

DEVELOPING GELATINE PLATES.

By W. BOVEY.

My enthusiasm in photographic research having lost the sanguine impulse of youthful ardor, I am humbly content to introduce my present mode of developing gelatine dry plates as a modestly slight modification of the generally adopted method, inasmuch as I discard the use of bromide, and regulate the amount of pyrogallol to suit exposure and the quality of the gelatine plate. As is, unfortunately, too frequently the case, gelatine plates lack uniformity.

With plates that are prone to over-intensity, I reduce the pyrogallol as low as one grain to an ounce of water. For thinly-coated plates I use five or six grains of pyrogallol to an ounce of water. To reduce the matter to rule, however, I will imagine the plate perfect in all respects; in such case I would prepare my developer as follows:

Pyrogallol.....about 2 grains.
Water.....1 ounce.

Exposure—About one-tenth the time required for an ordinary wet collodion plate. After exposure, place the plate in a dish larger than the plate. For a $7\frac{1}{4}$ by $4\frac{1}{2}$ inch plate, I use a 10 by 8 glass bottom dish or tray. Flood the plate with the pyrogallol solution, then tilt the dish to collect the solution at one end. A few drops of ammonia solution, prepared as follows, must now be added:

Ammonia fort.....2 drachms.
Water.....8 ounces.

The highest lights will shortly appear; these must be permitted to obtain some force before adding more ammonia to bring out the middle tones and details of shadows. The image should appear with exaggerated intensity as seen by reflected light, but care must be taken that in this state gradation of strength is duly preserved. A few trials would suffice to enable the operator to control the development. Keep the pyrogallol in excess, and guide with gradual additions of ammonia, which in weak solution can be used without fear that a drop or two more or less can do much harm.

I intensify weak images, when such chance to turn up, with B. J. Edwards's excellent formula, to which I add quite half more of hyposulphite than he recommends. This addition makes the intensification controllable, and the color it yields resembles that produced by the less reliable pyrogallol re-developer.

I have given the plan as above stated to several of my customers and other friends, who are unanimous in praising its simplicity and comparative certainty in correcting varied exposures. In the hope that my readers might benefit from the information also, I gladly add my mite to the fund which has been contributed to so liberally by admirers of gelatine dry plates.

In conclusion I will briefly describe a mode of preparing a non-actinic medium which has cheapness and thorough reliability to recommend it for general use—stout orange-colored paper, sold at one penny per sheet, brushed over one side with a liberal coating of urine, then dried. Mix sweet oil with paraffin, in equal proportion. Rub this well into the paper with a piece of flannel, and you have a semi-transparent medium, by which dry gelatine or wet plates may be developed with safety.—*Photographic News*.

SIEMENS-MARTIN STEEL.

By SERGIUS KERN, M.E., St. Petersburg.

THE chief steel works in Russia are situated near St. Petersburg. The Obouhoff Steel Works have erected lately two 10-ton Siemens-Martin furnaces. The furnaces have no muffles for heating previously the charges introduced into the furnace, and the mode of working adopted here differs from the Terre-Noire method, as described by Mr. A. L. Holley. The author desires to give a short description of the *modus operandi* and a full account of some charges. The charge consists of steel scrap, ladle scrap, and manganese pig iron. A pig containing 9 to 12 per cent. of manganese is ordinarily used. It is well known that big cast-steel ingots have a piping in their top part; and as such a part is of no use for forgings, therefore a certain part of the ingot, when forged into the required shape, is always cut off under the steam hammer. Such ends are also used for the Siemens-Martin furnace. Very often ends weighing about 2 to $2\frac{1}{2}$ tons are introduced among other steel scrap in the cold state into the furnace.

During the process of charging the furnace is kept as hot as possible. All the required materials, viz., pig iron, steel scrap, and ladle scrap (about 8 tons altogether) are charged at once, and no additional charges are introduced after the metal is in a melted state, save if the testing of a sample out of the furnace shows that the metal is too hard; then, ordinarily, some 15 to 20 cwt. of good puddled iron blooms are introduced into the metallic bath. The blooms are left for some time on the banks of the furnace doors, and when well heated are thrown down into the metallic bath. But it has been found to be cheaper and quicker, in order to soften the metal, to introduce some 2 to 5 cwt. of good magnetic iron ore in the form of a fine powder. The steel tests taken afterward soon show that the steel has turned mild; but if it happens that even then the steel is not so soft as desired, another charge of 3 to 4 cwt. of magnetic ore with 1 cwt. of ferro-manganese quickly brings the steel to the desired softness. Certainly, much depends on the state of the gas and on the quality of the materials, but with a well-going furnace and good materials the above holds good.

Before the casting, if soft steel is wanted, $\frac{1}{2}$ to 1 cwt. of ferro-manganese is added, and for harder steel, containing 0.55 to 0.65 per cent. of carbon, often 3 to 10 cwt. of spiegel-eisen is the additional charge. As there is no handy direct process to ascertain the amount of carbon in the samples taken out of the furnace, the engineer is often in a difficulty in calculating the amount of the last charge of ferro-manganese or spiegel-eisen to be introduced into the metallic bath. A very good test is the following: The sound part of a sample is heated to light welding heat, and hammered to the following dimensions (approximate): $5'' \times 0.5'' \times \frac{1}{8}''$. This small bar, cooled slowly in ashes or sand, must bend nearly double, and if it stands the test tolerably well, it may be supposed to contain not more than 0.25 to 0.30 per cent. of carbon. The sample after being drawn, by hammering before being cooled, as mentioned above, must be reheated to a red heat.

The following charges give an idea of the mode of working:

Hard Steel.—Charge: Steel scrap, 120 cwt.; ladle scrap, 17 cwt.; pig iron, containing 12 per cent. of manganese, 17 cwt.; all charged at once; charging commenced 4:30 A.M., finished 6 A.M. Melted and one sample taken out 8:15 A.M.;

17 cwt. puddled iron blooms charged 9 A.M.; sample hammered well, cooled, bent double; 15 cwt. pig iron, containing 9 per cent. of manganese, charged 10:20 A.M.; casting took place at 11 A.M. Analysis of the steel: carbon, 0.67; manganese, 0.40 per cent.

Medium Steel.—Charge: Steel scrap, 135 cwt.; ladle scrap, 23 cwt.; pig iron, containing 12 per cent. of manganese, 10 cwt.; charging commenced 1 P.M., finished 2:45 P.M.; melted, 0.5 cwt. ferro-manganese added, and first test taken 7:40 P.M. The steel was hard; 2.5 cwt. of magnetic iron ore added 7:55 P.M.; test taken 8:30 P.M.; sample bar bent nearly double, given only a slight crack; 0.5 cwt. of ferro-manganese added; casting 9:15 P.M. Analysis of the steel: carbon, 0.35; manganese, 0.18 per cent.

Soft Steel.—Charge: Steel scrap, 113 cwt.; ladle scrap, 26 cwt.; pig iron, containing 12 per cent. of manganese, 6.5 cwt.; charging commenced 11 A.M.; finished 12:30 P.M. Melted and first test, 6 P.M.; 2 cwt. ferro-manganese added 6:30 P.M.; test bar bent double after being hardened; $\frac{1}{2}$ cwt. ferro-manganese added 7 P.M.; casting, 7:15 P.M. Analysis of the steel: carbon, 0.16; manganese, 0.14 per cent. The steel was prepared for boiler plates.—*Chemical News*.

ON THE ELECTROLYTIC DETERMINATION OF METALS.

By LUDWIG SCHICHT.

THE author's researches refer to the metals of the group uranium, thallium, indium, and vanadium, and to the group molybdenum, selenium, and tellurium. Uranium is not precipitated from its solutions in mineral acids, but by the secondary action the effect of the nascent hydrogen uranic oxide is reduced to uranous oxide. From neutral solutions it is separated in very small quantities, of a yellow color. Alkaline solutions containing organic acids (tartaric, citric, acetic), or mixed with sugar, deposit likewise very small quantities of uranium. The precipitated uranium does not readily re-dissolve in dilute acids. Sulphuric and nitric solutions of thallium were prepared from the pure metal. The acidulated solutions were not precipitated by the current. From ammoniacal solutions metallic thallium was deposited at the cathode with a brisk disengagement of gas, whilst at the positive pole there appeared blackish brown thallium oxide, much resembling lead peroxide. For the decomposition the author used at first the current from 4 Meidinger Pincus elements, giving hourly 160 c.c. of decomposing gas, but this was found too strong, as the thallium was deposited in a spongy state and of a darker color. On using two or three elements fine, permanently adhesive metal was obtained. From neutral solutions the metal is imperfectly precipitated on account of the acid which is liberated. In alkaline solutions the separation is complete, and the metal is bright and solid. It re-dissolves readily in sulphuric acid. The oxide dissolves in hydrochloric acid, evolving chlorine. Indium is completely precipitated as metal at the negative pole, both from acid and alkaline solutions; in the latter case the metal is very bright and firm.

Vanadium.—Vanadium chloride was dissolved in water containing hydrochloric acid and electrolyzed. No precipitation took place in the blue solution, the vanadic acid being merely reduced to oxide. Sulphurous acid, organic acids, etc., reduce merely to vanadium tetroxide, V_2O_4 . The same reduction occurs in the alkaline solution.

Palladium.—The nitrate, dissolved in water and acidified with a little nitric acid, deposited at the negative pole a bronze-colored coating, which on continued action of the current became darker, and finally black. It re-dissolves easily in nitric acid. Some reddish oxide was formed at the positive pole. Alkaline solutions of palladium behave in a similar manner, but the deposition is slower and more adhesive.

Molybdenum is precipitated from the ammoniacal solution of molybdic acid as molybdous oxide, which appears at the negative pole at first in colored rings, which gradually thicken and become blue-black. The first blue precipitation is molybdic molybdate; then follows molybdic oxide and molybdous oxide. The precipitation is complete and adheres very firmly. In acid solutions there is no precipitation; in ammonium molybdate acidified with free molybdic acid the precipitation is imperfect.

Selenium is readily and completely reduced and thrown down, both from acid and alkaline solutions. The current should not be strong (two elements) or the deposit is pulverulent. In order to determine selenium electrolytically it is oxidized by boiling with nitric acid, and the solution of a metal is added, which occasions the separation of the selenium in a solid combination. A solution of copper is suitable for this purpose.

Tellurium behaves like selenium, but it is reduced much more readily. From an acid solution it is easily deposited with a blue-black color. From alkaline solutions it is thrown down in a very loose state at the positive pole, with strong disengagement of gas. If much metal is present it floats on the surface of the liquid.

Gallium, like zinc, is thrown down completely at the negative pole in a pure state.—*Berg und Hüttenmännische Zeitung*.

THE BEHAVIOR OF SULPHURETED HYDROGEN WITH THE SALTS OF THE HEAVY METALS.*

By H. DELFFS.

THE author called attention to the different precipitability of the metallic salts in presence of a strong mineral acid on the one hand, and of acetic acid on the other. Just as the limit between precipitable and non-precipitable salts is altered by the use of acetic acid instead of hydrochloric acid, it is further modified if formates are treated with sulphureted hydrogen. In that case the salt of zinc is precipitated, but the compounds of cobalt, nickel, iron, and manganese are not affected. Manganese cannot be precipitated by sulphureted hydrogen from propionic, butyric, and valeric solutions. In precipitations by this last reagent several metals are never simultaneously converted into the corresponding sulphides, but the precipitation ensues in such a manner that one metal is first completely separated before the removal of another begins. Upon this fact is founded a very convenient method for obtaining cobalt and nickel in a state of purity. As sulphureted hydrogen first completely precipitates cobalt acetate, and then acts upon nickel acetate, a solution of the two nitrates is mixed with sodium acetate in quantity insufficient for complete double decomposition, and sulphureted hydrogen is introduced, so that, according to the respective proportions of the two metals,

* A Paper read before the Chemical Section of the Congress of German Naturalists and Physicians, at Baden-Baden, Sept. 19, 1879.

either nickel free from cobalt is obtained in solution or cobalt free from nickel as a precipitate. The required quantity of sodium acetate may be calculated from the relative quantities of the two metals which are mostly known. The more electro-positive a metal the later it is precipitated from a mixture of its salts with those of other metals, and thus a series of "chemical tension" may be established which, on account of the electromotive action of the liquids, does not always agree with the series of "physical tension."

DETERMINATION OF ZINC.

By W. ALEXANDROWICZ.

THE separation of zinc from the metals of the copper and the iron group presents considerable difficulties. The quantity of zinc thrown down along with copper by sulphureted hydrogen is not appreciable if the solution is sufficiently acid. Where great exactitude is required, a double precipitation is recommended.

The complete separation of cadmium and zinc by means of sulphureted hydrogen is impossible, especially in presence of copper. In separating arsenic from zinc, if the solution is distinctly acid, the zinc is not thrown down by sulphureted hydrogen.

In separating iron and zinc the author recommends that the solution of the mixed metals should be poured drop by drop into the ammonia, and not *vice versa*. The zinc remains in solution. The precipitate is then washed with ammoniacal water.

In separating manganese from zinc the author acidifies with acetic acid and precipitates with sulphureted hydrogen. All the manganese remains in solution.—*Revue Universelle des Mines*.

METHYL CHLORIDE.

METHYL chloride, or the hydrochloric ether of methylic alcohol, is represented by the formula $C_2H_5Cl=50.5$. It is gaseous at common temperatures, possesses an ethereal odor and a saccharine taste; its specific gravity is 1.738 (air=1.0 at 0°). The weight of a liter of this gas=2.261 grammes. Water dissolves 2.8 vols. methyl chloride at 16° and under a barometric pressure of 0.765. Glacial acetic acid dissolves 40, and absolute alcohol 35 vols. under the same conditions. Methyl chloride burns with a white flame edged with green, forming water, carbonic acid, and torrents of hydrochloric acid gas. If methyl chloride is compressed, it is easily converted into a colorless and highly mobile liquid boiling about -23° under the normal pressure of 0.760 m. The slight vapor tension of this product renders its liquefaction, its management, and its carriage easy. Thus the total tension of its vapor is at—

0°.....	2.48 atmospheres.
+15°.....	4.11 "
20°.....	4.81 "
25°.....	5.62 "
30°.....	6.50 "
35°.....	7.50 "

From these figures, one atmosphere must be deducted to find the pressure really exercised upon the vessels containing the liquid.

Hitherto chloride of methyl, as prepared by the mutual reaction of common salt, sulphuric acid, and methylic alcohol, has not been suitable for industrial applications on account of the difficulty of preparing it in a state of purity at a moderate price. Quite recently M. Camille Vincent has made known a process which enables it to be procured in abundance and free from impurities.

This process consists in heating the hydrochlorate of trimethylamine which is obtained industrially from the refuse of beet root. The hydrochlorate of tri-methylamine is thus decomposed into free trimethylamine, ammonia, and methyl chloride. Washing in acid water removes every trace of alkali, and the dried gas may then be liquefied by compression. The product thus obtained, perfectly pure, is manufactured on the large scale by MM. Brignonnet & Son, at Saint Denis.

USES OF METHYL CHLORIDE.

As a frigorific agent, methyl chloride may be employed either in the laboratory or in manufactures. If it is allowed to issue into an open vessel, it enters into a brisk ebullition for a few moments. Its surface then becomes tranquil, forming a bath at -23° , into which the objects to be refrigerated may be plunged. If the evaporation is intensified by the injection of dry air, the temperature of the bath may be reduced to -55° in a few minutes, so as to freeze mercury. M. Vincent has designed a small apparatus for the laboratory in which a bath of one liter of an incongealable liquid (e. g., alcohol) may be kept for some hours at a temperature of -23° , or of $50-55^\circ$. It is composed of a cylindrical vessel of copper with double walls.

M. Vincent has also constructed a more complete apparatus, suitable either for experimental or domestic purposes, and so arranged that the methyl chloride may be recovered. Large machines are also made adapted for cooling water, air, etc., on the great scale. They have the advantage of employing, as vehicle of heat, a neutral liquid incapable of attacking metal work and free from poisonous or offensive unexplosive properties.

It must be remembered that the chloride of methyl can be used in any machine for the production of ice with the exception of those constructed to work with liquid ammonia.

PREPARATION OF METHYLIC PRODUCTS.

Methyl chloride is a product which offers great advantages to the manufacturers of coloring matters derived from coal-tar. It may serve in the manufacture of colored or colorable products in which methyl plays any part soever, such as methylaniline, methylphenylamine, methyltoluidin (which yields a red violet, Hofmann's violet, methyl-green, methylic eosin, etc.).

It is an advantageous substitute for the other methylic compounds commonly employed, such as methyl bromide, iodide, and nitrate, the two former of which are costly and the latter dangerously explosive. Liquefied methyl chloride being a pure and anhydrous compound, is well adapted for exact operations which lead to perfect regularity in the quality of the product.

The methylated compounds which have been already prepared with liquid methyl chloride are diamethylaniline, methylphenylamine, Hofmann's violet, and methyl-green. We will briefly describe the preparation of the two latter according to the process of MM. Monnet and Reverdin, of Laplaine, near Geneva.

To obtain green with methyl chloride, we place in an autoclave a solution of methylaniline violet in methylic alcohol rendered basic by the addition of soda. The ap-