

This does not leave any film on the wood, but serves merely to fix the white pigment.

The next operation is an unpleasant one, as it necessitates the working with albumen which, before being used, must have passed into a state of putridity. Beat into a froth the whites of as many eggs as may be found desirable, and for each egg employed add four grains of chloride of sodium and eighteen minims of strong ammonia. Keep this standing in a warm place for about a month, and add water to make up the loss from evaporation. When putrid, filter and apply to the surface of the wood by means of a brush. After being dried, apply, by the same means, a forty-five grain silver solution. The block, thus sensitized, is exposed under a reversed negative until printed sufficiently deep, after which it is washed by means of a broad camel's hair brush, and toned and fixed in the usual way.

At this stage we may introduce the method by which the negative may be used in a reversed position. Of course, when the negative is taken expressly for the purpose of being employed in connection with engraving, the photographer will take care that it be reversed or non-reversed to suit his special purpose; but in the case of pre-existing collodion negatives the case is different.

Let us suppose that a collodion negative several years old, and well varnished, is required to produce a reversed print. The first operation is to remove the varnish. This is best effected by pouring over the surface a little of the following mixture:

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| Caustic potash..... | 2 parts. |
| Alcohol..... | 2 " |
| Water..... | 20 " |

This must be poured off and on until the varnish is dissolved, when the surface is well washed with water and allowed to become dry. The plate is now placed on a leveling stand and coated with a very thin solution of India rubber in benzole, followed, after being dried, by a coating of transfer collodion composed of alcohol and ether, two pints of the former to one of the latter, in which is dissolved one ounce each of castor oil and gun-cotton. The object of the coating of rubber is to prevent the transfer collodion from acting upon the collodion that contains the image.

When the transfer collodion is quite dry, which may take one or even several hours, it is gently warmed to dispel any milkiness, should such exist. A knife is next run round the margin so as to cut through the film, and the negative is placed face upward in a flat vessel of water. Ere long the film will be seen to become loosened on the glass, and in a short time it will become altogether detached. It must then be placed between two sheets of blotting paper to be dried, after which it is kept in a folio for use.

In printing from a pellicular negative prepared as described, the picture may be either reversed or non-reversed according to the side placed next to the paper, and both classes of prints will be equally sharp.

We now describe a method by which the wet collodion process is applied to this purpose by a transfer system which does not injure the surface of the wood by the action of chemicals. Its practical nature may be deduced from the fact that it was by this agency the large portrait of Prof. Huxley, together with similar portraits of other eminent men of science, which appeared some time ago in a leading London illustrated newspaper, were placed upon the wood ready for the engraver. The process is mainly that of Grüne, subjected to such modifications as were found necessary in getting it brought to a successful state of working.

It is first of all necessary, by means of a copying camera, to produce from the negative a transparency the exact size which the engraving is required to be. The knowledge required to produce a transparency, together with a suitable camera for the purpose, is assumed as being in the possession of the operator. The collodion must be prepared with soluble cotton, made at a low temperature to insure its being tough or skinny, and it is so far fortunate that cotton of this class can be readily obtained throughout the United States, especially in New York. The mechanical characteristic of the collodion is that it shall be tough; its photographic peculiarity being that it shall not yield a dense image, but one that is very soft and transparent in even the deep blacks. The following is a formula which, we were informed by a professional photographer on wood, who is also a practical engraver, invariably gave the best results.

PLAIN COLLODION.

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| Alcohol..... | 900 parts. |
| Ether..... | 1,800 " |
| Pyrroxyline..... | 60 " |

IODIZED COLLODION.

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| Plain collodion (as above)..... | 700 parts. |
| Alcohol..... | 450 " |
| Ether..... | 150 " |
| Iodide of cadmium..... | 14 " |
| Bromide of sodium..... | 10 " |
| Alcohol..... | 100 " |

To dissolve the bromide of sodium, rub it in a mortar with a few drops of distilled water, then add the alcohol last mentioned in the formula, and finally the iodide of cadmium.

We have given the proportions in "parts," which any photographer may interpret by grains or drachms so as to suit his own idea as to the quantities desirable to be made at a time. But we must make one observation, which is this: It is necessary that the collodion be tough; but seeing that the longer a collodion is kept the less tough, or more rotten, it becomes, it is not desirable to make too large a quantity at a time.

The strength of the nitrate of silver bath should not exceed thirty grains to the ounce. The developer, too, must be somewhat weak, consisting of twelve grains of protosulphate of iron to the ounce of water, together with a drachm of acetic acid and a few drops of alcohol, although the latter may be omitted if the developer flows smoothly.

The glass on which the picture is to be taken should have a coating of a solution of a wax or paraffine in ether, which must be rubbed off with a dry cloth. This leaves a very thin film that facilitates the removal of the collodion at a later stage. In exposing, according to the side of the negative that is turned toward the lens, so will the subsequent transparency be reversed or not; and it need scarcely here be said that the image, when finally placed upon the wood block, must be reversed, so as to print direct after it is engraved.

It is impossible here to give data for exposing, as this must be determined by a few trials. It is better to employ a lens with a small stop, and give a liberal exposure, having the negative directed either to a uniformly lighted portion of sky or backed at some little distance by a white card inclined backward. When developed, the lights must be absolutely transparent, and there must not be a trace of fog

observable on the picture; nay more, the whole picture must be so thin and transparent as to permit the details of the shadows to be plainly seen when the plate is laid face down upon a sheet of paper. After fixing with cyanide and washing, tone by the application of a solution of chloride of platinum, one grain to eight ounces, or of a strength sufficient to penetrate throughout the thickness of the image in about a minute. It is recommended to add tartaric acid to the platinum solution, in the proportion of five grains for each grain of the metallic salt. When toned, the transparency, without being allowed to become dry, must be placed in a bath of diluted sulphuric acid, one ounce of acid to a pint of water. This serves to detach the film from the glass.

But previous to the operation just described, the wood block must have been prepared. Place in a porcelain vessel eighty grains of Nelson's gelatine, or that of any other good maker, and cover it with cold water. Allow it to stand for two or three hours to absorb as much as it can; then drain off the superfluous water, and add ten ounces of warm water. If this does not cause the gelatine to dissolve, place the vessel near the fire, and it will speedily liquefy. Having rubbed up thirty grains of oxide of zinc in a mortar with a little water, add it to the gelatine, and filter through linen into a wide mouthed glass bottle. A few drops of carbolic acid will prevent decomposition, if it is to be kept any considerable time. Next apply to the surface of the wood a paste made of oxide of zinc and water, and rubbed by the palm of the hand, and then apply the gelatine by means of a broad camel's hair brush. This must be allowed to dry spontaneously.

Returning to the collodion picture in the acidulated water, it occasionally requires a little time, although sometimes only one or two minutes, to insure the film becoming quite detached from the glass. When this is the case, a sheet of stiff waxed or paraffined paper is introduced, and the film is lifted out of the water by its agency. An easy way of doing this is to operate in a deep wooden dish having a plugged hole in the bottom. Lay the sheet gently down upon the collodion film, still *in situ* on the glass plate, although not now adhering to it; then, by withdrawing the plug, let the water run off, thus enabling the glass plate with the collodion film and the paper to be removed without disturbance.

The surface of the wood having been made wet by drawing a broad camel's hair brush dipped in cold water over it, the paper, to which the film now adheres in preference to the glass, is gently lifted up from the latter, and superimposed on the wood block, collodion side down. A sheet of blotting paper is placed upon it, and over that a piece of rubber cloth, and moderately smart friction or pressure is applied to insure the attachment of the collodion to the gelatinized surface of the wood. By means of a penknife the margin of the paper is then raised, and the sheet lifted from the block, to which the film now adheres. This adhesion is rendered more firm by placing the block for a few minutes in a warm place, sufficient to impart tackiness to the still wet gelatine by which it was sized. To prevent the wood from warping, at this stage the back of the block should be sponged with water. Some operators effect the required adhesion by holding the surface of the block to the fire for a few seconds. But care must be taken not to let the collodion become dry.

The next operation consists in removing the collodion and leaving the image remaining on the wood. This is expeditiously effected by pouring over the surface first a little alcohol, following this by ether. If a good quality of soluble cotton has been employed, the collodion quickly dissolves by the method described. The wood is not affected by either alcohol or ether. When dry, the block is ready for being placed in the hands of the engraver, or in those of the artist to have the details supplemented by a few pencil touches, or for the removal of portions not desired to be engraved.

Although the film of gelatine upon the wood is so thin as not to clog the point of the graver, it may be rendered still more attenuated by increasing the proportion of water in the gelatine solution.—*Photographic Times*.

THE DIRECT SYNTHESIS OF AMMONIA.

MR. STILLINGFLEET JOHNSON has continued his researches upon the supposed existence of an active form of nitrogen which is capable of directly combining with hydrogen to form ammonia. He claims to have substantiated this discovery by a series of experiments with Grove's gas battery. The exact nature of these experiments need not be detailed here; but it may be stated that the results show that when nitrogen and hydrogen are suitably placed in relationship with each other, a considerable proportion of the two gases combines to form ammonia. The active agent in promoting this combination is the electrical effluve—*i. e.*, the silent and continuous discharge of electricity from an electrode. In Mr. Johnson's words, "Complete combination of nitrogen and hydrogen gases to form ammonia, with contraction of both gases, in proportions N_2 to H_2 , may be effected by subjecting the nitrogen to the effluve while it is in contact with a platinized platinum plate." The practical value of this discovery, and the help it may afford in the direct synthesis of ammonia, are not as yet apparent.

THE DETECTION OF CARBON DISULPHIDE.

A PROCESS for the detection of carbon disulphide is described by M. Vitali in last month's *Journal de Pharmacie et de Chimie*. It consists in filling a gasholder with pure hydrogen, which is allowed to traverse a series of U-tubes filled with fragments of glass or pumice stone steeped in lead nitrate, silver nitrate, and caustic potash. For the same purpose, fragments of pumice steeped in sulphuric acid and in potassium permanganate may be used. The liquid in which carbon disulphide is to be sought is introduced into a three-necked bottle connected to a second bottle containing tartar emetic. A current of pure hydrogen is made to pass into the former, and thence into the latter. The hydrogen is then conducted into a chloride of calcium tube; after which it may be treated with reagents, or the products of its combustion may be examined. In a first trial, the gas is received in a few cubic centimeters of an alcoholic solution of caustic potash, to which are afterward added a small quantity of neutral ammonium molybdate and a very small excess of dilute sulphuric acid. If the liquid contains traces of carbon disulphide, it takes a rose color, which then passes to a vinous red. Another portion of the gas is passed into a small volume of an alcoholic solution of lead acetate, to which are added a few drops of caustic potash, and the mixture is heated to boiling point. If the mixture contains carbon disulphide, lead sulphide is produced. If the quantity of carbon disulphide is large, it becomes sensible to the smell. The flame has a blue center, and gives off the odor of burnt

sulphur. It decolorizes blue starch paper; blue starch paper charged with iodic acid; and produces a yellow spot upon porcelain, which, if treated with caustic potash and then with sodium nitro-prusside or lead acetate, gives the reactions characteristic of the presence of sulphur. If a plate of silver is used instead of porcelain, there appears a black spot of silver sulphide. If there are dropped upon the porcelain plate solutions of caustic potash, of lead acetate, cadmium sulphate, antimony chloride, or arsenious acid, and the flame is allowed to spread over these points of the plate, the characteristic colors of the metallic sulphides appear. If the carbon disulphide is mixed in more or less considerable quantities with solid matters, they are divided as finely as possible, distilled along with water acidulated with sulphuric acid, and the distillate is further examined as above. If it is required to detect the carbon disulphide in illuminating gas, the gasholder is filled with the gas, and the process is conducted as described.

PURE HYDROSULPHURIC ACID GAS.

IN precipitating arsenic from solution it is necessary to have sulphydric acid that is absolutely free from arsenic. Otto and Reuss recommend, for the preparation of this gas, the substitution of calcium sulphide for iron sulphide. The former may be prepared by heating gypsum and charcoal together at a high temperature. This is acted upon by pure acid free from arsenic. As no hydrogen is formed, any arsenical compound in the acid could not be reduced to arsenated hydrogen. To obtain a steady and quiet current of gas, large pieces of the calcium sulphide are placed in a Woulfe's bottle, a little water poured on it, and a 25 per cent. hydrochloric acid allowed to flow slowly from a funnel with stopcock, drop by drop.

Barium sulphide is also an excellent material for this purpose.—*Chemiker Zeitung*.

ACTION OF LIGHT UPON COLORS.

By M. DECAUX.

THE author refers first to the researches of Dufay and Helot undertaken in order to classify the colors into fixed and fugitive, and expresses regret that the rules based upon this regulation have been permitted to fall into abeyance.

As regards the action of sunlight or diffused daylight upon colors fixed in dyeing, M. Decaux proves by a long series of comparative experiments that the shades dyed upon wool in the vat, with Prussian blue, cochineal, madder, weld, and even fustic, are much more permanent than those obtained with Nicholson blue, magenta, jaune d'or, and picric acid. Four of the coal tar colors differ from the rest of their class as regards stability, *i. e.*, the ponceau called naphthol carmine, orange No. 2, chrysoïne, and artificial alizarin.

Colors for painting in water and in oils are divided into the absolutely permanent, the moderately permanent, and the fugitive. If used with water all the most beautiful reds, carmine, carmine-lake, most madder lakes, and vermillion, fall under the fugitive class. If mixed with oil, the madder lakes rank as moderately permanent.

The action of the arc light is similar to that of the sun, but has only one-fourth of the power.—*Bulletin de la Société d'Encouragement*.

ROCELLINE.

LITMUS or lacmus has long been employed as a test for the presence of acids, and so general is its use for that purpose that few dyes are so familiar to chemists. Like cudbear and archil, its source is the lichens which grow upon islands in the Atlantic, and it differs from these dye-stuffs chiefly because of the manner in which it is prepared. The process consists in subjecting the mass of gathered lichens, the principal of which is the *Rocella tinctoria*, to a species of fermentation, ammonia being added. The red coloring matter, orcin, is converted into a blue azo-pigment, which is separated, mixed with a sufficient quantity of gypsum and chalk to give it consistence, dried, cut into small cakes, and in that form sent into commerce. Its use is by no means confined to the dye-house. Being reddened even by dilute acids and restored to its blue color by weak alkaline solutions, it is constantly employed in chemical laboratories as a test for the presence of soluble acids and bases in excess, and for determining, by the failure of a mixture of an acid and a basic solution to effect the tint, that the mixture is neutral.

The French, who give to litmus the name *tourne-sol*, prepare a form of the dye on rags by steeping them repeatedly in the juice of *croton tinctoria*, and exposing them to the ammoniacal fumes given off by stable manure when undergoing fermentation. Although it appears to serve the purpose of the dyer equally well, the litmus on rags cannot, as a test, take the place of that from the roccella. It is employed to dye the peculiar kind of paper in which sugar-loaves come wrapped, and in Holland to tint the rind of certain sorts of cheese made in that country, and which, when externally dyed, is said to be less liable to mould and to be attacked by cheese-mites.

The discovery of the process of making roccelline artificially has been the natural outgrowth of the remarkable investigations of the last few years into the production and properties of the azo-compounds of naphthalene. After Mr. Z. Roussin, who in 1875-76 deposited a sealed packet in the French Academy, describing the process, thus establishing the priority of his discovery. Nitro-naphthalene is first treated with sulphuric acid. It is then reduced to the state of an amide and transformed into sulphonaphthylamic acid. By the action of nitrous acid this is converted into the diazo form. Finally the solution after concentration is thrown into a solution of beta naphthol, from which roccelline is precipitated by common salt, washed, and purified by crystallization.

Like some other of the coal-tar colors, roccelline has more than fulfilled the expectation of its discoverer. Designed to replace the natural dye, it, as Mr. Emile Roussel has recently shown before the Société Industrielle du Nord de la France, serves, under certain conditions, as a substitute for cochineal and madder in the production of shades of red and crimson. So far this is true of animal fiber only. On cotton roccelline has not been satisfactorily fixed. So great is the adhesion of the dye for wool that the rapidity with which it attaches itself is productive of a cloudiness over the surface of the fabric unless skillful hands be employed.

The following is the process: Slightly acidulate the dye-bath with hydrochloric acid, raise the temperature to 50° C., enter the wool, and let it remain for fifteen to twenty minutes; then add roccelline little by little and raise temperature gradually during half an hour to 90° C. By maintaining