful that the paper, when used, is perfectly dry, or there will be danger of its staining the object laid on it to copy. If perfectly dry, it will not injure the most delicate piece of lace.

"3rd. The vessels into which the fluid is poured must be glass or earthenware, and the brushes must not be set in tin, nor must metal of any kind come in contact with the fluid.

"4th. Take great care that none of the solution of salt drops into the fluid; it would render it turbid and almost useless.

"5th. The paper should be prepared by candle-light.

"6th. Immediately after using the brush in the fluid, let it be well washed in water.

"7th. No more of the fluid should be poured out than can be used at the time, as there is danger, in pouring it back into the bottle, that some trifling portion of salt may be mixed with it, which would render the liquid turbid.

"8th. To avoid the danger of staining the fingers or dress, the vessels employed in the process should be thrown into a basin of water *directly* they are done with. We recommend gloves to be worn while the paper is prepared."

PROCESS OF PHOTOGENIC DRAWING.

M. DAGUERRE divides the whole process into what he calls five operations. The object of the first is to prepare the plate for receiving the sensitive coating on which the drawing is to be traced. The object of the second is to apply this coating. That of the third, placing the plate in the camera obscura, in order to receive the impress of the natural images through the agency of light. The object of the fourth operation is to bring out the invisible drawing on the sensitive coating, and make it apparent. That of the fifth is to prevent the influence of the rays of light on the prepared plate, which would otherwise become black all over alike, and so necessarily destroy the drawing: thus, so far as it has yet been possible to ascertain, completing the process of the art.

Preparation of the Plate.

The medium upon which the representations of natural objects is received is a coating of silver on a plate of copper. In order to meet the requirement of exceeding delicacy, which the subtle agent employed in the delineation needs, it is necessary that the surface should be perfectly smooth, and, which is almost saying the same thing, highly polished. The plate then of copper, covered with the purest silver, both together being of the thickness of about a common card,—we repeat some of these statements, in order to ensure as much perspicuity as possible, —must be laid, with the silvered side upwards, flat, upon several folds of paper, for a bedding. Having been well polished in the usual way, the surface must be powdered equally and carefully all over with pumice, ground down in a porphyry pestle and afterwards with a muller on plate glass, enclosed in the muslin bag. Then, taking a little cotton wool dipped in olive oil,

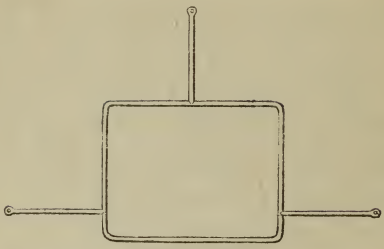
the operator must rub it over the plate with rounding strokes, and then crossing them by others, which commence at right angles with the first. By this means the plate is rubbed with the most even touch that the human hand can attain. This process must be repeated frequently, of course changing the cotton and renewing the pumice powder every time. When well polished, the oil and pumice must be rubbed off, the plate powdered all over again with pumice powder, and that again rubbed off with dry cotton, with the same sort of rounding and cross strokes as before.

A small portion of cotton must now be rolled together, and moistened with the diluted nitric acid, by applying it to the mouth of the phial, being at the same time gently pressed with the fingers, so that only the centre is moistened with the acid. This must be applied equally to the whole surface. Let the cotton be changed, and apply as before, until the whole of the surface has been completely visited. Should the acid

run into small drops or globules, as is not unlikely, from the high polish, they must be broken down as quickly as possible, but with all gentleness, as, should the acid remain on any particular spot, it will leave a stain or defect upon the drawing. It will be seen that the acid has had a sufficient effect upon the plate by the appearance of a sort of veil upon the polish. When this is perceived the pumice must be powdered over again, and then cleaned with fresh cotton as before, being particularly careful not to occasion any inequality on the face of the plate.

The next thing to be done is to make the plate thoroughly and equally hot. For this purpose Daguerre used the frame of wire represented in the figure. He placed the

SIDE VIEW.



FRONT VIEW.

plate upon this and then applied the spirit lamp to the whole of the under surface. But a better plan is to hold the plate with a pair of pincers, by the corner, over a charcoal fire, as the influence of the heat is likely to be more equally obtained. Soon as the plate is sufficiently hot, a white coating will be observed upon the silver, which indicates that that part of the operation is finished.

An even cold surface is next wanted, such as a plate of metal or of stone; M. Daguerre suggests a marble table, but perhaps it would be better to use a metallic plate, cooled almost to the freezing point by muriate of soda; and to this the heated plate must be suddenly trans-

ferred. When quite cold the plate must be again polished, in order to remove the gummy appearance of the surface, using the precaution to employ only dry cotton, as before, and care being taken to keep the fingers from the plate. Having finished the polishing, the operation of the diluted acid must be repeated three times, dry powder being dusted over the plate each time, and then rubbed off with dry cotton, so that not the slightest stain be left upon the surface.

The last operation of the acid must be repeated always immediately before the plate is put into the camera for the drawing process, and especial care must be taken to remove every particle of dust with cotton wool, both on the surface and back of the plate, before it is used. Should the plate not be wanted for immediate use, the application of the acid, after cleansing the plate from the gummy appearance, must be dispensed with, and then the plate can be stored up for a future period.

The Coating.

The object of the next operation is to give the plate that sensitive coating on which the light is to delineate the most delicate of its strokes.

For this purpose a cup containing iodine, broken in pieces in order to render the exhalation more equal and rapid, is placed at the bottom of the box first described. It is necessary that the exhalation of the iodine should be managed as well as possible, in order to avoid the fault of forming vesicles in the centre of the plate, which would otherwise ensue, and thereby prevent the equal formation of the coating, which is essential to the perfect success of the whole process. The plate is then put into the box with the face downward, and supported by small brackets at the corners. In this position the plate must remain until it assumes a full gold colour through the condensation of the iodine on its surface. If the plate remain too

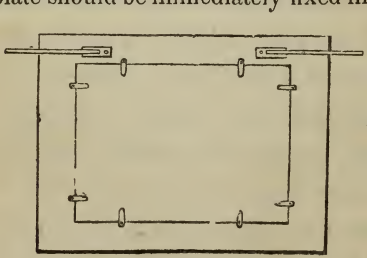
long it will become of a violet colour, if not long enough it will be of a pale straw colour; either of these two states is inimical to the desired effect. The *gold* colour, *and nothing but that*, is the indication of the right state of the plate.

Circumstances alone can regulate the length of this part of the process, as it depends upon a variety of causes—chiefly the temperature of the apartment in which the process takes place. No other heat should be used for the evaporation of the iodine than that of the apartment in which it goes on; and it should be particularly observed that the temperature within the box should be equal to that of the surrounding atmosphere, as, otherwise, moisture settles upon the surface of the plate, which is a grand fault. Practice alone can enable the experimenter to judge of the requisite time for the condensation of the iodine; the period varies from five minutes to half an hour.

It is of course necessary that the plate should be examined during the process, in order to as

certain its colour. To do this well requires some little judgment and dexterity, for if the plate be exposed to much light the effect is injured. It is better therefore to carry on this part of the operation in a dark room, where a little *side* light is admitted. Having turned up the lid of the box, lift the plate quickly with both hands, and a momentary glance will suffice to show the colour. If the tint be too dark the whole operation must be gone over again, polishing the plate as before. If the tint be too pale the plate must be replaced until the requisite hue has been obtained.

When this desirable point is arrived at, the plate should be immediately fixed in the frame represented in the annexed *figure*, fastening it with catches and bands, and then placing



FRAME FOR THE PLATE.

it immediately in the camera. As at this stage of the process the plate is remarkably sensitive to light, the transference from one receptacle to the other must be made as quickly as possible, and with only just so much light as will enable the operator to see what he is about; for instance, that of a small taper in a darkened room.

This transposition should not be delayed longer than an hour at the most, as after that period the iodine and the silver lose something of the power of their combined action.

On placing the plate in the box for the operation of coating, the cover should be shut down very gently, lest the sudden compression of the air should drive any of the particles of the iodine upon the surface of the plate, which would occasion large stains, and consequently spoil the drawing. It will also be advisable to cover the cup with gauze, as that tends to occasion a more equal exhalation of the iodine as well as to the avoidance of the defect just

spoken of. Lastly, between the coating of one plate and that of another, the box should be turned upside down and thoroughly cleaned from all the particles of iodine, being at the same time careful that none remains upon the fingers.

The Camera Obscura.

The next operation is to obtain the drawing. Having placed the Camera in front of the scene of which the representation is desired, and the glass through which the scene is conveyed to the interior of the box being adjusted to the right focus, the ground glass of the camera is withdrawn, and the prepared plate, with the face downwards, is substituted for it. Then, fastening it properly with screws or pins in order to save all shaking and uncertainty in the depiction, the whole is left until the natural images are drawn by the natural light on the plate.

This is the nicest and most difficult portion of the whole of the process. The time which it is necessary to leave the plate for a complete

delineation of the objects depends upon the intensity of the light; consequently, the state of the weather will have very considerable influence. A dull day will require more time than a bright one; and objects in the shade, on a bright day, will require more time for their delineation than those in the broad light, even on a dull day. The full clear light of the south of Europe, Spain, and Italy, for instance, will effect the object much more speedily than the duller luminence of a more northern clime. And the observation of course holds with still greater force respecting the more glowing brilliancy of tropical countries. Nor should it be lost sight of that some hours of the day are more favourable than others for the photographic, or heliographic process, whichever we may call it. M. Daguerre says that "the most favourable time is from seven to three o'clock, and a drawing which could be effected at Paris in three or four minutes, in the months of June and July,

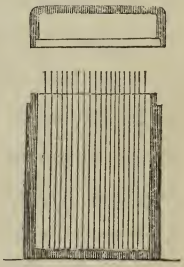
would, in May or August, require five or six, and seven or eight in April or September." These can only be general data, for the state of the atmosphere must be taken into account as well as time of day and season of the year, and the brightness or shade of the objects to be delineated. From three to thirty minutes was the time needed, according to M. Daguerre's experience at Paris.

But it is of little importance that we are unable to give any positive directions on this subject; for the experimenter can always readily rectify his own mistakes. Should the drawing be too much blackened by an over-prolonged solarization, the next plate must be withdrawn sooner; should the details be too vague and indistinct, the next plate must be submitted longer to the action of the light. Perhaps we cannot do better than subjoin here Mr. Talbot's directions.

"*To produce a Photogenic Drawing.*

"The following method is applicable to the purpose of obtaining copies of leaves of plants and flowers, prints and paintings on glass, wings of insects, sea-weeds, lace, &c., &c.

"The apparatus employed to copy the above objects consists of a wooden frame like that of a small looking-glass, in which a plate of clear glass is placed, resting on a *rabbet* in the usual manner, over which is a cushion of silk, fixed to the back-board, and pressed upon the glass when necessary, in the usual manner. The glass being downwards, and the back-board removed, the object to be copied is laid upon it (the glass), and a piece of prepared paper of sufficient size is laid on this object, the prepared side touching it:



BACK-BOARD.

over this you place the cushion and back-board, and force it gently against the glass, by means of the cross-pieces. When all this is done, the glazed side of the frame is held opposite the sun, and the drawing is made in a shorter or longer time, according to the brightness of the sunshine, and the goodness of the prepared paper. When sufficiently darkened, it is to be removed into the shade, and taken out of the frame, to be afterwards fixed in the manner we shall presently explain.

"*Cautions in taking a Photogenic Drawing by Transmission of the Sun's rays.*

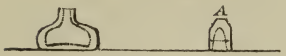
"1st. It is absolutely necessary, to the ob-

tainment of a clear drawing, that the object to be copied should lie close to the surface of the prepared paper.

"2nd. It is best to cut the paper into the requisite sizes by candle-light, and to mark the back of each piece so that it may be known at once; for, if there is any delay, the surface undergoes a partial change of colour, and the drawing is less distinct."

DISENGAGING PROCESS.

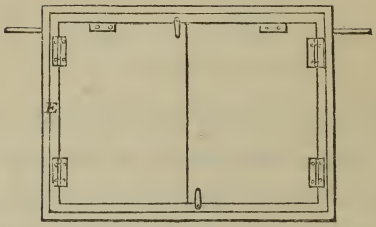
IMMEDIATELY on removing the plate from the camera it should be placed on the inclined frame in the box previously described, and which is represented in the figure. Having placed a cup at the box or iron vessel,—for this latter article is in every respect the better for the purpose,—let it be filled with mercury by means of the long glass funnel specified in the list of articles necessary for the art. Then, taking the plate fixed in the frame in which it was placed in the camera, put it with the face downwards within the ledge in the inclined frame, so that it can be seen through the glass in front of the box or vessel, and afterwards close the lid very carefully so that none of the particles of mercury are disturbed. All these being thus rightly disposed the spirit lamp should be applied to the bottom



SPIRIT LAMP.

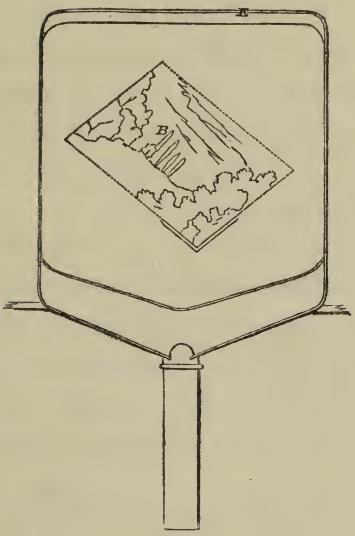
of the cup containing the mercury, until the bulb of the thermometer in the cup shows a heat of about 140 degrees of Fahrenheit, when the lamp should be removed, and the mercury will continue to rise without its aid. But it should not be suffered to exceed 177 or 178 degrees.

When the plate is first placed in the iron vessel the natural images drawn by the light will be invisible, but in the course of a few minutes, a faint tracery will begin to appear, and the progress of its development may be watched by removing the wooden screen to the glass window, and using the light of a small candle at different intervals, being particularly careful that the rays of the candle flame fall as obliquely and as little upon the plate as possible. When the sketch is suffi-



FRAME FOR HOLDING DRAWING.

ciently developed, the plate should be withdrawn, for the operation is then completed. But it should be observed that, after having risen to the highest heat specified above, the temperature will recede, and by the time, or before, the plate is finished, will be reduced to 120 or even 100 degrees. The degree, indeed, often suffices to show the state of the plate, and it may generally be confidently relied upon that, when the thermometer has fallen to 100 or 105, the operation is completed; but observation of the drawing itself is the best mode of judging.

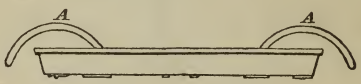


DRAWING ON FRAME.

The sketch may now, if necessary, be kept for a considerable period, provided it be saved from frequent exposure to the light; care also being taken that the surface is not rubbed. But the better plan is to proceed at once to

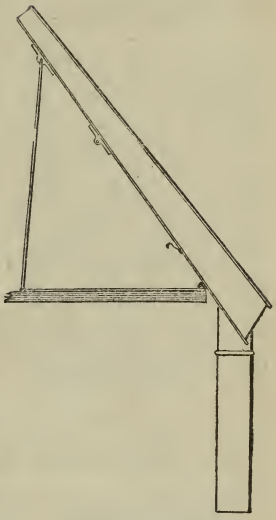
FIXING THE IMPRESSION.

THE object of this operation is to prevent the destruction of the drawing, through the discolouration of the plate by the decomposition of the iodine by light. This is done by a thorough cleansing of the plate. For this purpose, the two troughs must be placed at a convenient distance from each other, and one filled with pure water and the other with the saline solution. The plate must first be placed in the trough of plain water and moved about freely with the wire handle or

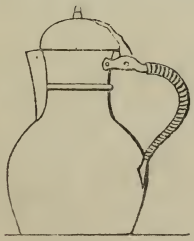


hook until the surface has been well moistened. It must then be plunged into the solution and subjected thoroughly to its action, as it was before to that of the water, and, when the yellow colour has disappeared, it should be lifted out with both hands and

placed upon the inclined tablet upon the stand, being well secured that it does not fall. Then, holding the jug containing the distilled water at an elevation of about a foot above the plate, pour the water in one continued forcible stream upon it, taking care that it freely and fully washes every part of the sketch. The dis-



INCLINED TABLET.



tilled water should be hot to render it more efficient, and enough of it should he used to thoroughly cleanse the plate from every particle of the saline solution. Should any globules of water remain upon the plate they should be removed by blowing upon them. But, in order to render our instructions as complete as possible, we will add Mr. Talbot's directions for fixing the drawing as given in the Literary Gazette.

"*To fix the Drawings.*

"First method. — After the drawing has been made by the action of the sun's rays, it is to be dipped into the solution of salt in water; when taken out, the superfluous moisture is to be removed, and the paper dried at a fire; after this it is but little injured by a partial exposure to the rays of the sun, and remains unchanged if kept in a portfolio, or only exposed to common daylight.

" *N.B.* If the drawing is very dark, a saturated solution of salt is necessary.

" Second method. — This method fixes the drawing with more certainty, but requires greater care in its application; instead of the solution of salt, a small quantity of iodide of potash is used in the same manner; but if it is in the least degree too powerful, it attacks the dark part of the drawing and destroys it, and, if not sufficiently strong, it acts so slightly on it, as to leave the paper still liable to change on exposure to the light.

" To ascertain if it is of the requisite degree of strength, it must be tried on the edge of the paper on which the drawing is made; and, if it change the *dark parts* to a primrose colour, it is too strong and must be diluted. A sixth part of the quantity of iodide in the bottle will be, in general, sufficient for a large wine glass full of water."

The sketch is now finished, and when dry, the plate should be stored away from the

dust or any substance that would bring a tarnish on the silver, and where nothing can rub it; for the mercury by which the images are rendered visible is partially decomposed, and, though it is not injured by washing, will not bear the slightest touch or rub. The best plan of preserving the drawings is to put them in a frame having a ledge raised above the surface of the drawing and protected by a covering which does not touch the plate."

TO OBVIATE DEFECTS.

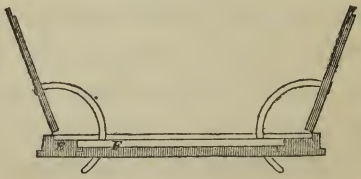
One thing is especially needed in practising the art of Heliography, extreme care throughout the whole process. During the operation of polishing and preparing the plate it is necessary that it should be rubbed by the pumice powder as evenly as possible, and that the diluted nitric acid does not accumulate in drops or globules, as their presence leaves stains on the surface of the plate which will appear in the drawing.

During the second operation of coating the plate, the time when the plate assumes the right tint of full gold colour should be strictly observed, and the plate should be removed neither before nor suffered to remain after that time. Any defect at this stage necessitates the repolishing of the plate. The plate may be repolished and used over again until the silver is worn through to the copper.

Taking the drawing in the camera requires only care in placing the plate squarely in the box, and the exercise of good judgment as to the time it should be left there. Experience alone will enable the experimenter to become an adept in the knowledge of this time, and with the hints we have given him, but little practice, we should think, would suffice. Failure in one trial should be followed immediately by another attempt, as success in the second is almost sure to correct error in the first.

The disengaging process is, perhaps, the

most difficult portion of the art, but care here, as in other instances, will ensure good fortune; observation as to the precise moment of removing the plate being the principal requisite. When the mercury is done with, it should be removed by means of the syphon cock at the side, and the inside of the vessel should be carefully cleared from any particles of mercury that might adhere to the sides; and the holds, catches, and bands, must be carefully cleared from it with pumice powder and water after each experiment.



The mode of fixing the drawing is so simple that no person of ordinary intelligence can, we think, make a mistake in it.

Should after all the drawing not be satis-

factory, the plate may be polished again, and used, as we have said, for reiterated trials, until the silver plating is worn through to the copper. The copper plated with silver may be obtained at any silver plated manufactory in town or country.

CONCLUSION.

We have here given, as succinctly as is possible, a full account of this novel and interesting art, and sincerely trust that this little treatise may conduce by encouraging the practice of it to the amusement and instruction of many a philosophic mind. Heliography has certainly developed a new feature in the physical world; it has made us acquainted with a new secret from that storehouse of arcana, by which, through infinite wisdom, we have been surrounded, and opened up a new pathway to scientific attainment for the welfare and benefit of mankind. It has given us a new proof — a repetition of every discovery in the world of nature and of mind — of the aptness of means to their ends throughout all creation, and the presence of Omniscient Goodness superintending the whole.

THE ART OF DIORAMA PAINTING.

The term *Diorama* is derived from a Greek word signifying *to see through,* and is a very fair definition of that which it is intended to indicate. Though inferior, we might say far inferior, to the Panorama as a means of representing extensive subjects, it possesses advantages far above those of any other description of painting for the production of immediate effect.

The mode of arranging the picture adds not a little to the illusion which a dioramic view is, even without such aid, well calculated to create. The peculiar object of the diorama is, as most of our readers are aware, the mimicry of natural changes, while the view is constantly before the eyes of the spectator. Thus, for instance, in one of the scenes lately exhibited at the building erected for the pur-

pose in the Regent's Park, the interior of the church of St. Paul, at Florence, when first submitted to the visitors, presents the quietude and solemn repose of a picturesque and beautiful place of Christian worship. Its aisles and nave, its pillars, its monuments, its altar, and all the other attendant circumstances of such a scene, are observed, illumined by the broad daylight, and inspire that sense of awe which is invariably the result of the inspection of a well ordered ecclesiastical edifice.

The fulness of noon decreases, and the fading light of declining day throws a more and more sombre hue over the long drawn aisles, the varied pavement, and fretted roof. The pillars throw stronger shadows, the silent memorials of a silent race seem more prominent in the roughness of their sculptured ornaments, and less and less distinct in their lower details, until at last the obscurity deepens, as the evening grows, into the gloom

that gathers, and spreads and diffuses itself throughout the vast interior, and, at length, wraps every object in its own dim uncertain commingling and congenially confused shadows. The hazy gleam, that had thrown its faint and feeble hue in a flickering struggle to dispel the darkening shades, dies away entirely from the topmost pane of the lofty windows, and the pitchy blackness of night settles over all. Then gradually the darkness gives way to growing brightness, and one by one the supports of the building are lighted by brilliant candles, and the whole church is, at length, illuminated for a midnight mass. Every distant nook is displayed in its minutest part, and the vast instance of architectural skill is bright as if filled by a noontide sun, but with all the peculiarity of artificial light. Then are shown the seats, forms, and clustering figures of a numerous assemblage; the priests in their stoles and copes, and all the imposing accessaries of a

Romish rite. The service concludes, the congregation retires; and, at last, the sinking figures of the clerical personages and their attendants depart, as if in life, from before the eye. The lights are successively extinguished, and utter darkness succeeds to the striking scene. Then the dawn sheds its shadowy heralds through the high windows of the roof, the rays grow in strength and brightness, until again perfect day reigns throughout.

Much of the completeness of the illusion arises from the circumstance of the spectators being placed at a distance from the picture. They sit in a darkened room forming an arc of a circle fitted with concentric seats. Before them is a species of proscenium, less than the picture, which is placed several feet beyond it, so that minute defects are not evident except to an artistical observer, and on an intent inspection.

This species of painting was invented by

two French artists, M. Daguerre and Bouton, of whom M. Daguerre was the chief. In compliance with the terms of the agreement through which the French Legislative Chambers secured to him his pension of 6000 francs, that gentleman was bound to make his whole process of diorama painting public, and the following detail is condensed accurately from his own account.

Instead of the common canvass used by painters, M. Daguerre employed the finest calico or even lawn, as free from defects and as equally made as he could procure it, and at the same time of as great width, in order to avoid the unsightliness and inconvenience of seams. This canvass, for so we may term it, is primed on both sides with two coatings of parchment size, or more if necessary.

The *first effect* is painted on the right side of the canvass, the sketch being first made with lead pencil, as cleanly and lightly as possible; for the lights of this portion of the

design can only be obtained by having the ground untouched by colour, as otherwise the transparency of the medium for the lights of the *second* effect would be destroyed. The colours used are ground in oil, but laid on with turpentine, using a little animal oil for the deepest shadows, which may be varnished without any detriment to their effect. Manipulation of the colours is pursued precisely in the same manner as for water-colour painting, with the exception of using oil instead of gum, and applying them with turpentine; especial care being taken that the transparency of the canvass is preserved as much as possible, avoiding all opacity of tint, where it would appear to the injury of the second effect.

The *second effect* is produced by painting on the wrong side of the canvass, using no other light but that which comes from the first side of the design. By this plan the forms of the first effect are kept transparent,

and may be preserved just as they are, or painted over, as may be conceived best.

In the first place the whole of the canvass (that is, the *wrong side*) is covered with a blue transparent wash, the tracings of the brush being effaced by a large tool of badger's skin. This wash must be thinner along the seams and selvages than elsewhere. When quite dry, the alterations of the design are sketched, and the artist has then only to model in his light and shade. This is done by means of a tint, of which white is the base, mixing it with lamp black in order to obtain a grey. The strength of the tint is ascertained by viewing it from the right side of the picture. If of right strength it will not be at all perceptible from that side. The gradation of tones is of course obtained by the gradation of this tint. Should the shadows of the first side be too strong for the effect on the second, it must be harmonized by the use of the grey tint of the requisite opacity.

When this is done, the picture may be properly coloured, using only the most transparent tints prepared in oil. The colours must still be applied with turpentine, which produce only a powerful effect in proportion to the repetition of their use; but, in strong effects, more of oil may be used. For slight effects, however, the essence of turpentine is sufficient.

Each effect is made clear in its turn by the light used to make it evident. The *first effect* is shown by reflected light, that is, a light before it, and brought from above. For this purpose, windows are made in the roof behind the proscenium, and, consequently, out of the sight of the spectator, fitted with ranges of shutters, so as to exclude the light gradually.

In the *second effect* the light is obtained by refraction, behind the picture, and comes from vertical openings. Only one light is used when one effect is intended to be shown

in its full power, but both lights may be employed when a modification of effect is to be produced. The windows ought to be at least seven or eight feet from the painting, in order to prevent, in the first place, the light from appearing in patches — stronger in one part than another; and, in the second, to allow of the interposition of coloured media, in order to obtain a modification of the light: these means are necessary on both sides of the picture.

M. Daguerre explains the grounds of dioramic effect upon the principle of the decomposition of light. He states that, if two colours be put upon canvass, the one red and the other green, and a red glass be interposed between the colours and the light that falls upon them, the red colour will reflect its consonant rays, but the green will remain black. If green glass be interposed, the converse will take place; the green will show green, but the red will appear black.

This principle is strictly applicable to dioramic painting. There are two effects; one before, the other behind, and these effects, not passing into one another but through a complicated combination of tint, lessen the necessity for any strongly marked media for the light to pass through; for, the light having in both effects to traverse the colours on the canvass, the result is a close similarity to nature in her changes from morning to night, and, by parity of inference, a similarity to all other changes from light to shade. Nor is it necessary to have any very strong tints in order to produce a powerful effect, for even a slight shade is often sufficient for the purpose.

THE END.

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