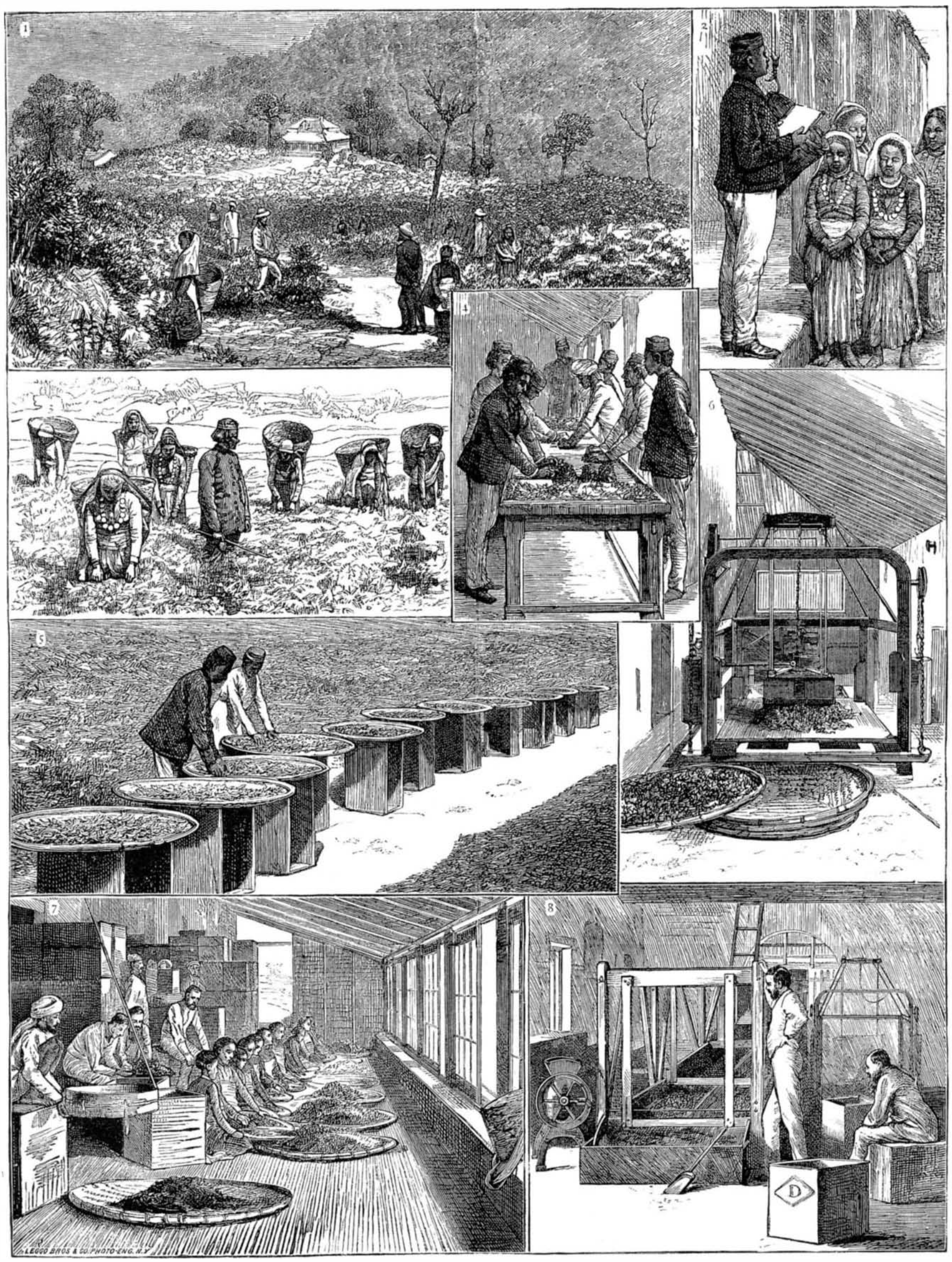
TEA AND TEA CULTURE.

Some time in the third century, says tradition, there lived in China a hermit of great piety. His vigils were long, his prayers constant; but despite a stomach normally empty from fasting, he was ordinarily sleepy. (This part of the story fails to agree with Mr. Buckland's recent assertion that hunger is a prime cause of insomnolence, but the discrepancy is immaterial.) The constant disposition of our hermit's eyelids to close begat in him a holy wrath against the weakness of the flesh; and with sublime indifference to physical pain, the veracious chronicler (scorning physiological probability) asserts, thereupon he cut off the offending eyelids and hurled them to the ground. To a convenient god, who lived near by, this little act of self-abnegation was especially gratifying, and accordingly the eyelids were caused to sprout and grow, generating, not an eyelid plant but the tea plant, in the leaves of which may yet be traced the lids and eyelashes of the pious hermit. While this tradition may not be strictly true, it perhaps is as veracious as any other Chinese fable accounting for the origin of tea: for as to who first found the leaf and brewed "the cup that cheers but not inebriates," history is altogether silent. On the first day of February last, there existed in stock in England alone 105,100,000 lbs. of Chinese tea, representing a value of nearly $40,000,000. The quantity exported from China to the United States, for the year ending June, 1874, was 49,831,800 lbs., representing a value of $21,212,334. These figures are sufficient to indicate the enormous commerce comprised under the name of the tea trade; but they do not by any means represent the proportions of the total tea traffic, since they relate to that of but one country. China tea is perhaps the best grown; but in South America it is superseded by the leaf of the *ilex Paraguayensis*, or Paraguay tea plant; and in Java and Sumatra, coffee leaves are greatly preferred by the natives. Among the other kinds of tea known are Labrador tea, made of the dry leaves of the marsh ledum (*ledum palustre*), indigenous to North America, Abyssinian tea or *chaat*, Tasmanian tea, or the dried leaves of various *myrtaceæ*, found in large quantities in Australia. Faham tea is the leaves of a fragrant orchid found in Mauritius; Appalachian, Oswego, Mountain, and New Jersey teas are all from plants found in the United States.



THE CULTURE AND PREPARATION OF TEA IN SIKKIM, INDIA.

Sloe and strawberry tea are perhaps the best substitutes for the Chinese production. There are also Mexican tea, a Brazilian tea—the aromatic *capitão da matto*—a Santa Fé tea, Indian tea, Toolsie tea; beside tea made from the leaves of scores of other plants, however, unlike the above, have never come even into a limited use.

In the face of gigantic statistics relating to its consumption, and of the great profusion with which Nature has provided the herbs suitable for the beverage, it is a little startling to find that tea is, after all, a poison, one capable of producing functional nervous disarrangements when taken in excess. It exerts an astringent action; and by the presence in it of an organic substance, *theine*, it exercises its special influence. "In poverty-stricken districts," says Dr. Richardson, in "Diseases of Modern Life," "among the women who take tea at every meal, an extremely nervous semi-hysterical condition from the action of tea is all but universal. In London and other fashionable centers, in which the custom of tea-drinking in the afternoon has lately been revived under the old name of 'the drum' (kettledrum is the society name for these social parties in the United States), these same nervous symptoms have been developed in the richer classes of society, who, unfortunately, too often seek to counteract the mischief by resorting to alcoholic stimulants. "The maladies caused by tea are deficiency of saliva, destruction of taste for food, biliousness, nausea, nervousness (often extreme), and nightmare whenever sleep is obtained." A formidable indictment, truly, for the harmless looking and fragrant contents of one's tea caddy. It is more pleasant to contemplate the reverse of the picture, and agree with a Chinese writer that "drinking it tends to clear away all impurities, drives off drowsiness, removes or prevents headache," or with Dr. Edward Smith in his recent work on Foods, in which he says that the beverage stimulates respiration, and "powerfully promotes the assimilation and transformation of other foods."

To enter into all the varied details of tea culture would be far to transcend our present limits. An excellent idea, however, of a tea farm will be obtained from the large engraving given herewith, which is taken from photographs of new plantations near Dargeeling, in British Sikkim, India. Tea flourishes best on mountain slopes where there is plenty of rain, but where the water does not stagnate about the roots of the plant, and where the annual mean temperature varies from 68° to 76°. These conditions are fulfilled especially in those parts of Sikkim which are situated from 2,000 to 4,000 feet above the sea, and the tea produced is of exceptionally fine flavor. The tea seed is planted by drills in what are termed nurseries; and when the plant has grown to be 3 or 4 inches in hight, it is transplanted finally into a garden. The leaf is plucked by women and children from the middle of March up to November, when the cold season has begun, and cultivation commences. The leaves are then rolled into a form called a dullah; and after these have fermented and turned brown, they are broken up and placed in a bamboo vessel over a sharp, clear, charcoal fire until roasted. The tea then passes to women, who pick out all red leaves and stalks. It then goes to the sifter, who separates the different kinds of tea. After this it is again returned to another set of women, who fan out all chaffy leaves by shaking it up in a round shell bamboo basket. The tea is then heated over a slow fire, and finally packed for transportation. No. 1 of our engravings is a general view of the plantation; 2 represents the leaves being weighed; 3 shows the hands employed in plucking the leaf. In 4, the leaves are being rolled; in 5, they are represented in large baskets, withering in the sun; 6 shows the rerolling operation by machine; 7, withering in the factory; and 8, a machine for sorting the various kinds.

Few articles of commerce are more adulterated than tea. The London *Times*, in 1873, published some interesting revelations on this subject, and once stated that, "out of twenty samples, nineteen were found to be adulterated with plumbago, lie tea, iron filings, and sand. Since tea naturally contains a large quantity of tannin, there are thus brought together the two chief constituents which enter into the composition of ink, and by appropriate treatment a bottle of good ink actually was made from the tea in question." The London *Medical Examiner*, of recent date, very fully examines the various adulterations of the Chinese leaf, and says that these, for the most part, consist in redrying and refiring exhausted leaves. It is quite impossible to tell to what extent this is done, as the leaves can be made to look as good as new, and can be mixed with fresh ones without much chance of detection. Another method, practised in Canton, is the production of scented and green teas from the leaves of other plants. Whole chops of tea, consisting of 1,000 packages each, and called Canton gunpowder tea, have been exported, composed entirely of rose leaves painted green. The facing powder used in these cases is Prussian blue and sulphate of lime or gypsum. Willow leaves are frequently employed as adulterants; and an ingenious fraud, capable of deceiving even experienced tea dealers, is perpetrated by boiling rice and dropping the conjee or rice water into tea dust. This done, it is impossible to tell the quality of the article until the liquor is distilled from it.

A wreck brings a great and profitable harvest to tea dryers. Several years ago, the steamer St. Petersburgh was lost with a cargo of tea, and after being immersed for sixty days the chests were regained. The tea was rather salty to the taste; but as many thousand barrels full were obtained, it is probable that it was all revamped and sold to the retail trade.

Three words as to making tea by way of conclusion, and these are: Don't boil it; to do so is a barbarism. Theine in tea, like caffein in coffee, is a volatile principle which boiling drives off, leaving only a decoction of the bitter astringent residue, for which we know no better name than liquid headache generator. It is a strong stomach that can withstand more than a pint of the simmered abomination, sold in most restaurants under the name of tea. Tea well made is fragrant, aromatic, and exceedingly grateful to the taste; tea badly made has a flavor like boiled brooms. The rule for making good tea is first to scald the teapot, put in the tea, pour on fiercely boiling water, cover tightly, and if green tea, serve immediately, or if black tea, stand near a fire for five minutes. Certainly no rule could be simpler than this; and yet in the average household, there is none for which the Irish handmaid entertains a more profound contempt.

NEW METHOD FOR THE DETECTION OF NICKEL IN THE PRESENCE OF COBALT.

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In October, 1875, I began comparative experiments upon various nickel and cobalt salts, in hopes of detecting some characteristic difference, which would serve for qualitative purposes. I was soon surprised at the intimate relationship existing between these elements; and although I was not led to believe that nickel and cobalt were one and the same element, as has been thought by some chemists, yet I will unhesitatingly state that a search for qualitative and quantitative methods for these metals has been as great a source of annoyance to chemists as was the discovery of these elements in an ore by any of the old German miners, who attributed their occurrence to the evil spirits *Kobold* and *Nick*.

The literature upon these metals alone would fill volumes; yet all that is known in regard to this subject has not yet been made public, since the metallurgical treatment of nickel and cobalt ores is kept in the greatest secrecy. Long before I had completed my researches into the literature of the subject, and before I had performed the various qualitative reactions suggested, I was overwhelmed with the magnitude of the undertaking. My investigations have, however, led to the discovery of a new and yet undescribed salt of nickel, eminently characteristic of this element. Its formation could, I think, be more advantageously applied upon a metallurgical scale than in the qualitative laboratory. The qualitative method which I suggest, which has been successfully used at the School of Mines for some time, may be stated as follows: Remove the metals precipitated by hydrochloric acid and hydrosulphuric acid as usual; then add ammonium chloride, ammonic hydrate, and ammonium sulphide; the precipitate may contain aluminic and chromic hydroxides, also zinc, manganese, iron, nickel, and cobalt sulphides. Treat the precipitate with dilute hydrochloric acid, and gently warm; all the metals will be dissolved as chlorides, except the nickel and cobalt sulphides, which will remain as a more or less granular black residue. In order to insure the complete removal of the other metals, especially iron, which would interfere with the subsequent proceedings, it will generally be found advisable to wash the black residue several times with warm dilute hydrochloric acid. The residue is next tested in a borax bead. If it is brown, the student may safely conclude the absence of cobalt, and only the presence of nickel.

Since, however, the beginner in qualitative analysis frequently mistakes a dark residue of iron sulphide, which often occurs at this point, mechanically enclosed in the separated sulphur, for a residue which contains nickel or cobalt sulphide, it is generally advisable to recommend that, in case a brown bead is obtained, to dissolve a small portion of the residue in dilute *aqua regia*, and test for iron by the addition of potassium ferrocyanide. In case iron has been found, the remaining residue is to be digested several times with dilute hydrochloric acid, until no reaction for iron is obtained or the residue completely dissolved. If a blue bead has been obtained, indicative of cobalt, then nickel is to be looked for in the following manner:

(*a*) Dissolve the black residue in as small a quantity of concentrated nitric acid as possible; evaporate almost to dryness (this step should not be overlooked, since the next step taken is the addition of ammonia, which would have to be added in considerable quantity if the nitric acid was not at least partially expelled). (*b*) Add ammonic hydrate until the nickel and cobalt hydroxides are dissolved. (*c*) Add glycerin, $\frac{1}{10}$ or $\frac{1}{12}$ of the volume of the liquid upon which the experiment is made. Heat until the solution has acquired a purple or rose tint. (*d*) Filter. (*e*) Add potassium ferricyanide in slight excess, and heat to boiling for a few minutes; a light red precipitate, or a white flocculent precipitate, which soon settles, indicates nickel. If the ammonia be quite strong, or if considerable has been added, boil several minutes. A few drops of dilute hydrochloric acid will shorten the operation; but its use is not to be recommended in a qualitative laboratory, since the students are too apt to continue adding the acid till acid reaction ensues, in which case the cobalt will be precipitated. Even a large amount of cobalt, treated as above, remains perfectly clear.

When potassium ferricyanide is added (*e*), the solution acquires a beautiful red tint, similar to the coloration produced when ammonium sulpho-cyanide is added to a ferric salt. When this red tint is very intense, it is very advisable to dilute the solution slightly, in order that the analyst may easily see through the liquid; and then, on heating, in case nickel is present, a cloudiness will occur at the top of the test tube, which soon spreads through the entire liquid; and then, on heating still further, distinct floccules will make their appearance, which settle readily, having no tendency to adhere to the sides of the test tube. In case nickel is not present, the liquid clears up considerably.

I have been greatly aided in studying the chemical changes that take place by Professors Gibbs and Genth's "Researches upon the Ammonia-Cobalt Bases," from which I take the following: "An ammoniacal solution of chloride or cobalt (also nitrate?) absorbs oxygen readily from the air, becomes at first brown, and then gradually passes through various shades of color to a deep red." This solution "leaves upon the filter a quantity of hydrate of sesquioxide of cobalt, which is sometimes almost inappreciable, sometimes in comparatively large amounts." The glycerin, I think, plays no important part until the addition of the potassium ferricyanide. Since, however, a large number of samples of glycerin contain some lime, which can easily be detected with the spectroscope, and also since the ammonic hydrate invariably contains some ammonium carbonate, there will be a slight precipitate of calcium carbonate, after the addition of the glycerin and the application of heat. We see, therefore, from the above that the filtration (*d*) has a two-fold object: First, the removal of $Co_2(HO)_6$, and second, the removal of $Ca\,CO_3$.

The facility with which alkaline solutions of many of the metallic protoxides, say Professors Gibbs and Genth, absorb oxygen from the air attracted the attention of chemists at an early period. The proto-salts of iron, manganese, and cobalt are particularly remarkable in this respect. The object, then, of the boiling (*c*) is twofold: 1. The separation of $Ca\,CO_3$. 2. The formation of purpero-cobalt.

"The salts of purpero-cobalt are often found among the direct products of the oxidation of ammoniacal solutions of cobalt. They are often formed from the salts of roseo-cobalt by heating or by boiling, or with strong acids, the cobalt passing, as we conceive, from one modification to another. The salts of purpero-cobalt are distinguished by a fine violet red or purple color, which is common to nearly all of them, and which is very different from the comparatively dull red of the salts of roseo-cobalt."—*Researches upon the Ammonia-Cobalt Bases.*

Professor Gibbs' explanation of the action of ammonia on a protoxide of cobalt may be briefly stated as follows: "The protoxide is converted into sesquioxide of cobalt, which, at the instant of its formation, unites with a certain number of equivalents of ammonia, so as to form an integral portion. The new base partakes, in some measure, of the properties of the alkalies, the peculiar character of the salts of cobalt being wanting."

There are various other elements that form compounds analogous to the ammonia-cobalt bases. For example, Claus obtained ammonia-rhodium and ammonia-iridium, bases corresponding to roseo-cobalt, and, like this, triacid bases. Professors Gibbs and Genth say: "We have made many experiment in this direction, without, as yet, interesting results. Iron and manganese promised to afford similar classes of compounds; yet, in their behavior towards ammonia and oxygen, the proto-salts of these metals exhibit no analogy to those of cobalt. With chromium, the case may be different; but we cannot as yet pronounce, with certainty, on this point. Experiments with nickel failed entirely, and yielded ammonia salts of the protoxide."

In regard to the precipitation of cobalt with potassium nitrite, Dr. Fleitman says (*American Chemist*, November, 1875, page 193): "In the case when less than 1 part cobalt in 100 parts nickel is present, the precipitation of the former by $K\,NO_3$ is by no means accurate." Professor Wolcott Gibbs says, in regard to this subject: "The complete precipitation requires 48 hours, and rarely succeeds, unless in experienced hands."—*Chemical News*, March 17, 1865, also *American Journal of Science and Arts*, January, 1865.

I have found, when the amount of cobalt is large, that 48 hours is not long enough. Yet this method of separating cobalt from nickel is the one upon which very great stress is laid by nearly all the writers on chemistry. It is the one placed in the hands of beginners in the science of chemistry. No one, however, seems to raise a cry of objection except the poor tortured qualitative student, who finds, at the expiration of the 48 hours, that something is wrong; no yellow precipitate has formed; and even if a yellow precipitate has formed, in the filtrate, when evaporated to dryness and the residue tested in a borax bead, very frequently a beautiful cobalt blue looms up, beautiful in itself, but most aggravating to behold at this stage of his expended patience!

The French Exposition of 1878.

A law has has been passed by the French Legislature, decreeing the opening of an International Exposition in Paris, on May 1, 1878, and the continuance of the same to October 31, of the same year. A commission has been appointed to make preliminary preparations; and of this, a sub-committee under M. Viollet-le-Duc, the celebrated French architect, was charged with the devising of a project for the grand buildings. M. Viollet-le-Duc's committee has reported as follows:

"Your sub-commission thought that it was necessary to have the covered space amount to 2,255,000 square feet in the Champ de Mars, and that it was proper to adopt rectilinear dispositions of the inclosure, forming a compact whole, which might be easily divided off according to the nature of the products exhibited in one direction and according to the nationality of the exhibitors in the other, a sort of Pythagorean table, upon which, on following one direction, a range of similar products might be inspected, while on taking an opposite direction to the first the nationalities would show their different merchandise. In the middle of this vast building are to be arranged saloons to receive an exposition of objects of art submitted by masters in every coun-