

TIN-PLATING PROCESSES.

Perhaps the best and cheapest substitute for silver as a white coating for table ware, culinary vessels, and the innumerable articles of manufacture requiring such a coating is pure tin. It does not compare favorably with silver in point of hardness or wearing qualities, but it costs very much less than silver, is readily applied, and easily kept clean and bright.

There are several methods in use by which small articles—wire, etc.—of iron, copper, brass, zinc, and composition are tin plated. These are:

1. By contact with melted tin.
2. By tin amalgam.
3. By simple immersion.
4. By battery.

The contact process is that by which all sheet tin, or, more properly, tinned sheet iron, is produced. A description of this process as applied to tin plate will be found on page 68 current volume.

In tinning hollow ware on the inside the metal is first thoroughly cleansed by pickling it in dilute sulphuric (or muriatic) acid, and scouring it with fine sand. It is then heated over a fire to about the melting point of tin, sprinkled with powdered rosin, and partly filled with melted pure grain tin covered with rosin to prevent its oxidation. The vessel is then quickly turned and rolled about in every direction so as to bring every part of the surface in contact with the molten metal.

The greater part of the tin is then thrown out, and the surface rubbed over with a brush of tow to equalize the coating. The operation is repeated, if necessary. The vessels usually tinned in this manner are of copper and brass, but with a little care in cleansing and manipulating iron can also be satisfactorily tinned in this manner.

The vessels must be hot enough to keep the tin contained in them fused.

The amalgam process is not used so much as it was formerly. It consists in applying to the clean and dry metallic surface a film of a pasty amalgam of tin with mercury, and then exposing the surface to heat, which volatilizes the latter, leaving the tin adhering to the metal.

The immersion process is best adapted to coating articles of brass or copper. When immersed in a hot solution of tin properly prepared the metal is precipitated upon their surfaces. One of the best solutions for this purpose is the following:

Ammonia alum	17¼ ounces.
Boiling water	12½ pounds.
Protochloride of tin	1 ounce.

The articles to be tinned, first thoroughly cleansed, are put into the hot solution until properly whitened.

A better coating can be obtained by using the following bath, and placing the pieces in contact with a strip of clean zinc, also immersed:

Bitartrate of potassa	14 ounces.
Water (soft)	24 "
Protochloride of tin	1 ounce.

It should be boiled for a few minutes before using.

The following is one of the best solutions for plating with tin by the battery process:

Potassium pyrophosphate ..	12 ounces.
Protochloride of tin	4½ "
Water	20 "

The anode or feeding plate used in this bath consists of pure Banca tin. This plate is joined to the positive (copper or carbon) pole of the battery, while the work is suspended from a wire connected with the negative (zinc) pole. A moderately strong battery is required, and the work is finished by scratch-brushing.

In Weigler's process a bath is prepared by passing washed chlorine gas into a concentrated aqueous solution of stannous chloride to saturation, and expelling excess of gas by warming the solution, which is then diluted with about ten volumes of water and filtered, if necessary. The articles to be plated are pickled in dilute sulphuric acid, and polished with fine sand and scratch-brush, rinsed in water, loosely armed with zinc wire or tape, and immersed in the bath for ten or fifteen minutes at ordinary temperatures. The coating is finished with the scratch brush and whiting.

By this process iron—cast or wrought—steel, copper, brass, and lead can be tinned without a separate battery. The only disadvantage of the process is that the bath soon becomes clogged up with zinc chloride, and the tin salt must be frequently renewed.

In Hern's process a bath composed of—

Tartaric acid	2 ounces,
Water	100 "
Soda	3 "
Protochloride of tin	3 "

is employed instead of the above. It requires a somewhat longer exposure to properly tin articles in this than in Weigler's bath. Either of these baths may be used with a separate battery.

German Petroleum Springs.

The German people are excited over the alleged discovery of petroleum springs near Hanover, but the Berlin correspondent of the London *Times*, who announces the discovery, remarks that it will be wise not to overrate their value, as they may prove to be unimportant. It is, however, natural for the Germans to be hopeful of being able to produce their own oil, and possibly some for export in lieu of importing, as they now do nearly 68,000,000 gallons of crude and refined petroleum, chiefly from the United States.

ARTIFICIAL INDIGO IN MEISTER, LUCIUS & BRUNING'S EXHIBITION OF DYE STUFFS.

The new dyestuffs exhibited by this firm at the recent General German Patent and Design Exhibition may be divided into three groups: artificial indigo, naphthaline dyes, and chloraniline dyes. The first of these excites, for the moment, the greatest interest, because the discovery of the synthesis of the king of dyes is the most recent discovery in the coal tar industry, and is undoubtedly the most brilliant one since the discovery of artificial alizarine. The name of its discoverer, Prof. Bayer, which was already widely known before this, his greatest achievement, has now passed beyond the limits of his professional circle.

At the present day, discoveries in the chemistry of dyes are founded upon calculations sustained by a knowledge of chemical facts and laws. The success of experiments based upon these calculations proves or disproves their correctness. When the results are unfavorable, it is a proof of the flaws that still exist in chemical theories, in spite of their present complete development.

The synthesis of indigo could only be accomplished after an accurate knowledge of its constitution had been acquired. Many chemists have been employed in its study, but Bayer completed it. In the German patent granted him March 19, 1880, he designated the constitution of indigo in these words: "There is a certain arrangement of atoms which is peculiar to indigo and its color derivatives, and which is built up from one molecule of benzol containing a side-chain of two carbon atoms, and on this latter a nitrogen atom in the ortho position."

In his attempts to find out simple bodies whose transformation products furnished similar arrangement of atoms, he found that certain derivatives of cinnamic acid on proper treatment with chemical reagents were able to produce the desired bodies. Formerly cinnamic acid could only be made from certain resins such as storax, tolu, and Peru balsams. Of course a technical use of this costly material for the production of so cheap a dye as indigo could never have been thought of, but cinnamic acid had already been made synthetically by the action of acetyl chloride upon benzaldehyde, and more cheaply by treating benzol chloride with acetate of soda. This chloride of benzol, and the aldehyde obtained from it, are made from toluol, a hydrocarbon very abundant in coal tar. Since Bayer's discovery experiments have been undertaken on a large scale to make indigo from cinnamic acid derivatives. The most important of these, and the only one now under consideration, is the orthonitrophenylpropionic acid. In a dry state this is a yellowish white powder, and when treated with alkaline reducing agents furnishes indigo directly.

Nitrophenylpropionic acid is best prepared as follows:

1. Cinnamic acid is nitrified with nitric acid. This produces a mixture of the ortho, meta, and para acids.
2. To separate these three acids from each other and isolate the only one that is used for making indigo, the ortho acid, they are converted into the methylic ether. This is accomplished in the usual manner with the aid of hydrochloric acid and wood spirits. The separation is effected by fractional crystallization of the ethers. The most abundant companion of the ortho acid is the para acid, and a patent has been granted for its use in the manufacture of a beautiful red dye.

3. The methylic ether of this orthonitrocinnamic acid is next saponified, i. e., treated with dilute soda lye, and thus converted into methylic alcohol and the soda salt of the acid, and from this latter the acid is set free by means of another acid, and then dried.

4. By treating this with liquid or gaseous bromine, as long as it will absorb any, it is converted into dibromo-orthonitrocinnamic acid.

5. By treatment with alkali the bromine is abstracted along with hydrogen to form hydrobromic acid. The cinnamic acid, deprived of two atoms of hydrogen, is thereby converted into a new substance, the orthonitrophenylpropionic acid.

Of course it is necessary to recover as far as possible the expensive materials, the bromine and methylic alcohol, used in its preparation. The complicate process requires a considerable outlay for apparatus and labor. The essential factor that governs the price of the manufactured material is, of course, the yield of dye. This depends, in the first place, upon the purity of the materials used; then next upon the various processes working smoothly, and in this case, too, it depends upon whether a body is to be produced that corresponds exactly with natural indigo, or one that is homologous with it, or some substitution dyestuff.

These near relatives of indigo may, in all probability, possess the same or nearly the same properties as the true indigo, so that it is supposable that the production of one or other of the many bodies theoretically possible offers greater chances for its cheap production than does now the manufacture of orthonitrophenylpropionic acid, which yields true indigo.

To explain the difficulties that attend the cheap production of this body, we need only recall a few facts, namely, how difficult it is to employ pure material on a manufacturing scale, that chemical reactions rarely run smoothly, but are generally accompanied by secondary reactions, and that it is one of the most difficult problems of scientific and practical dye making to produce that isomere in largest quantity which is needed. So in the above process the toluol employed in making the cinnamic acid contains the higher homologues xylol and cumol; in nitrating and bromiding substitution products are formed instead of addition pro-

ducts, etc. All these undesirable accidents necessitate expensive purifications, which stand in the way of smooth manufacture.

The expense of making artificial indigo might have proved an insuperable objection if one lucky circumstance had not come to the aid of this industry. Heretofore the cotton printers were only able to use indigo in topical printing for dark shades at a very considerable expense, which was greatly out of proportion to the price of natural indigo, and at the same time he had great difficulties to overcome in this operation. Only a few calico printers knew how to do this, while most of them were compelled to dye the goods in the indigo vat, and then bite out the spots which were to be printed in some other color.

Any preparation suitable for printing on the goods and capable of producing equally fast colors would be very welcome to the calico printer, even if it was much more expensive than natural indigo. The orthonitrophenylpropionic acid seems to fulfill all these conditions. It comes into the market as a 25 per cent paste, which can be used to produce indigo directly upon the fiber. It differs from reduced indigo—indigo white—in this respect, that it forms the dye by reduction, losing an atom of oxygen, while the other is converted into indigo blue again by absorption of oxygen. It is very easy to produce the deepest shades in printing with this new product, either by mixing the printing material with a suitable reducing agent, or, what is preferable, first impregnating the cotton with a reducing agent and then printing upon it.

The color is developed in twelve to twenty-four hours spontaneously in the cold. The reducing agents employed at first were grape and milk sugar, now potassium xanthogenate is employed. The reducing agents act only in alkaline solution, but the weaker the alkali the finer the colors; hence alkaline salts, like borax, are preferable.

The disadvantage of mixing the reducing agent with the printing material is that the color is developed too rapidly, and the advantages of a dye formed in the fiber is lost, while finished dyes cannot be fixed without albumen.

The reducing agents in use previous to xanthogenate of potash had the disadvantage that heat was necessary in developing the color. Then, too, it was difficult to ascertain the correct time and temperature, for if either was exceeded at all the color suffered and might even be destroyed.

One disadvantage of the new product which has not yet been overcome is that the color cannot be developed by superheated steam, and hence it cannot be used along with other steam colors. It is to be hoped that this will be overcome in time by suitable reducing agents.

As remarked, indigo can be readily prepared from orthonitrophenylpropionic acid; this can easily be converted into indigo carmine in the usual manner. It acts just like natural indigo, but the color is handsomer than the best Bengal indigo. We have said already that the production of indigo is not yet to be thought of. But since the calico industry is able to pay a price for the new product which is proportional to the cost of its manufacture, there is abundant opportunity to collect experiences of all sorts in its manufacture, to improve the methods, and also discover new ways of reaching the desired goal. The progress already made in this domain justifies the most brilliant expectations.

Grain Harvests of 1881.

A summary of the reports on the harvests of the world in the annual volume of M. Estienne, just issued, shows that the wheat crop in France is better than last year's. The year's barley is not so good as in 1880, but it is fairly good. The maize crop is ordinary. Oats and rye are fair. On the whole the crops are not up to those of last year, but wheat is not much below the average. None of the crops will be very bad, but none will be very good. The crops in Great Britain are described as follows: Wheat is ten per cent below the average, and likely to realize only 10,000,000 quarters. Barley is ten per cent above the average, and oats are twenty per cent below the average. The year is one in which farmers are not likely to recoup themselves for losses during the past five years. In Austria and Hungary the crops are good all round. Wheat and barley are both above the average. Rye is very much and oats are slightly under the average. The reports from Italy agree that the crops are of medium quality and much below the abundance of those of 1880. In the Turkish provinces on the Danube the wheat harvest will be medium. Rye is good and abundant. Barley is good as regards quantity, but bad in quality. Oats are very much above the average. All the reports from Russia agree that the barley is the best crop of the year, doubling that of 1880 in quantity, but not so plump and weighty. Rye is abundant. Wheat is good.

Throughout Germany winter and spring sowings are in marked contrast, the former yielding good and the latter very defective crops. Oats are very good. Barley is thin. None of the crops are of the average. In the Prussian States the crops are fair. The Swiss wheat crop is very poor in quantity owing to drought, but in quality it is very fine.

Oats and barley are good in quantity and quality, but there is a small area sown of the latter. Belgian wheat is far below the average. Barley is good; rye and oats are fair. All crops in Spain are bad. All cereals in Holland are in good condition. All reports from the United States agree that the yield will be under the average.