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TOBACCO SMOKING.—PRESTON'S TOBACCO MANUFACTORY.

Tobacco smoking is no doubt an American custom of great antiquity. It has always possessed particular virtues in the ancient rites and ceremonies of the primitive races who peopled the temperate, and perhaps sub-tropical parts of America. Among northern tribes, although smoking appears to have been all but universal, when Europeans first came in contact with them, yet it was not the fumes of tobacco which they inhaled, but those of the Bear Berry, Willow leaves, the inner bark of the Red Willow, the leaves of the Sumach, &c., which they dried and roasted over a fire. But they prized tobacco, after having once smoked it, above all other substitutes. The tobacco pipe and smoking weed, in some form another, entered into most of their religious ceremonies, and was intimately connected with the observance of their rites and superstitions. Pipes are found in great abundance all through the valleys of the Mississippi and the St. Lawrence; many of the relics discovered in ancient burial places are of curious workmanship, and show a considerable degree of skill in their sculpture, and ideality in their design.

Against the inordinate use of tobacco, there are many and most potent objections.

The experience of some eminent medical practitioners, tends to show, that on many constitutions, the practice of smoking or chewing, is very prejudicial.

In the competitive examinations to which young persons are submitted in the military schools of France, the smokers of tobacco occupy the lowest places. Sir Benjamin Brodie, goes so far as to state that "the effects of this habit are indeed various; the difference depending on differences of constitution, and differences in the mode of life otherwise. But from the best observations which I have been able to make on the subject, I am led to believe that there are very few, who do not suffer harm from it, to a greater or less extent. The earliest symptoms are manifested in the derangement of the nervous system."

On the other hand, it has been observed by Lane, the learned annotator of the Arabian Nights (and the observation is confirmed by the experience of Mr. Layard, M.P., the explorer of Asyria) that the growth and use of tobacco amongst oriental nations, has gradually reduced the resort to intoxicating beverages, and Mr. Crawford, in a paper "*On the History and Consumption of Tobacco*" in the Journal of the Statistical Society (1853), remarks, that simultaneously with the decline in the use of spirits in Great Britain, has been a corresponding increase in the use of tobacco.* The quantity of tobacco consumed throughout the world is truly enormous. North America alone, produces about five hundred million pounds annually.

In Great Britain the quantity of tobacco consumed in 1821, was, 15,598,152 lbs., or at the rate of 11.71 oz. per head; in 1851, it had risen to 28,062,978 lbs., or 16.86 oz. per head. In 1859, the quantity reserved for Home consumption, reached the enormous figure of 34,791,261 lbs.

This is the more suprising when we reflect that tobacco was first brought to England by Sir Francis Drake, in 1586, and the colonists of Sir Walter Raleigh. In 1560 it was brought to France by Nicot, and into Turkey and Arabia it was introduced about the beginning of the 17th century, and in 1601 it is known to have been carried to Java, and yet in the short period of 256 years, its use in one form or another, has spread so rapidly and extensively, that the greatest commercial nation in the world, which does not grow one particle of tobacco, imported in 1859, more than sixty millions of pounds, and, retaining half that quantity for the consumption of her people, exported to distant countries, where tobacco will not grow, or where enough can not be cultivated, upwards of thirty-two millions of pounds weight.

The cultivation of tobacco has proceeded with very rapid strides in the United States. The crops in 1849, amounted to 199,752.655 pounds, in 1859, it reached 429,390,771 pounds.†

The superintendent of the eighth census of the United States, naively says: "It would seem surprising that a crop which is said to impoverish the soil more than any other, and to injure to some extent, every one who uses it, should be found so desirable as to increase 106 per cent. in ten years; but such is the effect of a ready market with renumerative prices."

To its excessive use in some parts of the United States, and indeed in Canada, and to the horrible habit of uncontrolled expectoration, which is so freely indulged in, the words used in King James' "Counterblast of Tobacco" may be applied with some degree of justice, "A custom loathesome to the eye, hateful to the nose, harmfull to the brain, dangerous to the lungs, and in the black stinking fume thereof, nearest resembling the horrible Stygian smoke of the pit that is bottomless."

* Hunt's edition of Ure's Dictionary of Arts, &c. † Eighth Census.

Let, however, physicians, priests and kings, say what they will, the pipe, the cigar, and the snuff-box, have become the common solace of mankind, notwithstanding all the fierce opposition waged against tobacco by emperors, popes, and sultans, who in the form of edicts, bulls, denunciations, the knout, and death itself, have opposed its use in vain. It is indeed supposed by many, that the custom of smoking had long been prevalent among the Chinese and East Indians, before it was introduced into Europe.

It is chiefly for its soothing and tranquilizing effect on the mind, that tobacco smoking is indulged in. Both Dr. Pereira and Dr. Christison, agree that no well-ascertained ill effects have been shown to result from the national practice of smoking"—(*Treatise on Poisons*) Dr. Prout was of a different opinion, and as has been already stated, Sir Benjamin Brodie and Sir Charles Hastings, M.D., both agree that it is deleterious. "Generally of the physiological action of tobacco upon the bulk of mankind, and apart from its moral influence, it may be received as characteristic of this substance among narcotics:"

First, that its greater and first effect is to assuage and allay and soothe the system in general.

Second, that its lesser and second or after effect, is to excite and invigorate, and at the same time give steadiness and fixity to the powers of thought.*

The chemical constituents of tobacco have been well described by Professor James F. Johnson, from whose work, before referred to, the following abstract is taken :—

The active substances or ingredients of tobacco or tobacco smoke, those by which all its varied effects are produced are three in number: a volatile oil, and a volatile alkali, which exist in the natural leaf—and an empyreumatic oil, which is produced during the burning of the tobacco in the pipe.

1. *The Volatile Oil.*—When the leaves of tobacco are mixed with water and submitted to distillation, a volatile oil or fat comes over in small quantity. This fatty substance congeals or becomes solid, and floats on the surface of the water which distils over along with it. It has the color of tobacco, and possesses a bitter taste. On the mouth and throat it produces a sensation similar to that caused by tobacco smoke. When applied to the nose, it occasions sneezing; and when taken internally, it gives rise to giddiness, nausea, and an inclination to vomit. It is evidently one of the ingredients, therefore, to which the usual effects of tobacco are owing; and yet it is remarkable that from a pound of leaves only two grains of this fatty body are obtained by distillation. Upon such minute quantities of chemical ingredients do the peculiar action and sensible properties of some of our most powerful medicinal agents depend!

2. *The Volatile Alkali.*—When tobacco leaves are infused in water made slightly sour by sulphuric acid, and the infusion is, subsequently distilled with quick lime, there comes over mixed with the water a small quantity of a volatile, oily, colorless, alkaline liquid, which is heavier than water, and to which the name of *nicotin* has been given. It has the odor of tobacco, an acrid, burning, long-continuing tobacco taste, and possesses narcotic and very poisonous qualities. In this latter respect it is scarcely inferior to prussic acid, a single drop being sufficient to kill a dog. Its vapor is so irritating, that it is difficult to breath in a room in which a single drop has been evaporated. The proportion of this substance contained in the dry leaf of tobacco varies from 2 to 8 per cent.*

So far as experiments have been made, the tobaccos of Havanna and Maryland contain 2 per cent., that of Kentucky 6, that of Virginia nearly 7, and that of France from 6 to 8 per cent. It is rare, however, that a hundred pounds of the dry leaf yield more than 7 pounds of nicotin. In smoking a hundred grains of tobacco, therefore—say a quarter of an ounce—there *may* be drawn into the mouth two grains or more of one of the most subtle of all known poisons. For as it boils at 482° Fah., and rises into vapor at a temperature consideraby below that of burning tobacco, this poisonous substance is constantly present in the smoke. From the smoke of a hundred grains of slowly-burning Virginia tobacco, Melsens extracted as much as three-quarters of a grain of nicotin; and the proportion will vary with the variety of tobacco, the rapidity of the burning, the form and length of the pipe, the material of which it is made, and with many other circumstances.

3. *The Empyreumatic Oil.* — But besides the two volatile substances which exist ready formed in the tobacco leaf, another substance of an oily nature is produced when tobacco is distilled alone in a retort, or is burned, as we do it, in a tobacco pipe. This oil resembles one which is obtained in a similar way from the leaf of the poisonous fox-glove (*digitalis purpurea*) It is acrid and disagreeable to the taste, narcotic and poisonous. One drop applied to the tongue of a cat brought on convulsions, and in two minutes occasioned death. The Hottentots are said to kill snakes by putting a drop of it on their tongues. Under its influence the reptiles die as instantaneously as if killed by an electric shock. It appears to act nearly in the same way as prussic acid.

The oil thus obtained consists of at least two substances. If it be washed with acetic acid (vinegar) it loses its poisonous quality. It contains, therefore, a harmless oil, and a poisonous alkaline substance which

* "The Narcotics we indulge in," by James F. Johnson (The Chemistry of Common Life).

* The reader may recollect the great sensation produced in 1851 by the trial of the Comte de Bocarmé at Mons, and his subsequent execution, for poisoning his brother-in-law with nicotin.

the acetic acid combines with and removes. The nature and chemical properties of this alkaline poison have not as yet been investigated. The crude oil is supposed to be "the juice of cursed hebanon," described by Shakspeare as a distilment.*

Thus three active chemical substances unite their influences to produce the sensible effects which are experienced during the smoking of tobacco. All three are contained in variable proportions in the smoke of burning tobacco. The form and construction of the pipe, among other circumstances, influence, as I have said, the proportion of these ingredients which the smoke contains. Thus the Turkish and Indian pipes, in which the leaf burns slowly, and the smoke is made to pass gently bubbling through water, arrest a large proportion of the poisonous vapors, and convey the smoky air in a much milder form to the mouth. The reservoir of the German pipes retains the greater portions of the oily and other products of the burning tobacco, and the long stem of the small Russian pipe has a similar effect. The Dutch and English clay pipes retain less; the metal (bronze or iron) pipes of Thibet, by becoming warm, bring still more of the constituents of the mild Chinese tobacco to the mouth of the smoker; while the cigar, especially if smoked to the end, discharges directly into the mouth of the smoker everything that is produced by the burning. Thus the more rapidly the leaf burns and the smoke is inhaled, the greater the proportion of the poisonous substances which are drawn into the mouth. And finally, when the saliva is retained, the fullest effect of all the three narcotic ingredients of the smoke will be produced upon the nervous system of the smoker. It is not surprising, therefore, that those who have been accustomed to smoke cigars, especially of strong tobacco, should find any other pipe both tame and tasteless, except the short, black *cutty*, which has lately come in favor again among inveterate smokers. Such persons live in an almost constant state of narcotism or narcotic drunkenness, which must ultimately affect the health, even of the strongest. The chewer of tobacco, it will be understood from the above description does not experience the effects of the poisonous oil which is produced during the burning of the leaf. The natural volatile oil and the nicotin are the substances which act upon him. These, from the quantity of them which he involuntarily swallows or absorbs, impair his appetite, and gradually weaken his powers of digestion.

The same remark applies to the taker of snuff. But his drug is still milder than that of the chewer. During the first fermentation the leaf undergoes in preparing it for the manufacture of snuff, and again during the second fermentation, after it is ground, a large proportion of the nicotin escapes or is decomposed. The ammonia produced during these fermentations is partly the result of this decomposition.* Further, the artificial drying or roasting to which tobacco is exposed in fitting it for the dry snuffs, expels a portion of the natural volatile oil, as well as an additional portion of the natural volatile alkali or nicotin. Manufactured snuff, therefore, as it is drawn up into the nose, and especially dried snuff, is much less rich in active ingredients than the natural leaf. Even the rappees, though generally made from the strongest Virginian and European tobaccos, containing 5 or 6 per cent. of nicotin, retain only 2 per cent. when fully manufactured.

I have already stated that in all the sensible properties by which the unadulterated leaf of the tobacco plant is characterized, the produce of different countries and districts exhibits important economical differences. All such diversities in quality and flavor, in strength, mildness, odor, &c., the chemist explains by the presence of the above-named active ingredients, sometimes in greater, sometimes in smaller proportion; and it is interesting to find science in his hands first rendering satisfactory reasons for the long-established decisions of taste. Thus he has shown that the natural volatile oil does not exist in the green leaf but is formed during the drying; hence the reason why the mode of drying and curing affect the strength and quality of the leaf. He has also shown that the proportion of the poisonous nicotin is smallest in the best Havannah, and largest in the Virginian and French tobaccos. Hence a natural and sound reason for the preference given to the former by the smokers of cigars, who receive directly into their mouths all the substances which escape from the burning leaf. And, lastly, by showing that both of the poisonous ingredients of tobacco are volatile, and tend to escape slowly into the air, he has explained why the preserved leaf, or the manufactured cigar, improves by keeping, and, like good wine, increases in value by increase of age.

As to the lesser niceties of flavor by which certain samples of tobacco are distinguished, these probably depend upon the presence of other odoriferous ingredients, not so active in their nature, or so essential to

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* The effects, real or imaginary, of this "juice" are thus described:

"Sleeping within mine orchard,
My custom always of the afternoon,
Upon my secure hour thy uncle stole,
With juice of cursed hebanon in a vial,
And in the porches of mine ear did pour
The leperous distilment: whose effect
Holds such an enmity with blood of man,
That, swift as quicksilver, it courses through
The natural gates and alleys of the body:
And with a sudden vigor it doth posset
And curd, like eager droppings into milk,
The thin and wholesome blood: so did it mine;
And a most instant tetter bark'd about,
Most lazar-like, with vile and loathsome crust,
All my smooth body."—*Hamlet*, Act i, Scene 5.

* Nicotin is one of those powerful vegetable principles which, like the *theine* of tea and coffee, are rich in nitrogen. Of this element it contains 17 per cent.

the leaf as those already mentioned. The leaves of plants, in respect to their odors, are easily affected by a variety of circumstances, and especially by the nature of the soil they grow in, and of the manures applied to them. Even to the grosser senses and less minute observation of Europeans, it is known, for example, that pig's dung carries its *gout* into the tobaccos raised by its means. But the more refined organs and nicer appreciation of the Druses and Maronites of Mount Lebanon readily recognise by the flavor of their tobacco the variety of manure employed in its cultivation. Hence, among the mountains of Syria, and in other parts of the East, those samples of tobacco are held in the highest esteem which have been aided in their growth by the droppings of the goat.

Preston's Tobacco Manufactory.

Very nearly two centuries ago (1672) Mr. Colbert communicated to Mr. Talon, the Intendant of New France or Canada, certain instructions respecting "all sorts of manufactures."

"His majesty" said the minister, "does not wish tobacco to be planted, as that would not be in any way profitable to the country, which has much more need of whatever can direct the inhabitants to trade and navigation, to fixed fisheries and to manufactures, and as the cultivation of that plant would be prejudicial to the islands of America.

Sixty-two years after this injunction against the cultivation of tobacco, viz., in 1734, the number of pounds raised in Lower Canada, amounted to 166,054, and since that time its cultivation has largely increased, as will be shown hereafter.

The quantity of tobacco raised in Canada during the year 1851, amounted to 1,220,485 lbs.; Upper Canada producing 777,426 lbs., against 443,059 lbs. from Lower Canada.

The imports of this important commercial product are given below, for the years* 1855 to 1861 inclusive.

Manufactured Tobacco.			Unmanufac. Tobacco.	
Year.	Quan'y in lbs.	Value.	Quan. in lbs.	Value.
1855	3,062,529	$456,461	747,695	$76,340
1856	3,053,869	510,762	577,644	118,540
1857	2,926,185	602,029	959,896	120,133
1858	3,294,154	592,250	1,390,074	135,025
1859	3,493,453	574,943	1,964,693	146,994
1860	1,987,433	124,115	3,703,677	466,556
1861	1,901,045	163'771	2,544,800	315,620

The practice of preparing tobacco for common use in England, is first to separate the damaged leaves from the bale as it comes from the grower, and spread the approved contents on a stone floor. They are then watered with a solution of sea salt, to moderate the fermentation which sets in when the moist leaves are exposed to air in a heap. Instead of a simple solution of salt, molasses or liquorice is added, which gives a sweet taste to the tobacco. The following is the prescription of a skilful manufacturer:—

"In a solution of the liquorice juice a few figs are to be boiled for a couple of hours; to the decoction, while hot, a few bruised anise-seeds are to be added, and when cold, common salt to saturation. A little spirit of wine being poured in, the mixture is to be equally, but sparingly sprinkled with a watering pot, over the leaves of the tobacco, as they are successively stratified upon the preparation floor."—*Hunt's Edition of Ure.*

When the leaves are properly fermented, which is a point of great nicety, they are stripped of their middle ribs, sorted anew, and the large ones set apart for making cigars.

Messrs. Preston and Company commenced the manufacture of Tobacco in Toronto in November, 1862, so that they have just been one year at this comparatively new and important branch of industry in this city. They had formerly pursued the same business in Virginia and Kentucky, and were induced to come to Canada by the tempting protective duty of 30 per cent. on manufactured tobacco, the small number of establishments engaged in the manufacture throughout Canada, and the large and growing consumption in the country. They import nearly the whole of their raw material from the States of Kentucky and Missouri—the State of Virginia, which produces the best tobacco, being closed by the blockade. It is shewn farther on that there is a vast difference between the market value of tobacco grown in different countries; and although Canada produces the very respectable quantity of about twelve to fifteen hundred thousand pounds per annum, yet it is not sought after by the Messrs. Preston, on account of its inferior quality. These gentlemen employ from 100 to 125 hands in their manufactory. They use a solution of liquorice for the double purpose of inducing fermentation and sweetening the leaf. When the stem is abstracted, bundles of leaves are formed in rolls or twists, laid in the drying room, and a considerable portion of the moisture drawn off. They are then taken to the press room, and submitted to powerful hydraulic pressure in suitable shapes and sizes. These shapes or plugs are put into boxes; again submitted to powerful pressure, to exclude any particle of atmospheric air; and finally nailed up, branded and stored for market. The object of submitting the tobacco a second time to powerful hydraulic pressure is to prevent, by the exclusion of air, any chance of fermentation or mould.

* A few thousand pounds of tobacco are returned each year as exported—these are damaged goods, which being unsaleable, are returned to the shippers.

The mercantile values of tobacco are very varied. Owing to the comparatively short season with us in Canada, the standing of Canadian tobacco is very low. In the English market the prices per pound are about as follows:

	s.	d.
Canada	0	4
Kentucky	0	6
Virginia	0	7
Maryland	0	9
Turkey	0	9
Cuba	1	6
Havannah	3	6

There can be little doubt that the value of Canadian tobacco might be very much increased by prolonging the season for ripening, and by proper attention to forcing manures and the preparation of the soil. We read in the Quebec *Chronicle* as follows:

"CANADIAN TOBACCO.—A tobacco stalk was grown this year on the farm of Mr. Drummond, in the Eastern Townships, weighing, without the seeds, four pounds and a half. Five of its leaves were of the following dimensions: 29½ by 14, 24½ by 13, 27½ by 14¼, 26½ by 13½, and 27 by 14."

But what does this luxuriant growth signify, if the sample is harsh and strong. Canadian tobacco requires a longer time to mature the leaf in order to subdue the harshness which belongs to it. This can be done by artificially lengthening the season of its growth by raising the young plants in hot-beds, and thus adding five or six weeks to the season of its growth. Now that we have several important tobacco manufacturing establishments in our midst, it is worth the farmer's while to grow tobacco with care, and improve the sample. We shall not then find more than half a million dollars sent out of the country annually to purchase foreign tobacco; and Messrs. Preston and others will always be glad to pay a fair price for a good home raised article, if it can be manufactured into a saleable product.

TRAVELS OF CAPT. GRANT & CAPT. SPEKE TO THE SOURCES OF THE NILE.

Sir R. Murchison, on taking the chair at the last meeting of the Geographical Section of the British Association said, he had great pleasure in now calling attention to the communication about to be made to the section by his friend Captain Grant. He regretted very much that Captain Speke was not present, and he was sure that Captain Speke regretted his absence as much as he did; but he was so intensely occupied in preparing the work which was to describe the travels of Captain Grant and himself, that he could not spare the few days to come and address that meeting. Captain Speke had addressed so many public assemblies in the metropolis, that the general object he had in view, and the manner in which he had carried them out, had been so extensively explained to geographers, that the public were now pretty generally informed of the manner in which the expedition had been carried out. He (Sir Roderick Murchison) would ask his friend Captain Grant, in the first place, to give a very brief sketch of the whole journey from the time they disembarked at Zanzibar; and after he had described the route that had been gone through, Captain Grant would conclude by reciting some of the conversations which he held with some of the kings that lived on the equator. (Applause.)

Captain Grant, who was loudly cheered, began by expressing his regret that Captain Speke was not present, to relate an account of a discovery which was only due to himself. Captain Burton and Captain Speke went out together and explored the country in that part of Africa, and on his return to England, Captain Speke expressed his opinion that the Nile had its source in the lake Nyanza. Sir Roderick Murchison then sent him out to make further explorations.

Sir Roderick begged to correct Captain Grant. He only suggested to the Geographical Society, with others, to send him out. He (Sir R.) could only boast of that honour.

Captain Grant continued:—He luckily knew Captain Speke in India, and volunteered to accompany him. They started about 200 miles from Zanzibar. They found a difficulty in getting through the knots of native princes; they were detained sometimes for days or even months together. Pushing on, after 18 months they got up to Coragua. The lake here looked like a boundless sea. All the waters were collected from the country on the west. Rains here were very abundant. Two days out of three they had rain. The streams caused by these rains all ran into the Victoria Nyanza. After leaving Coragua, they proceeded to another place, where they met with a native prince, a fine young fellow, who was very unwilling to let them go north, as he could not understand what object they had in view. After keeping them six months, he agreed to give them an escort. Capt. Speke first went to see where the Nile escaped from the lake. Captain Grant here showed on the map the course they took through the Napoleon Channel and Ripon Falls, which were represented on a large drawing. They then proceeded to the King of the Equator. The Nile here was a splendid large black stream of water, more like a Highland river than anything else; but it was three times the size. After this, the river takes an immense bend to the west. But, by this time, all their stores were expended, and they had not a single shot left to make presents to the princes of the country. They were, therefore, unable to go round that point; but they knew the river was straight ahead of them, so they cut across the curve and found the old river again. They then followed the stream the whole way down to Alexandria. At Gondokoro, they found a station where there were 20 large boats, and each boat would contain about 20 camels. They found Mr. Baker there, who kindly placed some of the boats at their service. At that station, they were told of a white man having been there who had cut his name on a tree. This white man, they afterwards ascertained was Mr. Miani, a Venetian gentleman. They were, of course, very anxious to see this tree, and it so happened that the very men who escorted them were the same who had escorted this white man. They were directed to a tamarind tree. The person who cut his name on the tree must have climbed up the tree, as the name was at a considerable height. The letters, however, were almost effaced, having been cut two years previously; but they distinctly traced the letters A and I. It had been said that the Nile of Mr. Miani was not the Nile that he and Captain Speke visited, but here was conclusive proof of their identity.

Captain Grant then proceeded to read the following paper:

Captain Speke and myself were the only two white men of the exploring party across Africa. We were accompanied by about 200 blacks, ten of whom were of the Cape Mounted Rifles, and one—a half caste Arab—commanded the porters (formed of Seedees from Zanzibar, and men returning to the interior.) Although we started with twelve mules and four to five donkeys, every one walked along the little path, except when sickness obliged them to ride. The animals were chiefly used in carrying ammunition and baggage; but after three or four months, all had died, not from want of water, food, or insect bite, but from the deleterious pasturage along our route. There was no such thing as coinage in the country; we got on by paying everything with Venetian beads, cotton cloths, or thick wire, from our—at first—abundant supplies. When they were exhausted Captain Speke, in the far interior, laid in a fresh supply from the trading Arabs, paying them at the rate of 1,700 per cent. on the articles purchased. Unfortunately for him, after giving a note of hand, which was readily accepted, all the goods purchased had to be left behind, as no men could be found willing to carry them on for us. The King of Unyiro, the last of the kings on our route, was told—if he sent for them—he might have all, provided he allowed us to leave his country and get on to Gondotoro. To this he agreed, but whether or not they reached him, we never heard. Being thus left without the ordinary funds to pay our way, it required no small management to conciliate the native Princes. It was admirably arranged by giving them private rifles, ammunition, watches, instruments, medicines, boxes, and a good deal of worthless lumber, for all of which they showed their gratitude by entertaining us and our men during the year we were amongst them, and ultimately allowing us to go on our way towards Egypt. The route from the coast to the lake district was traversed through large provinces governed by paltry but independent sultans, or small rulers, who were most exacting in their demands for taxes—detaining us for days palavering—never getting away from them without a row, disagreement, or threat of attack. As an instance, although I stayed with the old Sultan of Ukuni, in the land of the moon, providing, of course, my own food, showing him and his five wives many kindnesses and civilities, I became so indispensible to his amusement that, for three months, he would render me no assistance to get away, and on the day of my leaving, he coolly drove my porters away with his stick, and took forcible possession of one of my rifles, thinking to exact more presents from me, and defeat my plans of getting on. The presents had to be paid, and the rifle I had to wrest out of his grasp. Again, in passing the lands adjoining his, a boisterous party turned out of a large village demanding tax, but my party was too strong for them and nothing was lost. Two days afterwards, while marching at the head of a file of 200 laden men, enjoying the pretty, hilly country all around, a mob sprung out of the bushes, their skin coverings flying like wings on their backs, making their spears quiver, threatening with their bows and arrows, howling and yelling. I smiled at their graceful antics over the high grapes and bushes, thinking they merely were showing their delight. However, bursting on the centre of my followers, they broke the line from centre to flanks, seized and ransacked every load, while I was left with but two or three followers. All the property was stolen in an instant, and had disappeared on their backs through the cover. The only redress obtainable from this sultan, after having frightened my porters away to their homes, destroyed more than a fourth of the property, and hindered me for ten days, was the condescending permission to leave his Highnesses dominions and rejoin my companion Speke. This even was not accomplished till another unwarrantable exaction was made by a drunken fellow, who frightened away some of my load carriers by beating his war drums whenever I refused to satisfy his greed for presents. Until a rifle and a case of ammunition, with other presents, were given to him he would not allow us to move from his village, while he brought my men into subjection by prohibiting his people from selling us the ordinary necessaries of life. The Governor of Uzinza had next to be passed. Although he had invited us to come quickly, by sending his royal copper-rod bearer, we did not feel confident that he also would not fleece us, because the Arab traders had reputed him as a man whose avariciousness knew no bounds. We were ill-provided with cloths and beads, but a bold front was made to pass the extortioner's country, and we considered ourselves fortunate in paying only half our stock-in-trade, without receiving an article in exchange. Crowds of his retainers wildly welcomed us; the first white men, laughing and ridiculing us as we walked along the path, generally afraid to come near, and sometimes dogging us for miles. Even in camp, under canvass, we were not safe from being stared at. Pitching water over them was found the most efficacious, making them run away laughing. During the night we had to fire at thieves, they became so bold and daring, throwing stones into camp, and stealing the clothes of single individuals. While outside, two or three were killed, which gave the inhabitants a wonderful idea of our power and watchfulness; also, that we must be magicians to have killed robbers, hitherto considered invulnerable. Nothing was ever said for having killed them. Some instances may be given of the superstitions of this country. The people having seen me visit a waterfall alone, reported it to their prince, and the story went about that we had come to flood the country. Milk could not be supplied us as we eat fowls, neither would it be supplied to those who eat the bean of the country. The ruler feared our evil eye, and would not show us anything, neither would he accept a revolver pistol, because he thought it had been bewitched! Our camp was kept two or three miles away from the miserable creature's abode. After ten days, we had the good fortune, one midnight, to be ordered forthwith out of his dominions, when we proceeded towards the countries ruled over by the three great despotic kings near the Victoria Nyanza. The first, Rumanika, proved a remarkable contrast to the rude barbarians we had seen previously, he receiving us with a "Yambo?" ("How do you do?") and a hearty shake of the hand immediately on our arrival. While seated in a tiny room, amongst his sons and brothers, he politely invited us to sit down on the matting facing him. Smiles, inquiries and welcomes at being so fortunate as to see white men, continually burst from him. "Every day do I see Arabs but never white men." He would say, laughingly, "Show me that gun, the powder flask, your hat," &c. Then would he look, and wonder at our shoes. "Did we think the lake big?" "How did we like the hills in his country?" "How did we know there were people here." "Did the chief in Uzinza treat us well?" He said this jokingly, knowing we must have been enormously fleeced by him. In fact, we formed the most charming impression of his gentleness, amiability, and intelligence. His brothers and sons showed great attachment to him, and no little sympathy towards me, sitting with me for hours, while lying sick; bringing me flowers, birds' nests, animals, or anything curious that might interest me. His people, also, living in the palace vicinity, had imbibed the gentleness of their king, whose greatest delight was in examining pictures of his peasantry, our soldiery, or Englishmen and women as they dressed at home. My servant, who called every morning to ask after him, would complain good naturedly at being kept so long exhibiting the pictures to each of his five wives in succession, but in return, would invariably bring me back some little present of a fowl or some wine. In appearance, this Rumanika was very tall, slender, with handsome straight features—shaved head and face—dressing generally in a loose-sleeved embroidered cloak to below the knee, and ornamented with brass bangles on each wrist, and large variegated beads on his ankles. Strangely enough, notwithstanding these superior qualities, like most Africans, any toy would amuse his uneducated mind. I made a jumping-jack for his child son, but this he at once appropriated to himself, and sent me a carpenter to cut down a tree, so that a life-size one might be made him. His chief diet was milk, rarely touching grain or meat. Goat and sheep he thought unclean; and seldom drank the plaintain wine for which his country is famous. His queens and female relatives fed upon milk, and the consequence was that they became fattened to enormous sizes, and when seen in motion, their excessive obesity obliged them to be supported on either side by a friend, the flesh of their arms hanging down in a flabby mass like the widest of fashionable sleeves. They are drilled from their infancy to suck at milk, and the milk-jug even after it has been emptied. The people have a curious custom of chewing coffee there; the berry is plucked and dried soon after the embryo has formed, and when eaten has a pleasant and stimulating effect. This king, superior and excellent as he was, was unable to rise above the superstitions of his country, and felt disappointment when Capt. Speke could not give him a medicine by which the death of a rebel brother could be effected. Again, one night my men shouted for their guns, they having seen three animals larger than donkeys, and hissing like snakes, come into the camp, and they turned out to shoot them, but were too frightened. Next morning, the king, being thought a diviner, was asked for an explanation of this phenomenon, and the plan to be adopted on their again appearing. His answer was—My rebel brother has sent these monsters of evil spirits, and you must shoot them, if after challenging three times they do not reply, as you may then be convinced that they cannot be men. He guarded us at the same time to beware of mistaking them for leopards. This caution had probably some connexion with their idea of transmigration of souls. During the five months I was laid up at his palace we were on the most friendly and intimate terms. If his gun was to be cleaned, or his clock to be mended, or his coat to be washed, or if he wanted a particular colour of fowl or goat for rain-making purposes, or a picture to be drawn, he always applied to me. Ordinary criminals he was never harsh with—his brother dealt with them. Thefts were punished by imprisonment (the stocks) for two or three months; beating with a stick; a fine of ten goats was sufficient; wounding with a spear; all property was confiscated, half going to the king and half to the injured party—if there was no property, he was sent to the stocks. The murderer was variously treated, according to the evidence; some had their eyes gouged, while the generality were thrown over a precipice, and the body dashed to pieces, the property going to the family of the murdered person. Their dead, that is, those of this Walruma race, are deposited in the cow-fold, sewn up in the skin of a cow, or, as in the case of a young prince while I was there, put amongst the rocks on an island in the lake. Burial grounds are never seen in the country; the bodies of the peasantry are thrown into Little Windermere. The next Equator king was named M'tessa, a fine young fellow, passionately fond of all field sports. Very exaggerated reports had come of him, *i. e.*, that he would take no presents—that Speke had to shoot one hundred cows daily for the king's pleasure—that my arrival there would be celebrated by the massacre of a great number of people—that he abhorred slavery—that no sick person could enter his territory, &c. I was consequently very anxious to reach Ugander to test these wonderful reports, and soon found that he took the most enormous presents we had yet made—daily shot a few cows the meat of which our men got—no human sacrifices were made in honour of my arrival; slaves he had in immense numbers, and he sent a carrying party to bring me, an invalid, up two hundred miles, so that the report proved to some extent a fabrication. The first time Speke took me there to call upon him he presided at an immense levee, (a most theatrical affair) looking a perfect fop and dandy—albeit with an overawing and contemptuous air (caused by the custom not to look at him). His back-clothes and head-ornaments were put on with the greatest care and neatness; not a hair was out of its place, and evidently his ladies' maids had spared no pains in his toilet. Two or three female soothsayers, called Witchnesee, sat by his side to hand him his wine-cup, or brush off a speck should it fall on the king; they appeared to exercise some sacred functions about the court, and were supposed to divine every event. They could obtain interviews and show their influence when no other party could prevail, and were the most haughty women-queens in the land, bowing to, or acknowledging *none*. They dressed fantastically, and like every individual present, exquisitely clean and tidy, with natural wreaths of flowers, stuffed lizards-shells, heads, or seeds, dresses of salmon-tinted bark cloths, to their ankles, aprons, perhaps two or three of the shining black, white, or red skin of a kid. For hours would they sit in this state waiting upon the king, until he chose to terminate his levee by retiring. Although the people are polite, full of etiquette and grace to another court, many curious and barbarous customs prevail in Uganda —one is, that if a page does not convey properly the king's orders, or misconveys them, the poor boy has his intellect sharpened by having one or both ears cut off—maimed boys and handless men, not seemingly disgraced, were therefore not at all uncommon, and on his seeing my hand, it at once struck him that I had been a page, for he asked me. He punishes by fine, torture or death—the lives of men and women are taken for the most trivial offences—a common saying being that he never looks bright, or no business can be done till the day has commenced with a few being led to execution. Not a day passed without our hearing of, or actually seeing *some* poor victim. A miserable young girl, or handsome woman, from the palace gates might be seen walking down the road perfectly alone and unheeded by passers-by, wailing nya-wo, &c., mother, in the most bitter, agonizing tones, perhaps bleeding from a spear wound, and mournfully following a single palace guard, walking fifty yards in front of her to the place of execution; others would have a whip-cord round the wrist and follow the man along like a dog, while others pull, I have seen most reluctantly, against the cord by which they are being led to death, screaming most cruelly. Princesses by birth had several privileges —they could not be executed like others—and the king's sister, the handsomest girl in the palace, had the privilege of also being his wife. At the close of the levee, a drawing-room would be held in another court. No one was admitted except ourselves and interpreters, because the public, on pain of death, dare not look at the queens. His Majesty, seated on a camp chair, would be surrounded by about two hundred of his wives (squatting on the ground,) a sister at his feet to talk nonsense or confidentially to him. Conversation would turn upon guns, when a queen would fly to bring in his; or on our route; or upon our strange appearance. Such interviews would last a couple of hours, and were generally enlivened by bands of drums or flutes, or a buffoon singing comic strains outside the enclosure. He returned my call the day after my first interview. I heard the sound of a rushing mob outside the fence of our hut, when in bounded the young king, bareheaded, clearing the fences, dressed in an open chintz jacket, no shirt, and loose white trousers trimmed with red, and looking, not the swell of yesterday, but the picture of a negro blackguard. He was followed by twenty lads and boys, his brothers, carrying guns, sticks, dead vultures, and other birds which he had shot. One or two were heavily ironed, feet and hands; another had a wide-awake of leather on; all were as jolly as only Africans can be. Giving him a chair outside the hut, he rapidly turned over the leaves of a sketch-book, stared wildly about, asked whether his likeness had yet been done, whether we had seen the birds he had shot, ordered me to shew my head uncovered to his brothers, who squatted round him, tearing at a sugar-cane in the most ravenous manner. In a moment he was off to shoot and enjoy himself, followed by the rabble of brothers, each struggling to get in front of and precede him. He had gone pic-nicking, having changed his dirty or torn clothes from a box load carried on a boy's head and returned to his palace by torch-light, the tremendous rattling din of the Queskooro on the palace drums accompanying his instruments. In marching through his country you are escorted by forty or fifty of his army, and a gallant captain who has his drummer to beat the reville, company's call, alarm, or assembly, is in command. The drummers are generally very smart fellows, as they must follow the captain and his dog wherever adventure may lead them. You are the guest of the king, and must never pay the people for anything, and every house must be deserted instanter on your arrival. Leaving, to speak figuratively, the wines in the celler, the dinner in the kitchen, the wardrobe and granaries full, the fruit in the garden, and the goats in the fields; all these things are at once laid hands on, then commences the chasing of fowls, goats, or sheep, and ransacking of houses. Squabbling and fighting begins almost before you arrive in your camp for the day. In fact it was a villainous system of oppression, but no redress could be had as these were the orders of His Majesty to eat and take whatever you liked, but not to pocket or carry away. Payment in clothes, guns, and other presents from one having thus plundered his peasantry, was made to him alone. The villages in the vicinity of the palace being occupied by the favourites of the court were alone exempt from this taxation; the ferrymen's houses, the very men who were to row us across the Katonga river, had their fowls seized and put on board the boats.

Captain Grant was frequently applauded while reading his paper, and at its close sat down amidst loud cheering.

THE SUN'S DISTANCE FROM THE EARTH.*

It may occasion surprise to many who are accustomed to read of the precision now attained in the science and practice of astronomy when it is stated that there are strong grounds for supposing the generally received value of that great unit of celestial measures—the mean distance of the earth from the sun—to be materially in error, and that in fact, we are nearer to the central luminary by some 4,000,000 miles than for many years past has been commonly believed. The results of various researches during the last ten years appear, however, to point to the same conclusion, and under the impression that the subject may be deemed one of more than scientific interest, I have drawn up a very popular outline of the actual state

* Addressed to the Editor of the London Times by J. R. Hind, F.R.S.

of our knowledge respecting it, which I now beg to place at your disposal.

The measure of the sun's distance which has been generally accepted by astronomers depends upon an elaborate discussion of the observations of the transits of the planet Venus over the sun's disc in the years 1761 and 1769, published by Professor Encke, of Berlin. The great importance of these rare phenomena in the solution of what has been justly termed "The noblest problem in astronomy" was first pointed out by our countryman Halley, towards the close of the 17th century. The principle involved is the determination of the amount of displacement of Venus upon the solar disc, as viewed from distant stations on the earth's surface, whereby the parallax of the planet is found, and hence from the known proportion of her distance to that of the sun the distance of the latter body can be inferred. In practice this principle resolves itself into one of two methods. The first and by far the best consists in the comparison of the observed duration of the transit at places favourably situated for shortening and lengthening it, either by difference of latitude alone, or in certain cases with the additional effect of the earth's rotation on her axis, which will diminish or increase the interval of transit, according as the observer is carried to meet the motion of Venus or the contrary. This method is independent of the longitudes of the stations, which are often very imperfectly known, but unfortunately it cannot be applied advantageously in every transit, and is liable to fail entirely if atmospherical circumstances interrupt the observations either at ingress or egress (or of the first and last contacts of the planet with the sun's disc). The second method is by comparison of observations of the absolute times of ingress only or of egress only at stations widely differing in latidude: here the longitude enters as an indispensable element, and it must be pretty exactly known to allow of a trustworthy result.

At no period probably, has an astronomical phenomenon excited a more wide spread interest than previous to the year 1761, as the first of the transits of Venus drew nigh. The Royal Society, at that time under the presidency of the Earl of Macclesfield (a nobleman distinguished for his great attainments and zeal in the encouragement of this particular science), took action in 1760, and procured the fitting out of two Government expeditions to points which had been judged favourable for the purpose in view. Mason and Dixon, originally destined for Bencoollen, were, fortunately as it happened, delayed on their passage, and stationed themselves at the Cape of Good Hope, while Maskelyne proceeded to St. Helena. The scientific academies of Paris, St. Petersburg and Stockholm, aided by their respective Governments, despatched observers to the Island of Rodrigues, in the Indian Ocean, and various parts of the extreme north of Europe, Siberia, and Tartary; indeed, from Lisbon to Pekin, and from Tornea, on the Gulf of Bothnia, to the Cape of Good Hope preparations were made for observations which it was hoped would lead to a more precise knowledge of that unit of measures upon which all distances and dimensions beyond the moon depend. The result, however, disappointed expectation; the values of the solar parallax obtained by different calculators exhibited discordances which tended to throw doubt upon the whole, and hence it cannot be said that the transit of 1761 was of material service in the solution of the problem. Encke's researches assign 8″.49 as the most probable parallax from this transit, but some of the contemporary computers arrived at much larger numbers. The cause of this unsatisfactory conclusion is sufficiently evident. In 1761 it was impossible to fix upon stations so situated as to give the first method described above a chance of success, and hence the value of the observations depended upon an exact acquaintance with the longitudes of the observers, which are open to considerable uncertainty in several of the most important cases.

The transits of Venus generally happen in pairs, an interval of eight years elapsing between the two, while from the last of one pair to the first of the next either 105 or 132 years will intervene. The second transit is always more favourable for ascertaining the sun's distance than the first, which circumstance, added to the contradictory nature of the results derived in 1761, gave occasion to preparations in 1769 on even a greater scale than in the former year. The British Government, again at the instance of the Royal Society, equipped several expeditions to distant stations. Captain (then Lieutenant) Cook proceeded to the Pacific, and with Mr. Green, one of the assistants at the Royal Observatory, had a favourable view of the transit in the Island of Tahiti, from a position still known as Point Venus; observers were also despatched to Hudson's Bay and to Madras. The Danish Government sent to Wardhus (an island in the Arctic Ocean, at the north-east extremity of Norway) a Vienna ecclesiastic, Father Hell, who had witnessed the previous transit at the observatory of that city, and who succeeded in establishing a most unenviable notoriety in connection with the second. The entrance of the planet upon the sun's disc was seen at nearly all the European observatories, and its departure therefrom at several points in Eastern Asia, at Manilla, Batavia, &c.; while the entire duration was watched at Wardhus, at different places in Lapland, at Tahiti, St. Joseph in California, and elsewhere. If the weather had been propitious at all the northern stations, the combination of the *data* thus obtained, with the observations of Captain Cook and Mr. Green in the Pacific, would in all probability, have led to a very reliable determination of the sun's distance—indeed, Professor Encke, at the conclusion of his treatise on the subject, has a remark which virtually implies that complete observations at the eight northern stations, and a similar number in the Friendly Islands, would have given this distance more exactly than the whole 250 observations taken at both transits elsewhere. Unfortunately clouds interfered at most of the selected stations, except Wardhus and it consequently happens that the times noted by Hell and his assistants exercise a great influence on the final result. This would have been comparatively unimportant if the Viennese astronomer had not tampered with his observations to such an extent as to induce some of his contemporaries (Lalande among the number) to regard them as forgeries. He delayed their publication for nine months, and repeatedly prevaricated respecting them; even when given to the world they were found to exhibit serious discordances from those of other observers; but although the suspicions of his dishonesty were pretty general at the time, it was not until 1834 that positive proof was forthcoming. In that year Professor Littröw, of the Vienna Observatory, discovered among Hell's manuscripts a note-book which, there is every reason to suppose, was the identical one used at Wardhus. It then became apparent that the principle figures had been erased so as to be for the most part illegible; but from a careful examination of such as remained it was thought that one observation of the ingress and one of the egress might be depended upon; this was Littröw's opinion, and Encke, accepting his reasons, discussed the whole anew, and found the solar parallax to be 8″.57, or, for the earth's distance from the sun, 95,365,000 miles.

Although for the reason stated some suspicion has attached to the value of the solar parallax obtained from the transit of 1769, the first serious doubts as to its accuracy may perhaps be dated from the publication of Professor Hansen's elements of the moon's orbit in 1854. Several years previous Mr. Airy had brought to a conclusion one of the most valuable and laborious works ever undertaken in astronomy—the reduction on a uniform system and comparison with theory of the immense mass of lunar meridional observations taken at the Royal Observatory, Greenwich, between the years 1750 and 1830, the results of which were printed in 1847. These calculations furnished the means of improving the tables of the moon so far as depends upon observations in the meridian, but such observations are impracticable when she is near to the sun, and consequently several of the inequalities of her motion are not completely exhibited by them. It was for this reason, and to secure a hold upon her entire orbit, or very nearly so, that the Astronomer Royal some years since devised and erected at Greenwich an instrument specially intended for determining the place of the moon in any part of her diurnal path. The results given by this instrument, which is known as the altazimuth, have proved of great value, affording a check upon the amount of several irregularities indicated by theory, and particularly upon one technically called the parallactic equation, which is directly connected with the solar parallax; or in other words, with the earth's distance from the sun. If the amount of this inequality, as given by observation, does not agree with that computed with an assumed value for the sun's distance, we know that the latter requires corection, and it is easy to ascertain to what amount. Professor Hansen found that the Greenwich meridian observations required a material diminution in the sun's distance, and were confirmed by a long series taken at Dorpat, in Russia: while the same conclusion was drawn by Mr. Airy from the observations with the altazimuth instrument in other parts of the moon's orbit. The solar parallax finally given by Hansen is 8″·97, about four-tenths of a second greater than was inferred from the transits of Venus and corresponding to a diminuation of more than 4,000,000 miles in the earth's distance from the sun.

Within the last few years M. Le Verrier has completed a most rigorous application of the theory of attraction to the motions of the Earth, Venus and Mars, as defined by a long course of observation at Greenwich and other astronomical establishments. Nothing can excel in completeness the three investigations of this eminent mathematician. The theory of the earth was published in 1858 in the *Annales* of the Observatory of Paris, and contains one striking result bearing upon the subject of my communication. The inequality, technically called the lunar equation, was found to require an increase of one-twelfth part, which would render necessary an augmentation of Encke's solar parallax, of nearly four-tenths of a second, and therefore a diminution of the assumed distance of the earth from the sun very nearly to the same amount assigned by Hansen's researches connected with the moon. M. Le Verrier adopts 8″·95 for the parallax in his solar tables, but does not, in this place, insist upon its substitution for the number given by the transits of Venus. The earth's mass as referred to the sun's would from the same cause require increasing to the extent of nearly a tenth part of the whole.

In the theory of the planet Venus it is found impossible to account for the motion of the line of nodes (the points where her orbit intersects the ecliptic) with the received values of the planetary masses; but, if a correction be applied to the mass of the earth of about the same magnitude as indicated by M. Le Verrier's previous researches, the calculated motion of the nodes would agree with that resulting from observations as far back as they can be depended upon. In this case, however, it would be necessary to diminish the adopted measure of the earth's distance from the sun by a thirtieth part—affording another and quite independent corroboration of the error with which it is affected. In 1861 the investigation of the orbit of Mars was completed, and forms, with the tables of the planet, a part of the last volume of the Paris *Annales*. M. Le Verrier announces, as the *fait capital* to which his discussion had led him, the absolute impossibility of representing the observations without a motion of the perihelion (or nearest point of the orbit to the sun) greater than is consistent with the planetary masses employed, and the equal impossibility of providing for the increase of disturbing force, except by the addition of at least a tenth part to the assumed mass of the earth, with the corresponding diminution in her distance from the sun.

Notwithstanding these very remarkable and confirmatory results M. Le Verrier appears to have been at this time very strongly impressed with the exactness of Encke's parallax, and terms the unavoidable increase of the received value "a grave objection" to the augmented mass of the earth derived from his theories. He had previously detected a motion of the perihelion of the planet Mercury, due to some unknown cause, and proposed to account for this and the other anomalous motions I have alluded to by the following assumptions:—

1. There exists, besides the planets Mercury, Venus, the Earth, and Mars, a ring of asteroids between the Sun and Mercury, the aggregate mass of which is comparable to that of Mercury.

2. At the distance of the earth from the sun there is a second ring of asteroids, the mass of which is at most equal to a tenth of the earth's.

3. The total mass of the asteroids between Mars and Jupiter is at most equal to one-third of the mass of the earth.

4. The mass of the last two groups are complementary to each other: ten times the mass of the group at the earth's distance, *plus* three times the mass of the group situate between Mars and Jupiter, gives a sum equal to the mass of the earth. "This last conclusion," adds M. Le Verrier, "depends on the measure of the distance of the earth from the sun by the transits of Venus, which astronomers agree in considering as very precise."

Now, it is to be remarked that the first of these assumptions may be admitted in explanation of the motion of the perihelion of Mercury, without affecting the question of the earth's distance; indeed, it acquires additional probability from the fact that dark spots have from time to time been observed to traverse the sun's disc, and from their rapid motion and well-defined appearance have been considered bodies of a planetary nature revolving within the orbit of Mercury. The existence of a ring of asteroids in the vicinity of the earth's path, and with an aggregate mass sufficient to explain the observed motion of the node of Venus and the perihelion of Mars, is perhaps a more disputable point. I shall not, however, stop to inquire how far it may be favoured or otherwise by our present knowledge of meteoric astronomy, but proceed to mention the further evidence which has been forthcoming since the publication of M. Le Verrier's investigations, and would rather induce us to adopt a diminished measure of the earth's distance from the sun, as the most probable solution of the difficulty.

M. Léon Foucault, of Paris, has succeeded in measuring the absolute velocity of light by means of the "turning mirror"—an experimental determination of no little interest and significance. He concludes that it cannot differ much from two hundred and ninety-eight millions of French metres per second, or 185,170 English miles, which is a notable diminution upon the velocity previously derived from astronomical data alone. The time which light requires to travel from the sun to the earth is known with great precision; at the mean distance of the latter it is rather less than 8 min. 18 sec., and if this number be combined with M. Foucault's measure of the velocity it will be evident that the received distance is too great by about one-thirtieth part—that light, in fact, has not so far to travel before it reaches the earth as generally supposed. The corresponding solar parallax is 8″·86 which approaches much nearer to M. Le Verrier's theoretical value than to the one depending on the transits of 1761 and 1769. So curious a corroboration of the former deserves especial remark.

The very rare occurrence of the transits of Venus has naturally induced astronomers to consider other practical methods of approximating to the sun's distance, admitting of more frequent repetition, though not possessing in a single application the same amount of accuracy. Among these the observation of the planet Mars at stations widely differing in latitude has received much attention. The orbit of this planet is so eccentrical as to cause a material variation in its distance from the earth when in opposition, and consequently most favourably placed for observation. In some years it will not approach within two-thirds of the distance of the earth from the sun, while in others it will be separated from us by little more than one-third of the same, and in such cases we have opportunities of ascertaining the sun's parallax from that of the planet, either by a system of observations at different points of the earth's surface, or even by measuring its distance from neighbouring stars at a single station. The nearer we are to Mars, the greater the probability, *cœteris paribus*, of an exact result. Suppose we have a number of determinations of the planet's distance from the celestial equator at an observatory in north latitude (as Greenwich or Poulkova) and others on corresponding dates at an observatory in the opposite hemisphere (as the Cape or Melbourne) and that from the known rate of the apparent motion of Mars we reduce them to the same instant, care being taken to eliminate the effect of refraction, the declinations will still exhibit a discordance, which neglecting error of observation will be due to the sum of the parallaxes of Mars at the two observatories. Erom this quantity the sun's parallax can be inferred, since we know the exact proportion which the distance of the planet bears to that of the sun. In 1857 Mr. Airy drew attention to two oppositions of Mars, 1860 and 1862, peculiarly favourable for such observations, and strongly recommending that an attempt should be made to correct the received distance of the sun by means of them. In 1860 the observations wholly failed through an unusual prevalence of clouded skies at the best stations, but in 1862 numerous comparisons of the planet with stars in his vicinity were procured at Greenwich, Poulkova, the Cape of Good Hope, and Williamstown, Victoria. If those at Greenwich and Williamstown are combined the sun's parallax is found to be 8″·93, while Poulkova and the Cape give 8″·97, numbers in close accordance with the theoretical values already mentioned. There is but little probability that any further light will be thrown on the question of parallax from observations of Mars during the next ten years, the planet's distance from the earth in opposition being always too great to afford that method a fair chance of success.

To recapitulate briefly: a diminution in the measure of the sun's distance now adopted is implied by—1st, the theory of the moon, as regards the parallactic equation, agreeably to the researches of Professor Hansen and the Astronomer Royal; 2nd, the lunar equation in the theory of the earth, newly investigated by M. Le Verrier; 3rd, the excess in the motion of the node of the orbit of Venus beyond what can be due to the received values of the planetary masses; 4th, the similar excess in the motion of the perihelion of Mars, also detected within the past few years by the same mathematician; 5th, the experiments of M. Foucault on the velocity of light; and 6th, the results of observations of Mars when near the earth about the opposition of 1862.

I subjoin a few of the numerical changes which will follow upon the substitution of M. Le Verrier's solar parallax (8″·95) for that of Professor Encke, on which reliance has so long been placed. The earth's mean distance from the sun becomes 91,328,600 miles, being a reduction of 4,036,000.

The circumference of her orbit, 599,194,000 miles, being a diminution of 25,360,000. Her mean hourly velocity 65,460 miles. The diameter of the sun 850,100 miles, which is smaller by nearly 38,000. The distances, velocities, and dimensions of all the members of the planetary system of course require similar corrections if we wish to express them in miles; in the case of Neptune, the mean distance is diminished by 30 times the amount of correction to that of the earth, or about 122,000,000 miles. The velocity of light is decreased by nearly 8,000 miles per second, and becomes 183,470 if based upon astronomical data alone. These numbers will illustrate the great importance that attaches to a precise knowledge of the sun's parallax, in our appreciation of the various distances and dimensions in the solar system.

The first of the ensuing pair of transits of Venus will take place on the 9th of December (civil reckoning), 1874, and the second on the 6th of December, 1882. I have calculated the circumstances of both phenomena from M. Le Verrier's new tables of the sun and planets, the full details of which may be found in the *Comptes Rendus* of the Paris Academy of Sciences for July 22, 1861. For the transit of 1874, December 9, I find—

"The conjunction in right ascension at 4h. 59m. 13s. a.m. mean time at Greenwich, Venus north of sun's centre by 14 min. 15 sec. External contact at ingress, 1 h. 46 m. 56 s. a.m.; internal ditto, 2 h. 15 m. 57s. a. m.; internal contact at egress, 5 h. 57m. 5s. a.m.; external ditto, 6h. 26m. 5s. a.m.

"The first contact at ingress will take place in the zenith in longitude 151 deg. 22 min. east, and latitude 22 deg. 57 min. south, and the last contact at egress in longitude 81 deg. 36 min. east, and latitude 22 deg. 58 min. south. As viewed in an inverting telescope, the planet will enter upon the sun's disc at a point about 131 deg. from the north towards the west, and will leave it about 160 deg. from north towards the east.

Similarly, for the transit of 1882, December 6, my computation gives,—

"The conjunction in right ascension at 4h. 20m. 14s. p.m. mean time at Greenwich; Venus south of sun's centre 11 min. 6 sec. External contact at ingress, 1h. 55m. 38s. p.m.; internal ditto, 2h. 15m. 56s. p.m.; internal contact at egress, 7h. 52m. 29s. p.m.; external ditto, 8h. 12m. 47s. p.m. The first contact at ingress will take place in the zenith in longitude 31 deg. 5 m. west, and latitude 22 deg. 40 min. south, and the last contact at egress in longitude 120 deg. 20 min. west, and latitude 22 deg. 42 min. south. As viewed in an inverting telescope, the planet will enter upon the sun's disc at a point about 35 deg. from north towards the west, and will leave it about 66 deg. from north towards the east."

From the preceding numbers it will appear that no part of the transit of 1874 can be witnessed in this country. The egress only will be visible in the south-east of Europe near sunrise—in Italy Turkey, &c. The entire duration may be observed in Australia, New Zealand, British India, China, Tartary, and the islands of the Indian Ocean, including Madagascar. The astronomical conditions, however, will not be very favourable for the investigation of parallax, either by the first or second method to which allusion has been made. Thus, for observations of the difference of duration of transit, we must rely upon stations selected so as to offer the greatest difference of latitude, without the possibility of introducing the additional effect of the earth's rotation. The Russian authorities, always energetic in matters of science may provide for the observation of the phenomenon in Eastern Siberia, and observers might be located in various parts of central Asia. For southern stations we have Australia, New Zealand, and several islands in the Indian Ocean, including Kerguelan's Land, but as remarked by the Astronomer Royal (whose lucid address on this subject, published in the *Monthly Notices* of the Royal Astronomical Society for May, 1857, I am here chiefly following) "the observable difference of duration will probable not be half of that in 1882." The successful application of the second method—viz., the comparison of differences of absolute times of ingress only or of egress only, will render necessary a precise determination of many distant longitudes between the Mauritius or the Isle of Bourbon and the Sandwich Islands. In the transit of 1882 the first and preferable may be advantageously used, under certain conditions. The entire duration will be observable in the United States and in a part of British North America, and in this region will be shortened not only by northern position, but by the effect of the earth's rotation, which must carry the observer to meet the motion of the planet. On the contrary the duration would be lengthened by the latter cause and by southern position in those parts where an Antarctic continent was laid down some years since by Admiral Wilkes, but upon the existence of which, if I am not mistaken, geographers will be by no means agreed. Assuming that land is really to be found in that region and may be approached in December, there can be no doubt, on merely scientific considerations, that observers would be very advantageously placed upon it in 1882. For the application of the second method the islands in the western part of the Indian Ocean will have the ingress accelerated, while the Atlantic seaboard of North America will have it retarded. The egress will be retarded in part of the Australian continent, including New South Wales and Victoria, in New Zealand; the New Hebrides and many islands of the Polynesian group, and will be accelerated in the United States, and West India Islands, and the north-eastern part of south America. In this case also, numerous longitudes would require determination with greater accuracy than they are as yet known. The ingress will be visible in England, the first external contact at Greenwich taking place at 1h. 59m. 57s. p.m.

It is scarcely to be doubted that every possible use will be made of the transits of 1874 and 1882 to improve our knowledge of the great astronomical unit, the measure of the sun's distance, and that all the resources of modern science and all the facilities afforded by modern enterprise will be combined for that purpose. No other opportunity of the kind will occur until the year 2004.

Bouquet of Wines.

M. Maumene has found that the odour of some wines can be imitated by a mixture of a few drops of œnanthic ether and essence of pears; the addition of a drop or two of butyric ether gave some resemblance to other wines. By mixtures of this sort the author thinks that the bouquets of most wines may be imitated.

Board of Arts and Manufactures

FOR UPPER CANADA.

BOARD ROOMS, Toronto, Oct. 29, 1863.

The monthly meeting of the sub-committee was held at 2 o'clock, p.m. Present: the President (Dr. Beatty), Professor Hincks, J. Shier, Professor Hind, W. H. Sheppard, W. S. Lee, Professor Buckland, and E. A. McNaughton.

Minutes of former meeting were read and approved of, business correspondence submitted, and accounts passed and ordered for payment

The Secretary-Treasurer submitted his financial statement, showing total receipts to date $1489 38; expenditure, $1424 60; balance in hand, $64 78. Anticipated revenue for remainder of year, including Govt. grant and above mentioned balance, $2499 74; expenditure, $1436 10; anticipated balance, $1063 64.

Professor Hind submitted a report upon the specimens of *Terra Sienna* forwarded by Messrs. Browning and Hitchins, Beauharnois, C.E., and referred to him for examination. (See report appended to these proceedings.)

The committee on "Final Examinations," Professors Hincks, Hind, and Buckland, reported a draft of programme for final examination for 1864, which was adopted and ordered to be printed in the Journal. The committee also submitted a sketch of a design for *Certificate to Candidates.*

Moved by Mr. Shier, seconded by Mr. Lee, and *Resolved,*—That the sum of sixty dollars be offered for the best design and one hundred printed copies of a certificate on stone, after the general design submitted by the committee.

The "Book & Journal" Committee submitted a report showing the cost of printing and publishing 1250 copies of the Journal to be nearly one dollar each per annum; that the present income is only about $750; annual loss about $500. The Committee recommended that for the ensuing year 2,000 copies be printed; that the subscription be raised from 50 cents (its present rate) to 75 cents per annum, of which 25 cents be allowed agents for canvassing for subscribers and remitting subscriptions. The assumed cost of printing 2,000 copies is $1489 per annum, income $1300, excess of expenditure over income anticipated $189 00.

The report was received and adopted, and its suggestions and recommendations ordered to be carried out.

Resolved,—That the *Book and Journal* Committee be authorised to have a circular letter prepared and printed, to be from time to time issued to proprietors of manufacturing establishments in Upper Canada, offering to send an agent to visit their respective manufactories, with a view to publishing a descriptive notice thereof in the Journal of the Board, provided said proprietors will pay the actual travelling and hotel charges of the agent in making such visit.

Resolved,—That we cannot allow this (the first opportunity which has presented itself) to pass without expressing our sincere regret at the death of Dr. Wm. Craigie, whose constant attendance at its meetings, and active cooperation in its objects, greatly contributed to the success which has thus far marked the progress of this Board. and whose sound sense, judgment, and general intelligence, united with his kindly manner, won him the esteem of all with whom he acted.

The meeting then adjourned.

W. EDWARDS, *Secretary.*

PROF. HIND'S REPORT.

Toronto, Oct. 29, 1863.

In compliance with the request of the sub-committee of the Board of Arts, I have examined the Ochres (oxides of Iron) sent to me, and find them to contain a considerable percentage of Silica; and the unburnt specimen a notable quantity of organic matter, which would interfere with its practical use in its present state. By calcination the whole of the organic matter is burnt out, and the yellow or amber coloured specimen becomes the ordinary burnt Sienna of commerce.

I did not think it necessary to make a quantitative analysis, in consequence of the great abundance of excellent ochres in Canada, of very superior quality.

Reference to the reports of the Geological Survey will show that ochres have been found in the following localities:—

1. Ste. Anne de Montmorenci—
   - *a.* Brownish ochre,
   - *b.* Brownish black ochre,
   - *c.* Yellow ochre.

This deposit appears to extend over four square acres, the thickness of the deposit varies from 17 to four feet.

2. Cap de la Madelaine—
   - *a.* Greenish black ochre,
   - *b.* Yellow ochre.

The deposit extends over 600 square acres.

3. Pointe du Lac—
   - *a.* Purplish ochre,
   - *b.* Yellow ochre.

Extends over 400 acres. Thickness varies from 6 inches to 4 feet. This deposit was worked in 1851 by Messrs. H. A. Monroe & Co., of New York.

4. Nottawasaga—
Yellow ochre.

This deposit covers half an acre.

5. Owen Sound, Town Plot.
Yellow ochre.

There are many other localities in Canada where deposits of ochre occur of greater or less extent.

HENRY Y. HIND.

ANNUAL EXAMINATION OF CANDIDATES.

This Board will hold its 2nd annual examination of members of the various Mechanics' Institutes in Upper Canada, under the rules and restrictions hereafter laid down; the object of such examination being to encourage, test, attest and reward efforts made by the industrial classes for self-improvement.

This examination will be open to all members of incorporated Mechanics' Institutes or Library Associations in Upper Canada, who are not students of any college, graduates or under-graduates of any University, or certified school teachers; or who are not following any of the learned professions.

The Board invites the attention of the managers of the respective Institutions to the annexed programme, and solicits their earnest co-operation in carrying it out.

PROGRAMME.

Local Committees.

The Managers of Mechanics' Institutes and Library Associations desirous of co-operating with this Board, in promoting the education of such of their members as have not been able to avail themselves of the benefits of academical instruction and distinction, but who are now willing to engage in classes or evening schools, or other means of self-improvement, are invited to form local committees for the purpose of organizing and superintending classes; for conducting the necessary preliminary examinations; and to assist and co-operate with the examiners appointed by the Board. Each local committee must consist of at least three members, and should be composed of such persons as would give their time and earnest attention to the subject.

Preliminary Examinations by Local Committees.

The local committees will conduct the preliminary examinations of their own candidates, and also supervise the working of papers which the examiners appointed by the Board will set for the final examination.

No candidate will be admitted to the final examination without a certificate from his local committee, that he has satisfactorily passed its preliminary examination in the subjects in which he wishes to be examined by the Board.

The preliminary examinations by the local committees may be either wholly written, or partly oral and partly written, as each local committee may think best; and must be held sufficiently early in the year to allow the results to be communicated to the Secretary of this Board on or before the first day of May, 1864.

The "pass" to the final examination should not be given to any candidate, however meritorious, whom the local committees consider not to have a reasonable chance of obtaining certificates from the Board.

Final Examination by the Examiners appointed by the Board.

Forms containing the names of the candidates "passed" by the local committees, and the subjects in which they wish to be examined, must be returned to the Secretary of the Board not later than the first day of May, 1864.

The Examiners appointed by the Board will set the requisite papers for the final examination, and these will be forwarded to the local committees. The local committees will see, and certify to the Board, in the form which the Board will furnish, that the papers are fairly worked by each candidate without copying from any other, and without book or other assistance; and will return the worked papers to the Board.

The final examination will be conducted by the means of printed papers.

The examiners will award certificates of three grades, but certificates of the first grade will be awarded only to a high degree of excellence.

The final examinations will be held simultaneously on the days, and at the hours specified in the time-table for 1864, at those institutions where local committees are established.

Judgment will then be passed by the examiners appointed by the Board, and the awards of certificates will be communicated to the respective local committees.

In appointing the following subjects for the final Examination in 1864, it is suggested to pupils that they confine their attention to the subjects as tabulated; but it is not the intention nor the wish of the Board to limit their studies to any of the branches embraced in particular groups.

1.	I.	Arithmetic.
	II.	Book-keeping.
	III.	English Grammar and Composition.
	IV.	Geography.
	V.	Penmanship.
2.	VI.	Algebra.
	VII.	Geometry.
	VIII.	Principles of Mechanics.
	IX.	Geometrical and Decorative Drawing, and Modelling.
	X.	History.
3.	XI.	Trigonometry.
	XII.	Mensuration.
	XIII.	Practical Mechanics.
	XIV.	Conic Sections.
	XV.	Chemistry and Experim'l Philosophy.
	XVI.	Geology and Mineralogy.
4.	XVII.	Animal Physiology and Zoology.
	XVIII.	Botany.
	XIX.	Agriculture and Horticulture.
	XX.	Political and Social Economy.
5.	XXI.	English Literature.
	XXII.	French.
	XXIII.	German.
	XXIV.	Music.
	XXV.	Ornamental and Landscape Drawing.

To indicate the portions of the subjects that will be taken in the examination, certain text-books are suggested for several of the departments. In other departments, where no text-books are named, the treatises in general use in the schools and colleges in Upper Canada are recommended; but it is distinctly to be understood, that in so doing no opinion is pronounced as to their comparative merits. Real knowledge, however or wherever acquired, will be accepted, and the exposition of a subject in the candidate's own words will be preferred by the examiners.

I. Arithmetic.

Fundamental rules of Arithmetic; Proportion, Simple and Compound; Practice; Interest; Fractions, Vulgar and Decimal; Extraction of Square and Cube Roots.

The Examiners will take into account not only the correctness of the answers, but the excellence of the method by which they are worked out, and the clearness and neatness of the working (which must always be shown).

II. Book-Keeping.

Book-keeping by Single and Double Entry; Drafts of the various forms of Bills of Exchange, Promissory Notes, Invoices, &c.; and an accurate knowledge of the various books used in the counting house.

III. English Grammar and Composition.

Grammatical Analysis of Sentences in Prose and Poetry; Composition on a given subject.

IV. Geography.

Political Geography. General Questions in Ancient and Modern Geography; Maps drawn from memory; Explanation of Geographical Definitions; Mathematical Geography; Physical Geography; Outlines of Physical Geography.

V. Penmanship.

Business Hand. An even round hand, without flourishes, will be preferred.

Specimens to be selected by the local committees, and forwarded to the Board, on the same conditions as specimens in department IX.

VI. Algebra.

Algebraic Fractions, Square and Cube Root, Simple and Quadratic Equations, Single and Simultaneous, Ratio and Variation. Candidates should be prepared to give explanations of Elementary Principles and proofs of Fundamental Propositions.

Text Books.—Colenso's Algebra or Bridges' Algebra.

VII. Geometry.

A facility in solving geometrical theorems and problems, deducible from the first four books of Euclid, will be expected on the part of those who desire to obtain certificates of the first or second class.

Text Books—Euclid, Books I, II, III & IV.

VIII. Principles of Mechanics.

The Properties of Matter, solid, fluid and gaseous.

Statics: The composition, resolution and equilibrium of pressures acting on a material particle; constrained particles; machines; attractions.

Dynamics: gravitation; collision; constrained motions; projectiles; oscillations.

Rigid Dynamics: Motion of a rigid body about a point; of a free rigid body; of a system of rigid bodies.

Hydrostatics: Pressures of fluids; equilibrium of floating bodies; specific gravity; elastic fluids; machines; temperature and heat; steam; evaporation.

Hydrodynamics: Motion and resistance of fluids in tubes, &c.; waves and tides.

Pneumatics: Mechanical properties of the air; the barometer.

Text Book—Silliman's Natural Philosophy.

IX. Geometrical and Decorative Drawing and Modelling.

Orthographical Projection, or Geometrical Drawing, of Architectural or Engineering subjects, Machinery, &c.

Linear Perspective.

Original Designs.

Models of figures, groups, foliage, &c., connected with the Fine or Decorative Arts.

The local committees will select, and forward to the Board, such specimens of Drawing and Modelling as they may deem worthy, and which they shall certify to be the work, solely, of the candidate named, who may not be an artist by profession.

X. History.

Outlines of Greek and Roman History; English History from the Norman Conquest; Canadian History.

XI. Trigonometry.

In Plane Trigonometry, the solution of plane triangles, and the use of logarithmic tables, &c.

Spherical Trigonometry, Napier's Rules, Solution of Spherical Triangles.

XII. Mensuration.

The calculation of the areas and circumferences of plane figures bounded by right lines or arcs of circles. The superficial and solid contents of cones, cylinders, spheres, &c. Measuring and estimating artificer's work.

XIII. Practical Mechanics.

The Application of the Principles of Mechanism to Simple Machines. The Steam Engine.

Text Books—Lardner on the Steam Engine; Nasmyth's Elements of Mechanism, with Remarks on Tools and Machinery (*Weale*); Bourne's Catechism of the Steam Engine.

XIV. Conic Sections.

Analytical Conics, including the equations of the straight line, the circle, the three conic sections, and the general equation of the second degree. The Principles of Projection, Orthogonal and Central.

XV. Chemistry and Experimental Philosophy.

Physical. Elementary laws of heat, light and electricity, in connection with chemical action.

Inorganic. Chemistry of the Metalloids and Metals, laws of combining proportions, volumes of gases, vapours, &c.

Organic. Composition, properties and decompositions of alcohols, acids, &c.

Candidates are expected to be able to explain decompositions by the use of symbols. Questions illustrative of general principles will be selected from the following amongst other trades and manufactures: Metallurgy of Lead, Iron and Copper; Bleaching, Dyeing, Soap-boiling, Tanning; the manufacture of Coal Gas, Sulphuric Acid, &c.

Text Books—Fowne's Manual of Elementary Chemistry; Croft's Chemistry (*Maclear & Co.*); Elements of Chemistry (*Chambers' Educational Course*); Tyndall's Lectures on Heat.

XVI. Geology and Mineralogy.

The properties and distinctive characters of the commonly occurring Minerals and Metallic Ores; the structural characters, conditions of occurrence, and classification of Rocks generally.

Text Books—Dana's Manual of Mineralogy, and Dana's Geology.

XVII. Animal Physiology and Zoology.

The general principles of Animal Physiology. Practical application of them to health and the wants of daily life.

Text Books—Agassiz & Gould's Introduction to Comparative Physiology; Paterson' Zoology; Carpenter's Animal Physiology, 1859 (*Bohn*); Lardner's Animal Physics (*Walton & Maberly*).

XVIII. Botany.

Vegetable Physiology. Classification of Plants; Leading principles of Morphology; Scientific and applied Botany.

Text Books—Gray's First Lessons in Botany; or George Bentham's Outlines of Botany.

XIX. Agriculture and Horticulture.

Theory and Practice of Agriculture and Horticulture.

Text Books—Johnston's Elements of Agricultural Chemistry and Geology; Youatt's Treatises on the Horse, Cattle, Sheep and the Pig; Sipson's Agricultural Chemistry; Buist's (Robt.) American Flower Garden Directory; and Family Kitchen Gardener; P. Barry's Fruit Garden; and Smith's (C. H. J.) Landscape Gardening, &c.

XX. Political and Social Economy.

A general knowledge of the Commercial, Financial and Statistical History of the United Kingdom and of Canada, will be required.

XXI. English Literature.

Shakspeare's "Tempest;" Milton's "Paradise Lost," Books I & II; Spencer's "Faerie Queen," Book I; Cowper's "Task;" Pope's "Essay on Man;" Wardsworth's "Excursion," Books I & II; Macauley's "Essays;" Bacon's "Advancement of Learning," Book I; Addison's "Spectator;" Johnson's "Rambler;" Craik's "History of the English Language;" Trench on the "Study of Words."

N. B.—Candidates may select any two of the authors in the above list.

Candidates are recommended to make a very careful study of the text of the authors they may select. The questions on each author will be divided into two sections, the first intended to test the candidate's acquaintance with the text, the second his knowledge of the subject matter, and his critical and literary information. Full marks will not be given for answers to the second section, if those to the first section do not prove satisfactory.

XXII. French.

Questions on any portion of the French Grammar (To be answered in French, if possible), and an extract from a contemporary French writer to be translated into English or *vice versa.*

An English extract to be translated into French, and a list of idiomatic expressions to be rendered from French into English or *vice versa.*

XXIII. German.

Schiller's "Wilhelm Tell." Grammatical and Critical Analysis of.

Goethe's "Iphigenie Auf Tauris."

Goethe's "Egmont."

Composition on a given subject.

Pieces from each of the above works will be given for translation. Every candidate must translate one piece. First class certificates will be given to those only who translate well from English, and write in German a good Essay relating to German History since the Reformation.

XXIV. Music.

Theory of music. Notation, the modern modes, intervals, time signatures, the stave, transposition, modulation, terms and characters in common use.

Elements of Harmony.

Arrangements must be made in the previous examinations by the local committees, to test candidates by oral examination, in their knowledge or appreciation of the sound of musical successions and combinations. A form of the test to be used for this purpose by the local committees, at the previous examinations, will be sent by this Board to such local committees as may apply for it, in due time before the examination.

XXV. Ornamental and Landscape Drawing.

Ornamental Drawing of Natural or Conventional objects.

Landscape Drawing in pencil, crayon, water colours, or in oil.

Specimens to be selected by the local committees, and forwarded to the Board, on the same conditions as specimens in department IX.

Terms of Admission to the Final Examination.

Every candidate for examination must be "passed" by a local committee, and must be a member of, or student of a class in, an Incorporated Mechanics' Institute or Library Association in Upper Canada.

The examinations will be held at the rooms of the respective institutions reporting candidates, on the evenings of Tuesday, Wednesday, Thursday and Friday, June the 7th, 8th, 9th and 10th, 1864.

Instructions as to the particular evenings upon which the respective subjects will be taken up, and all the necessary forms for returns to the Board, will be furnished by the secretary, so soon as candidates are reported by any local committee.

Proceedings of Societies.

THE TORONTO MECHANICS' INSTITUTE.

This institution has organised the several evening classes referred to at page 301 of this Journal; competent teachers have been secured, and a large number of pupils have entered their names.

At the close of the session of twenty weeks, an examination will be held, and two prizes in books, of the value of $10 and $6 respectively, will be awarded in each class.

On the evening of Tuesday, the 3rd instant, a lecture introductory to these classes was delivered by Mr. Richard Lewis. The President of the Institute, Mr. William Edwards, opened the proceedings by naming the classes that had been organized, and the rules under which they will be conducted; and also directing the attention of the pupils to the final examination of the Board of Arts and Manufactures, to be held in June next, when certificates of three grades will be awarded to successful candidates, similar to those awarded to seven of the pupils of this Institute at the last year's final examination.

We can only find room for the following extracts from Mr. Lewis' long and very interesting address:

"Here then arises the necessity for that systematic study which under the guidance of qualified teachers is secured by class instruction. The student is not a passive recipient of other men's opinions. He enters upon higher and firmer ground. He begins business on his own account. He undertakes a work of mental architecture, and commences the erection of a structure which in every step of his progress invigorates and disciplines his character, and not only secures him a possession of rare and inestimable value in the knowledge he is acquiring, but developes the faculties of his mind, clothes them with new powers—gives solidity to his judgment and expansiveness and method to his imagination, without consuming its immortal fires, and, by strengthening his faith in his own efforts, cultivates a feeling of self-reliance and moral courage, fitting him to meet with manly firmness the trials and temptations of life, and to discharge its duties with manly energy, honesty, and completeness.

* * * * * * *

"There is a strong tendency in all systems of education to make them preparatory to the university and the professions, instead of the place of business, the wants of commerce, the workshop and the world—a tendency often encouraged and stimulated by vanity and unwise ambition, and the erroneous views of what is honourable and respectable. * * * There is learning of a special kind required by him who would succeed in industrial pursuits, as extensive and profound and elevating in its influence as the special learning supposed to be necessary to the professional man. A large amount of the studies in which the professional man engages are for mental discipline, and all that can be urged in that direction in its behalf for him, may with equal force be urged on its behalf for every man; for in what occupation of life are not judgment, discretion, order, and all wisdom and power that grow out of a superior mental discipline, of inestimable value. You may urge that often great interests depend on the skill of the professional man—that human life is often in his hands—that property is entrusted to his honour and his judgment. I say to all this that the man of business, or the manufacturer, often, by his skill or his wisdom, wields the destinies of a community, or even a nation. Civilization depends more than ever for its development and progress on the skill, the intelligence, the culture of the people; and art, which refines and elevates, and science, which enlightens and liberalizes the mind, are as essential to the successful artizan and the man of business at least, as Latin and Greek, which constitute the standards of a genteel education, are to the professional man.

* * * * * * *

"Now these are some of the characteristics of the age that make self culture a matter of personal interest and safety. If you do not hasten to fill up the gaps made by early defects, your chances of self-advancement are lost. In fact there are no chances in the case at all. If you put off this work of self culture until the time when it is wanted, the game is up with you, the chance is lost for ever. 'There is a tide in the affairs of men, which, taken at the flood, leads on to fortune'—but he only can avail himself of that tide who stands on the shore with skiff and sail and helm set, and, above all, with the skill to guide his barque in the direction of the tide. In this, as in the more momentous concerns of the undying spirit,—

'The readiness is all.'

"No doubt there are many disadvantages connected with adult studies—many obstacles in the way—many discouragements to chill the hopes and sap the resolutions of him who has started on so good a work. Many enter on the effort of self-culture fascinated by the romance of knowledge. There is around the student's life a poetry that captivates ardent and hopeful minds. When we hear of the success of self-taught men we are apt to be fired with a zeal to walk in their footsteps—we hope to reach the same lofty eminence—we do not count the cost, nor measure the trials, and when we enter on the work we find it no royal road, but one of effort and difficulties. * * * The romance will come to the earnest worker, the noble sense of power as the assured reward of him who with a brave spirit patiently works, and he who is faithful to the end shall win the crown."

At the close of Mr. Lewis' lecture, Monsieur Pernet, teacher of the French class, delivered a short but very interesting address on the French Language, showing the advantages attending its acquirement, especially to commercial men and artizans in this Province, where the French language is principally spoken by a large section of its population.

Votes of thanks were unanimously passed to both Mr. Lewis and Mr. Pernet, for their very interesting addresses,

CANADIAN PATENTS.

PATENTS OF INVENTION,

As issued by the Bureau of Agriculture and Statistics, Quebec, 15th October, 1863.

Valentine Mitchell, jun., of the township of Cavan, in the county of Durham, machinist and farmer, for

"A Wood Cutting Machine."—(Dated Jan. 12, 1863.)

Thomas Webster, of the village of Brampton, in the county of Peel, accountant, for "Improved Feed Motion for Straw Cutters."—(Dated Jan. 12, 1863.)

Aaron Hawley Scott, of the township of Dereham, in the county of Oxford, cabinet maker, for "A Table Leaf Supporter."—(Dated January 12, 1863.)

Joel Hughes, of the township of West Gwillimbury, in the county of Simcoe, farmer, for "A Cheese Press, to be known as Hughes' Double Cheese Press." (Dated January 12, 1863.)

Richard H. Oates, of the city of Toronto, in the county of York, millstone manufacturer, for "A Vertical Post Rising Clothes Dryer."—(Dated January 12, 1863.)

John Aikman, of the township of North Norwich, in the South Riding of the county of Oxford, farmer, for "A Rocker, for the more convenient pouring of liquids out of large pots or vessels."—(Dated Jan. 12, 1862.)

Sylvester Day, of the township of Brantford, in the county of Brant, farmer, for "A two-wheeled Hay Rake."—(Dated January 12, 1863.)

Jas. F. McEnery, of the city of Quebec, merchant's clerk, for "A Salt-water Vapour Condenser and Shipmaster's Fresh Water Supplier."—(Dated Jan. 17, 1863.)

Walter S. Wilson, of the city of Montreal, tinsmith, for "New and useful improvements in the construction of Smoothing Irons."—(Dated Jan. 21, 1863.)

Donald Murray, of the village of St. Mary's, in the county of Perth, carpenter, for "An improved Wood-Sawing Machine."—(Dated January 21, 1863.)

Geo. Campbell, of the city of Toronto, blacksmith, for "A Lady's Skirt Lifter."—(Dated Jan. 22, 1863.)

Oscar F. Shafer, of the village of Thamesford, in the county of Oxford, nurseryman, for "A Bag-holding and Weighing Machine."—(Dated Feb. 4, 1863.)

Levi Willson McCormick, of the township of West Flamborough, in the county of Wentworth, wheelwright, for "A Root Seed Drill.—(Dated Feb. 4, '63.)

Thomas Penton of the township of South Dumfries, in the county of Brant, yeoman, for "A Regulating Seed Drill."—(Dated Feb. 4, 1863.)

William Sutton, of the town of Brantford, in the county of Brant, machinist, for "An improved Grain Drier."—(Dated Feb. 5, 1863.)

Richard Healy, of the village of Bedford, in the county of Missisquoi, machinist, for "A Machine for Rossing Tan Bark."—(Dated Feb. 5, 1863.)

Avery D. Bacon, of the township of Malahide, in the county of Elgin, mason, for "An improved Beehive."—(Dated Feb. 11, 1863.)

Damase Benoit, of the town of St. Hyacinthe, machinist, for "A new and useful Gas Purifier and Regulator."—(Dated March 5, 1863.)

Joseph Marks, of the city of Montreal, mechanical engineer, for "An Anti-Incrustation Powder, for the removal of silica deposits off the internal surface of steam-generating boilers."—(Dated March 5, 1863.)

John Brown, of the township of Waterloo, in the county of Waterloo, miller, for "Improvements in Machinery for the manufacture of Flour."—(Dated March 11, 1863.)

Burton Sanderson, of the township of Stanstead, machinist, "A Bit for Tapping Sugar Maples."—(Dated March 13, 1863.)

Robert Bloomfield, of the City of Montreal, engine driver, and Wm. Gothwaite, of the city of Montreal, machinist, for "An improved Steam Valve Piston."—(Dated March 13, 1863.)

John Pettingill, of Coaticook, in the county of Stanstead, machinist, for "A new and useful improvement in Machines for digging potatoes."—(Dated March 13, 1863.)

Alonzo Henry Parsons, of the village of Stanstead Plain, in the county of Stanstead, carpenter and joiner, for "A new and useful Beehive, to be called the Improved Platform Beehive."—(Dated March 16, 1863.)

Alex. Ross, of the city of Montreal, optician, for "A Thermo-Electric Fire-Alarm and Heat-Detector." (Dated March 16, 1863.)

John R. Martin, of the town of Cayuga, in the county of Haldimand, barrister and attorney-at-law, for "An improved Field Roller."—(Dated March 17, 1863.)

Samuel Trethewey, of the village of Muskoka Falls, in the county of Victoria, engineer, for "A Balance Piston."—(Dated March 18, 1863.)

Henry W. Ostrom, of the township of Sidney, in the county of Hastings, yeoman, for "A Broadcast Grain Sower."—(Dated March 21, 1863.)

Wm. Glendillen, of the township of North Oxford, in the county of Oxford, cabinet maker, for "A Washing Machine."—(Dated March 21, 1863.)

Thomas Brookes, of the city of Toronto, fruiterer, for "A Funnel Measure."—(Dated March 21, 1863.)

Eli Shupe, of the village of St. George, in the township of Dumfries, in the county of Brant, machinist, for "A Combined Reaping and Mowing Machine."—(Dated March 23, 1863.)

Edward Payne, of the town of Cobourg, in the county of Northumberland, gentleman, for "Improvements in the apparatus or machinery used in the process of distilling thickwash or beer."—(Dated March 24, 1863.)

Willet D. Bowerman, of Whitby, in the county of Ontario, clothier, for "A Friction Roll and Roping Belt Box and Gudgeon."—(Dated March 24, 1863.)

John W. W. Tindall, late of Liverpool, in England, now a resident of Sarnia, chemist, for "A process of Deodorizing Paraffine, Coal, Pitch, Rock and other like Oils and Hydro-Carbons."—(Dated Mar. 24, '63.)

George H. Fourdrinier, of the village of Lyn, in the county of Leeds, gentleman, for "A Revolving Dessicator, for drying and improving Grain and for manufacturing Malt."—(Dated March 24, 1863.)

James Arless, of the city of Montreal, ship joiner, for "A new and useful Steam Gangway for loading and unloading vessels."—(Dated March 30, 1863.)

Wm. D. McGloghlan, of Newbury, in the county of Middlesex, watchmaker, for "A Boot, Shoe and Stove Polisher."—(Dated March 30, 1863.)

Alex. Fleck, of the city of Montreal, iron founder, for "Improvements in the Tyler Water Wheel."—(Dated March 31, 1863.)

William H. Sutton and James J. Gibson, both of the town of Brantford, county of Brant, machinists, "A Combined Hot and Cold Air Mechanical Grain Drier." (Dated April 6, 1863.)

George Mitchell, of the city of Toronto, gentleman, for "A Self-Inflating Water-proof Floating Bag, intended for Mail and other purposes."—(Dated April 6, 1863.)

Michael Burkholder, of Pickering, in the county of Ontario, yeoman, for, "An improved Wheeled Steel-toothed Horse Rake."—(Dated April 8, 1863.)

Michael North, of the town of Brantford, in the county of Brant, builder, for "An Economical Drum Heater."—(Dated April 10, 1863.)

William S. Arnold, of the town of Chatham, in the county of Kent, carpenter, "An improvement in a Wood-Sawing Machine, being a crank attached to a pitman of the saw, and a self-adjusting guage for raising or lowering the saw when in motion."—(Dated April 10, 1863.)

William Randall, of the township of Uxbridge, in the county of Ontario, carpenter, "An improvement in Mechanical Movements for regulating the speed of Machinery."—(Dated April 10, 1863.)

William Randall, of the township of Uxbridge, in the county of Ontario, carpenter, "An improvement in Straw Cutters, called the Eccentric Straw Cutter." (Dated April 13, 1863.)

Freeman C. Noxon, of Bloomfield, in the county of Prince Edward, farmer, for "An improved Cultivator."—(Dated April 17, 1863.)

Wm. C. Richardson, of the city of Quebec, chemist and druggist, for "A Cough and Cold Mixture."—(Dated April 20, 1863.)

Edward L. Byron, of the township of Compton, in the county of Compton, mechanic, for "A new and useful improvement on a Reel and Swift combined."—(Dated April 24, 1863.)

Wm. H. Henderson, of the town of Brockville, in the county of Leeds, machinist, for "A Churn."—(Dated April 28, 1863.)

Edward Douson, of the township of Clarke, in the county of Durham, yeoman, for "A Root Cutter."—(Dated May 13, 1863.)

John S. Robinson, of the city of London, in the county of Middlesex, oil refiner, for "A Tanner's Oil." (Dated May 19, 1863.)

Charles Jones, of the village of Palermo, in the county of Halton, assignee of Samuel Morse, of the town of Milton, in the county of Halton, machinist, for "Improvements to Fraser's Churn."—(Dated May 19, 1863.)

Donald Bethune, of the town of Port Hope, in the county of Durham, esquire, for "A Ship Collision Guard."—(Dated May 19, 1863.)

Robert T. Sutton, of the town of Lindsay, in the county of Victoria, mechanic, for "A machine or apparatus for drying and cooling grain."—(Dated May 19, 1863.)

John Montgomery, of the city of Toronto, gentleman, for "A Solution for the prevention of fire, and the preservation of wood from decay."—(Dated 21st May, 1863.)

Edward Courtois, of the town of Iberville, machinist, for "A Portable and Self-adjusting Fence."—(Dated June 1, 1863.)

Harry Seymour, of the city of Montreal, trade chemist, for "A Chemical Compound White and Body Paint."—(Dated June 1, 1863.)

Gaetano Baccirini and Pasquale Filippi, of the city of Montreal, cement manufacturers, for "An improved Portland Cement."—(Dated June 1, 1863.)

Maurice Mahler, of the city of Montreal, furrier, for "A Seamless Hat."—(Dated June 1, 1863.)

Samuel J. Ward, of the town of Belleville, in the county of Hastings, machinist, for "A Roller and Wash Board."—(Dated June 3, 1863.)

Hugh Hennessey, of the city of Hamilton, in the county of Wentworth, machinist, for "A Self-acting Coupler, for coupling railway cars."—(Dated June 3, 1863.)

John Nelson, of the town of Napanee, in the counties of Lennox and Addington, machinist, for "A mode of constructing wrought iron Thrashing Cylinders."—(Dated 3rd June, 1863.)

Richard Sylvester, of the township of Scarborough, in the county of York, cradle manufacturer, for "An improved Cradle."—(Dated 3rd June, 1863.)

Josiah James, of Whitchurch, in the county of York, machinist, for "An Improvement in Pumps."—(Dated June 4, 1863.)

Geo. Bender, Zenas B. Lewis and Matthew Milward, of the village of Clifton, in the county of Welland, gentlemen "Improvements in Wood-Sawing Machines."—(Dated June 4, 1863.

Archibald McKillop, of the township of Inverness, in the county of Megantic, farmer, for "A Suspension Gate and Barn Door."—(Dated June 8, 1863.)

Randolph P. Cory, of Hillier, in the county of Prince Edward, for "An Apple Grinder."—(Dated June 9, 1863.)

O. H. Ellsworth, of the village of Bayfield, in the county of Huron, minister, for "A Lever Power or Endless Inclined Plane."—(Dated June 9, 1863.)

Francis T. Richmond, lumber merchant, and Wm. Thomas, carpenter, both of the city of London, in the county of Middlesex, for "The Locomotive Cross-cut Sawing Machine."—(Dated 9th June, 1863.)

Richard D. Chatterton, of the town of Cobourg, in the county of Northumberland, esquire, for "A Platform Elevator, for loading heavy bodies, such as wood, coal, freight, &c., into railway trucks, tenders or other carriages."—(Dated June 15, 1863.)

Richard D. Chatterton, of the town of Cobourg, in the county of Northumberland, esquire, for "A Railway Buffer and Collision Brake, called the Cobourg Railway Train Protector."—(Dated June 16, 1863.)

Richard B. Bennett, of the town of Belleville, in the county of Hastings, brewer, for "An improved Stainton Plough."—(Dated June 17, 1863.)

Israel Kinney, of the town of Brantford, in the county of Brant, carriage maker, for "A new and useful Motive Power."—(Dated June 17, 1863.)

John Walmsley, of the village of Berlin, in the county of Waterloo, farmer and waggon maker, for "Improvements in Agricultural Implements for pulverizing and cleaning the soil, and casting seed and other substances thereon."—(Dated June 18, 1853.)

William Thompson, of Ashburnham, in the county of Peterborough, gentleman, for "The Victoria Lever Power for Hand Machinery."—(Dated June 22, 1863.)

John C. McDougall, of Fort Erie, in the county of Welland, machinist, for "New and useful improvements in Harvesting Machines."—(Dated June 22, 1863.)

Geo. Campbell, of the City of Toronto, blacksmith, for "A Galvanic Magnetic Toilet Comb."—(Dated June 25, 1863.)

ABRIDGED SPECIFICATIONS OF BRITISH PATENTS.

185. W. Clark. *Improvements in preparing and obtaining photogenic pictures or representations.* A communication.) Dated January 21, 1863.

This invention relates to a photogenic process whereby a positive image may be obtained direct from a positive by the employment of ammonical salts, combined with the organic matter, and also by the precipitation of the following metallic solutions, viz.:—Salts of silver, copper, iron, nickel, mercury, gold, palladium, platina, lead, or tellurium, which are precipitated by means of hydrosulphates of ammonia, potash, or soda. The salts of silver, bismuth, or lead are precipitated by means of hydro-sulphuric acid; and the salts of mercury, by hydro-chlorate of tin. The salts of bismuth may also be precipitated by means of nut galls, gallic or tannic acids; and the salts of iron, by means of the same agents last mentioned. The inventor takes for example, the sulphate of iron precipitated by means of tannic acids.

251. R. Ward. *Improvements in locking up or fastening forms of type or other printing surfaces.* Dated January 28, 1863.

In place of a series of "quoins" or loose wooden wedges acting upon a "side-stick" or "foot-stick" the patentee employs two (though it is not absolutely necessary to use two, as the result may be accomplished by one) side-sticks or foot-sticks, with their beveled edges turned towards each other, and between these he places a continuous wedge (or a series of united wedges forming one piece) of iron or other suitable material or materials, which is fixed and kept in its place by means of a screw acting upon a square or suitably-shaped piece of iron placed in the corner of the chase, so that it will bear the pressure of the screws of both the bottom and side wedges.

256. W. Clark. *Improvements in the means and apparatus for copying and reproducing sculpture and other objects of art.* (A communication.) Dated January 28, 1863.

This invention relates to an improved process termed photo-sculpture, which is based on the employment of photography in connection with the pantograph. By this improved process the patentee can produce sculpture exactly similar to the model, whether living or otherwise, with much greater rapidity, at a less cost, and by the aid of persons having no previous knowledge of the art. He can further lessen the time necessary for the sitting, and produce sculpture of larger or smaller dimensions than the original, or in any other proportions desired. This invention cannot be described without reference to the drawings.

267. J. Pouncy. *Improvements in obtaining, transferring, and printing from photographic pictures or images, also in preparing materials for same.* Dated January 29, 1863.

The principal feature of this invention consists in the employment of a sensitive or sensitized ink or composition on which pictures or images may be produced by the agency of light, and which may be transferred or printed from in the manner described.

376. R. A. Brooman, *Improvements in photographic apparatus.* (A communication.) Dated February 11, 1863.

This apparatus enables the manipulator to operate in full light upon damp collodion, to sensitize the glass, and to finish the proof in the light. The apparatus does not alter the negative now used, but it serves as an auxiliary to it. In the apparatus the following characteristic elements are combined: —The employment of two verticle and independent bath vessels, arranged to allow of the glasses being easily plunged therein; one vessel, containing the bath of silver for sensitizing the damp collodion, may be of gutta percha, hardened rubber, or other material having no action on the bath; the other containing the iron bath for developing the picture, should be of yellow or orange coloured glass; if made of any other material, it should be lined with yellow coloured glass. There is a frame for holding the glasses to be exposed, capable of being opened and closed at bottom by withdrawing or inserting a sliding bar. There is a second frame for holding the collodionized glass in the former frame which second frame is styled the plunging-frame, because it is used for introducing the glass into the bath vessels, entering also with it; it is insulated from the first frame, and may be passed through it; a piece of catgut is attached to the plunging frame to raise and lower it into and out of the baths.

594. G. Price and W. Dawes. *Improvements in burglar proof safes and strong-room doors and frames.* Dated March 3, 1863.

The patentee claims—1, the method or principle of dispensing with the large lock and bolts upon the door, and using in lieu thereof the moveable security portions or "works" in the body or frame of the safe or door, as described; 2, the use, application, and methods of employing hard pig or white pig iron for the purpose of rendering safes and strong-room doors drill proof; 3, the method of protecting the interior of the small lock by electro-coating from the action of acids.

ALPHABETICAL LIST OF THE PRINCIPAL ENGLISH PUBLICATIONS FOR THE MONTH ENDING SEPTEMBER 30, 1863.

Albitès (Achille) How to speak French: or, French and France, 7th edit., 12mo...	0	5	6	*Longman.*
Bowes (Arthur) Practical Synopsis of English History, 4th edit., 8vo..................	0	2	0	*Bell & Daldy.*
Burn (Robert S.) Self-Aid Cyclopædia, for Self-Taught Students, &c, 8vo...........	0	10	6	*Ward & Lock.*
Civil Service of India Examination Papers, July, 1863, folio............................	0	2	6	*Stanford.*
Dana (James D.) Manual of Mineralogy, new edit., revised, cr. 8vo.....................	0	7	6	*Trübner.*
Day (Francis) Land of the Permauls; or Cochin, its Past and Present, 8vo..........	1	5	0	*Trübner.*
Fairbairn (W.) Treatise on Mills and Millwork, Pt. 2, Machinery of Transmission 8vo	0	16	0	*Longman.*
Gamgee (John) Our Domestic Animals, in Health and Disease, Third Division cr. 8vo	0	6	0	*Simpkin.*
Glen (W. C.) Public Works (Manufacturiag Districts) Act, 1863, &c., 12mo.........	0	3	6	*Butterworths.*
Handbook (The) of Manly Exercises, by "Stonehenge," 18mo........................	0	0	6	*Routledge.*
Hutchinson (Simon) Practical Instructions on the Drainage of Land, 8vo............	0	0	9	*Simpkin.*
Imperial Dictionary (The) of Universal Biography, 5 vols. imp 8vo.....................	5	10	0	*Mackenzie.*
Jenner (Edward) On the Origin of the Vaccine Inoculation, 4to..........................	0	1	0	*Elfick.*
Loudon (J. C.) Encyclopædia of Cottage, Farm, and Villa Architecture, new ed., 8vo	2	2	0	*Longman.*
Magneopathy, the Philosophy of Health, 8vo..	0	1	0	*Bentley.*
Men who were Earnest: a Series of Biographical Studies, new edit., post 8vo......	0	3	6	*Hogg.*
Miller (William A.) Elements of Chemistry, Part 1, Chemical Physics, 3rd edit., 8vo	0	12	0	*Parker & Son.*
Molesworth (G. L.) Pocket-Book of Useful Formulæ and Memoranda, 3rd ed., obl. 32mo	0	4	6	*Spon.*
Murphy (Wm.) Historical and Statistical School Atlas, 4to..............................	0	2	0	*Menzies.*
Royal Horticultural Society, Book of	1	11	6	*Society.*
Thomson (Spencer) Dictionary of Domestic Medicine & Surgery, 25th th., cr. 8vo.	0	7	0	*Griffin.*
Tate (A. Norman) Petroleum and its Products, cr. 8vo	0	2	6	*J. W. Davies.*
Wood (Rev. J. G.) Our Garden Friends and Foes, cr. 8vo.	0	7	6	*Routledge.*

BOOKS ADDED TO THE FREE LIBRARY OF REFERENCE.

Shelf No.		
B. 19 and 20.	Engineer and Machinist's Assistant: being a series of Plans, Sections, and Elevations of Steam Engines, Spinning Machines, Mills for Grinding, Tools, &c., &c.; with Descriptions and Instructions for Drawing Machinery, folio, by David Scott, Engineer	*Blackie & Son.*
D. 44	Book of Art: Cartoons, Frescoes, Sculpture, and Decorative Art, as applied to the new Houses of Parliament (English) and to Buildings in General; with an Historical Notice of the Exhibition in Westminster Hall, and Directions for Painting in Fresco, illustrated by Engravings on Wood, 4to., 1846	*F. Knight Hunt.*
G. 82	Complete Pronouncing Gazetteer, or Geographical Dictionary of the World, by J. Thomas and T. Baldwin, 8vo., 1863	*Lippincott.*
H. 55	The Weather Book: a Manual of Practical Meteorology, 8vo., 1863	*R'r Adm'l Fitz Roy.*
I. 76	Cyclopædia of London, illustrated by 36 Plates of its Parks, Palaces, Public Buildings, Bridges, Literary Institutions, Law Courts, Churches, Railway Stations, &c., &c., 8vo., 1851	*Charles Knight.*
I. 77	Dictionary of Universal Information: comprising Geography, History, Biography, Mythology, Bible Knowledge, Chronology; with the Pronunciation of every Proper Name	*S. O. Beeton.*
J. 40	Canadian Gazetteer: comprising Statistical and General Information respecting all parts of the Upper Province, or Canada West; with illustions and map, 12mo., 1846	*Wm. H. Smith.*
K. 36	Manual of Mineralogy, including Observations on Mines, Rocks, Reduction of Ores, and the application of the Science to the Arts. 260 illustions, 12mo., 1859	*James D. Dana.*
K. 37	Perfumery: its Manufacture and Use, with Instructions in every Branch of the Art, and Recipes for Fashionable Preparations; from French Authorities, with Additions, 12mo., 1853	*C. Morfit.*
M. 45	British Wine Maker and Domestic Brewer: a complete practical treatise on the Art of making British Wines, Liquors, Ales, Beer and Porter; containing also a Supplement on the Rhubarb Plant as the basis for Wines, 12mo., 1849	*W. H. Roberts.*
	The Illustrated London Almanac for 1864: containing a large amount of Information on the Laws, Government, and Public Institutions of Britain	*Pamphlet.*

Parliamentary Journals and Sessional Papers, and the usual British and American Scientific Journals.

Selected Articles.

ON SPECTRAL ANALYSIS.

The following paper was read before the last meeting of the British Association by PROFESSOR PLUCKER:—

It is generally admitted now, that every gaseous body rendered luminous by heat or electricity sends out a peculiar light, which, if examined by the prism, gives a well-defined and characteristic spectrum. By such a spectrum, by any one of its brilliant lines whose position has been measured, you may recognize the examined gas. This way of proceeding constitutes what is called spectral analysis, to which we owe, until this day, the discovery of three new elementary bodies. In order to give to spectral analysis a true and certain basis, you want the spectrum of each elementary substance. Most recently, some eminent philosophers, in examining such spectra, met with unexpected difficulties, and doubts arose in their minds against the new doctrine. These doubts are unfounded. The fact is, that the molecular constitution of gases is much more complicated than it has been generally admitted till now. The spectra, therefore, always indicating the molecular constitution of gases, ought to be more complicated also than it was thought at first. By these considerations, a new importance, a rather physical one, is given to spectral analysis. You may recognize, by the spectrum of a gas, not only the chemical nature of the gas, but you may also obtain indications of its more intimate molecular structure—quite a new branch of science. Allow me now to select out of the results already obtained two instances only. Let me try to give what I may call the history of the spectra of two elementary bodies—of sulphur and nitrogen. In order to analyze by the prism the beautiful light produced by the electric current, if it pass through a rarified gas, I gave to the tube in which the gas is included such a form that its middle part was capillary. Thus I got within this part of the tube a brilliant film of light, extremely fitted to be examined by the prism. The date of my first Paper on this subject is the 12th of March, 1858. After having provided myself with apparatus more suited to my purposes, I asked, about a year ago, my friend, Prof. Hittorf, of Münster to join me in taking up my former researches. The very first results we obtained in operating on gases of a greater density opened to us an immense field of new investigation. We found that the very same elementary substance may have two, even three, absolutely different spectra, which only depend on temperature. In our experiments we made use of Ruhmkorff's induction coil, whose discharge was sent through our spectral tubes. In order to increase at other times the heating power of the discharge, we made use of a Leyden jar. Now, let us suppose a spectral tube, most highly exhausted by Geissler's mercury pump, contains a very small quantity of sulphur. The discharge of the coil will not pass through the tube if it do not meet with ponderable matter, either taken from the surface of the glass, or, if the discharge be very strong, by the chemical decomposition of the glass. In heating slowly the tube by means of a lamp, in order to transform a part of the sulphur into vapour, all accidental spectrum, if there be one, will disappear, and you will get a pure and beautiful spectrum of sulphur. I supposed the Leyden jar not to have been interposed. If you now interpose it, the spectrum just spoken of will suddenly be replaced by a quite different one. We were generally led to distinguish two quite different classes of spectra. Spectra of the first class consist in a certain number of bands, variously shadowed by dark traversal lines. Spectra of the second class consist in a great number of most brilliant lines on a dark ground. Accordingly, sulphur has one spectrum of the first class and another one of the second class. You may as often as you like obtain each of these two spectra. In operating on a spectral tube, containing nitrogen at a tension of about 50 millimétres, you will, without the Leyden jar, get a most beautiful spectrum of the first class. After interposing the jar, a splendid spectrum of the second class will be seen. But here the case is more complicated yet. The above mentioned spectrum of the first class is not a simple one, but it is produced by the superposition of two spectra of the same class. Ignited nitrogen, at the lowest temperature, has a most beautiful colour of gold. When its temperature rises, its colour suddenly changes into blue. In the first case, the corresponding spectrum is formed by the less refracted bands extended towards the violet part; in the second case, it is formed by the more refracted band of the painting extended towards the red. Nitrogen, therefore, has two spectra of the first class, and one spectrum of the second class. The final conclusion, therefore, is that sulphur has two, nitrogen three, different allotropic states. It may appear very strange that a gaseous body may have different allotropic states—*i.e.*, different states of molecular equilibrium. It may not appear, perhaps, more strange that a substance, hitherto supposed to be an elementary one, may really be decomposed at an extremely high temperature. From spectral analysis there cannot be taken any objection that sulphur and nitrogen may be decomposed. Chloride of zinc (or cadmium), for instance, exhibits two different spectra. If heated like sulphur, and then ignited by the discharge of Ruhmkorff's coil, you will get a beautiful spectrum either of cholrine or of the metal, if either the Leyden jar be not interposed or be interposed. There is, in this case, a dissociation of the elements of the composed body in the highest temperature, and re-composition again at a lower temperature. You may consider the dissociation as an allotropic state, and, therefore, I may make use of this term as long as the decomposition be not proved by the separated elements.

KNIVES AND RAZORS.

We confine ourselves exclusively to the making of table and spring knives and razors. Nothing but the best Swedish iron, imported direct from the mines, principally from Dannemora, is used in the factory we are about to examine for the manufacture of the blades. The iron is converted in the usual way into steel, which is then double-sheared for table knives, and fused and cast for spring knives and razors. By double-shearing the steel, a better and sharper edge is obtained for table cutlery than cast steel would give.

"The blades are forged from the steel bars in a number of small rooms, containing each a fire-place or hearth, a trough to hold water, and another trough for the coke, which is specially prepared for its intended use; also an anvil and hammer, and other tools. Two persons are engaged in each room: the one is called the maker or forger, the other the striker. The forger buries the end of the steel bar in the fire to the extent required, and works the bellows to raise the heat to the proper degree. When the end of the bar has thus been duly heated, it is brought to the anvil, where it is fashioned by the striker with very few strokes into a blade of the required shape. This is cut off the bar, which is then again heated for a renewal of the process. The cutting part of the blade, thus rudely formed, is welded to a piece of iron which forms the shoulder or bolster (the part rising round the edge of the handle of the knife). To make the bolster of the size and shape required, and to give it neatness and finish, it is introduced into a die by the side of the anvil, and a swage placed upon it, to which a few smart blows in the desired direction are given by the striker. The die and swage are called prints by the work-people. Besides the bolster, the part which fastens into the handle, technically termed the tang, is also shaped from the piece of iron welded on to the cutting part of the blade. After the bolster and tang have been properly finished, the blade is heated again, and then well hammered on the anvil. This operation, which is termed smithing, requires particular care and attention, as our courteous conductor informed us. It is intended to consolidate the steel, and to render it brighter. The next process the blade has to undergo is that of marking. This is done with a broad punch made of the very best and hardest steel, and having the name and corporate or trade mark of the firm carved on the bottom end or point. The blade is heated to a dull red (worm red, as it is termed by the workmen), and the mark cut in on one side of the blade with the punch by a single blow of the hammer. The mere name of the firm would be no great protection against that most detestable system of piracy which is unfortunately but two often pursued even in this country; but the corporate mark granted by the Cutler's Company affords effective protection against piracy by English houses, as the penalties attached to the offence are rather too heavy to be lightly incurred. Of course, even this cannot altogether prevent base imitations on the part of Continental and American knaves [the English proof-reader of the *Ironmonger* must have made a mistake here; the author certainly meant *knives*. The courtesy of the editors of the *Ironmonger* is, of course, proof against intentional insult.—Eds. *Sci. Amer.*], who foist their worthless rubbish upon the public abroad by forging the name and trade mark, and imitating the labels and package of eminent Sheffield firms, like Messrs. Mappin, Rodgers, Wostenholm, and many others.

"Now comes the most important process of all, viz., the hardening and tempering of the blades. Upon the effectual performance of these depends the practical value of the articles. The Sheffield workmen have justly and deservedly acquired the very highest reputation for peculiar skill in this most difficult department of the cutlery business. The hardening of the blade is effected by heating it to bright redness, then plunging it perpendicularly into cold water, which operation renders it extremely hard, but at the same time very brittle, which is an inconvenience, of course, requiring to be remedied. This is done by the process of tempering. To this end the hardened blades are first rubbed with finely-powdered sand, to remove scales, &c., from the surface; they are then placed on an oblong tray made of steel, and on this exposed to the fire until they are of a bright blue tint. The workmen judges of the proper degree of tempering entirely by the color; and the utmost attention is bestowed upon this point, to insure the most perfect uniformity in this respect. The hardened and tempered blades are then submitted to the manager's inspection, who applies various tests to them, and rejects any that may turn out imperfect in any one point.

"We now follow the blades that have been examined and passed by the manager to the grinding mill, or as it is technically termed, the wheel. Each separate shop in which the grinder's work is called a hull. The grinding is done on stones of various qualities and sizes, according to the kind of articles to be ground. The rough-grit stones come mostly from Wickersley, near Rotherham; the finer and smoother grained stones, and the so-called "whitning" stones, come mostly from the more immediate neighborhood of Sheffield. The blades of table knives are ground or wet stones, the grinding stone being suspended, to that end, in an iron trough filled with water to a sufficient height to make the surface of the fluid just touch the face of the stone. A flat stick is used by the grinder to keep the blade pressed to the surface of the stones. The ground blades are then glazed, which simply means that a higher degree of lustre and smoothness is given them by grinding on a tool termed a glazer. This consists of a wheel made of a number of peices of wood put together in such a manner that the edge or face always presents the end way of the wood, which is done to preserve the circular shape by preventing contraction of the parts. The grinding face of the wheel is covered with so-called emery cake, which consists of a composition of beeswax, tallow, and emery. The glazing wheels have a diameter of four feet. The tang of the blade is stuck into a temporary handle, to facilitate the operation. The last process to which the blades of table knives are subjected in the grinding mill is that of polishing; this is done on circular pieces of wood covered with buff leather, with a coat of finer emery (flour emery) composition upon it, which are made to revolve with much less velocity than the grinding stone and the glazers.

The ground blades are again taken to the manager, who applies several very severe tests to them, to try their temper and edge.

We must now pay a short visit to the handle and hafting department. Knife handles are made of horn, ivory, ebony, silver, German silver, mother of pearl, &c. Two sorts of ivory are principally used—the Egyptian and the African: the latter is the more beautiful and transparent of the two, the Egyptian looking more like horn. The tusks are sawn in appropriate lengths, which are then cut by a small circular saw into handles of the required size. The handles are properly filed, and occasionally also carved or fluted in different patterns. A variety of files are used for these purposes, such as flat files, threading files, hollow files, half-round files, &c. The handle is then bored to receive the tang. The bolster of the blade having been properly filed, the tang is inserted into the bore, and fixed in by cement in the usual way. It is afterwards further secured by a German silver pin passing through the handle and tang.

The silver and German silver handles are stamped in dies. The mother of pearl handles are carved or fluted in different patterns.

The knives thus finished by the hafter are now taken once more to the manager, to undergo a final examination preparatory to their removal to the warehouse.

Razor Department.

Razors should be made of the best cast steel, properly tilted, hammered and rolled. The value of such steel is about £60 per ton. There is no difference in the several sorts of razors as regards the quality of the steel, the same material being used for the one-shilling, two-shilling, three-shilling, and much higher priced razors. The forging of razors is performed by a foreman and striker in the same way as in making the blades of table knives. The bars or rods, as they come from the tilt and rolling mill, are about half an inch broad, and no thicker than sufficient for the back of the razor. The anvil on which the razor blades are forged is rounded at the sides by dexterously working the blade on the rounded edge of the anvil; a concave surface is given to the sides, and the edge part thus made thinner, which saves the grinder a deal of labour. The blade having been cut off the bar, the tang is formed by drawing out the steel. The blade is then properly hardened and tempered. The last and most important process which the razor-blade has to undergo is that of grinding. The difference in the prices of blades, made all of them of the same material, is owing entirely to the circumstance that stones of much smaller diameter are used for grinding the higher-priced blades, and much more time and labor are given to the operation than is the case with the cheaper sorts. Thus, the best kind of razor-blades are ground hollow on stones measuring one and seven-eighths to two inches in diameter. A hollow-ground razor-blade of this kind may be said to be all edge, and will hardly ever require to be ground again. A very excellent and serviceable article is produced by grinding on a six-inch diameter stone. The two-shilling razors (50 cents American money) are ground on seven-inch diameter stones. The difference in the labor is very considerable. A grinder will turn out per week from twenty to twenty-four dozen of the common shilling razors, whilst he can manage only about five dozen a week of the better, and only a couple of dozen of the best sort.

The razors ground on a six-inch diameter stone are more suitable for hard, those ground on a two-inch diameter stone for soft beards. The more common sorts are, after grinding, lapped on the glazer, and the backs glazed and polished. The three-shilling blades are polished first, then drawn over a wood buff. Razor-blades are, in a great measure, ground on dry stones, which unfortunately causes the atoms of stone and steel to fly about freely, to the great injury of the workmen, and imparts to the whole place, where the operation is carried on, a peculiar brownish-yellow hue. The minute particles of stone and metal flying about are inhaled by the workmen, and, lodging in the lungs, produce asthma, consumption and other fatal diseases. This most dangerous feature of the dry-grinding business has, however, been very considerably modified of late by the introduction of an apparatus which, in a great measure, protects the grinders from the dust flying from the stones. This apparatus, which we saw at work at Messrs. Mappin's establishment, consists of a fan on the principle of a winnowing machine, with a flue to take away the dust from each of the stones in the room.

The difference in the price between the three shilling and the dearer razors in simply in the handles with which they are fitted, the blades being exactly the same in every respect. There are horn handles, ebony handles, plain and carved ivory handles, silver and German-silver handles, mother-of-pearl handles, &c. Some idea of the importance and extent of this branch of the cutlery business may be conceived from the fact that some 1,500 different patterns of razors are made in one factory.

There still remains now to visit one of the most important and most interesting departments of the Sheffield cutlery business, viz., that of the manufacture of

Spring Knives,

or knives that shut with a spring, to go in the pocket. The blades of spring knives are made of the best cast steel only. The ingot of steel, rolled to the required size, is placed in the hands of the forger or blade-maker, to be fashioned by him and the striker much in the same way as a table knife blade, only that the tang or joint part is cut off the steel bar along with the blade, instead of being made of iron welded on to the steel. Penknife blades are generally forged by a single hand, with a light hammer not exceeding three and a half pounds. The breadth of the striking part of the hammer does not exceed an inch, as a broader surface would not be suitable for striking so small an object as a penknife blade. In the manufacture of spring knives, the success depends in a very great measure upon the judgment and skill of the workmen who forms the blade under the hammer. The forged blade cut off the bar is taken first to the grinder for what is technically termed scorching, which means simply rough-grinding the tang or joint part. The blade is also chorled or nicked in the shoulder, to guard against its cracking in the subsequent operation of hardening. It is then taken to the marker's shop to be marked in the same way as the blade of a table knife. The little recess, called the nail-hole, or nail-mark is notched in, while the blade is still hot, by means of a chisel round on one side and flat on the other. The marked blades are now returned to the forge for the purpose of being hardened and tempered, which is effected much in the same way as with the blades of table-knives, only that the hardening heat is not raised to above a dull red heat, instead of to a bright red heat. In the subsequent process of tempering again, all depends upon the judgment of the workmen, spring knife blades being tempered variously according to the different purposes which they are intended to subserve. Thus, for instance, a whittling knife is tempered differently from a penknife, &c. The tempered blades are carefully straightened; they are then returned to the grinder's shop to have the proper edge given them, after which they, together with all the other portions necessary to make up the complete knife, also with bolsters, rivets, pins, &c., for fastening the whole together, are taken to the cutler's fitting department, the most important of all. Here the knife is made up or put together. There is separate set of parts required for every kind of knife made: and all the parts have the number of the pattern stamped upon them, to facilitate their being properly put together.

First and foremost there is the "spring," which constitutes the back of the knife. This is made of steel. It is cut out by a fly, then properly hardened by heating it to dull redness, and in that condition plunging it into cold water. It is now moistened with oil, which is then allowed to burn off in the fire. When the oil is gone off, the spring is considered to be properly tempered. Elasticity is given to it by filing; it is also filed down to the thickness of the blade for which it is intended, and bent out of the perpendicular, to give the requisite motion for the blade. It is rough-glazed on a leather-faced glazer, coated with glue and emery, and the inside of it is polished with a steel burnisher. The springs used in pocket-knives vary according to the number of blades.

Then there are the outer and inner scales, of which the former constitute the outer covering of the knife, whilst the latter form the small chambers in which the various blades fit. The outer scales are made of pearl, ivory, horn, shell, wood, or some other suitable material; the inner scales, of brass, iron, or German silver. The inner scales are hammered, to make them properly incline to the outer ivory scales. Dutch metal foil is placed between the ivory scale and the metal scale. The benefit of the Dutch metal interposed between the two scales is that it brings out the color, and imparts to the ivory the beautiful flush which it shows. The necessary holes are then drilled with a drill and bow in the scales, and also in the tangs of the blades. A longitudinal section is cut out from the ivory plate by drill and bow for the insertion of a name-plate which fits exactly into the aperture cut out, and is fastened with pins passing through holes drilled in. The scales are fastened together with German silver pins, and the nail notches are filed in. The spring is then placed with the blade fitted between the two double scales, and rough-filed level. The fitting and matching throughout require great judgment and nicety on the part of the cutler.

The fitting of the blade and spring is the most delicate part of the whole process, and requires great practical experience and the most careful and skilful manipulation. The blades are fitted in at right angles: they are taken out again and again, and it takes a good deal of filing, &c., to make them fit exactly as required. One of the principal points to be looked to, is to make the blade in shutting fall so that it does not come down upon the belly of the spring, as this, of course, would tend to take the edge off at the point of contact.

There are several branches of the cutlery business in which a few weeks' apprenticeship suffices to enable even boys to earn pretty good wages. But in the fitting department it requires an apprenticeship of full seven years to give a young man even a decent knowledge of his business.

On the occasion of our visit to one establishment, we saw a so-called double-box sporting knife in progress of fitting up. There were forty parts to be put together, the knife containing nineteen useful articles, such as a wood-saw, a cock-heel saw, a hollow gouge, a button hook, a nail-file, a pen-blade, a pocket-blade, a cork-screw, a punch, a gimlet, a sacking needle and another needle, a lancet, a picker, tweezers, a pair of scissors, and some other articles. All these articles were furnished ready-made to the fitter, with all other necessaries to put them together, yet we were apprized that it would take him ten days to finish the knife!

When matters have proceeded so far as above described, the blades and springs are sent back to the grinder, to have the tang and the outside of the springs polished; after which all the parts are fitted together, and the haft is finished. The bolsters are then carefully either squared or rounded by filing, as required. After this, the knife is buffed on a sand-buff, then finished on a gloss-buff with rotten stone and oil. The sand-buffing removes all the file-marks, and leaves a dead surface; the gloss-buff gives high polish and finish.

The fine grinding was formerly done on dry stones, which, however, was found to overheat and deteriorate the blades; they are now fine-ground on wet stones before lapping. The plain-ground pen-blades are ground hollow on grinding stones, the pocket blades are glazed on emery buffs. The shoulders of the blades are then ground on a lead lap, by which means they are got perfectly sharp and regular. A lead lap will give the very finest shoulder—finer, indeed, than could be obtained with any other material. The operation is termed lapping, most likely from the circumstance that lapidaries use a similar contrivance in their business. The blades, cleaned previously from grease by warming before the fire and wiping, are polished on leather and crocus; this is done by boys with very nimble fingers, who earn excellent wages at the work. After this the finished knives are taken to another department, where they are sharpened on Welsh hones. They are then finally cleaned, and sent to the warehouse,

Some notion of the immense extent to which this branch of the cutlery trade has grown at present, may be formed from the fact that one firm manufactures some 12,000 different patterns of spring knives, many of them, moreover, with several variations.—*Ironmonger.*

THE PERMANENT WAY.

Many thousands of pounds are annually wasted in the destruction of permanent way. We do not mean in legitimate wear and tear, but in that unnecessary deterioration which results from the employment of bad materials, the use of needlessly heavy rolling stock, and a faulty system of construction. Our railways date back some thirty years only; the first ten of these we may regard as having been devoted to experiment, from which certain rules were deduced to which our railway companies have adhered ever since, regarding apparently, further improvement as either unnecessary or unattainable. Economy has been sought for in the use of cheap rails, cheap sleepers, cheap chairs, &c., rather than in the adoption of those which, dearer at first, would, by their superior durability, effect a continuous annual saving in the outlay for maintenance. Indeed, this plan was carried to such an extent a very few years ago, that rails were little better than cast iron, being supplied at contract prices which effectually precluded their proper manufacture. Such rails have been known to break in two by being thrown from a waggon to the ground; while their duration, even when laid with great care, properly attended to, and nursed through their trials, rarely exceeded twelve months. This mode of proceeding was soon discovered to be simply ruinous; and a better class of rail, made almost without regard to expense, from good iron, properly piled and faggoted according to specification is gradually finding its way into general use, with the best results. The first cost of a track laid with good bars is really very little greater than one laid with those of inferior quality, a much smaller quantity of iron sufficing per mile of road; a 45 lb. rail, if good, being fully equal in every respect to one of 60 lb., if bad. A theoretically perfect track should be composed of rails absolutely hard on their wearing surfaces at least, incapable of deflection, and so laid that subsidence in any way, would be a mathematical impossibilty. So long as we consider the permanent way alone without reference to the rolling stock, no difficulty presents itself to the carrying out of these conditons with an extreme degree of accuracy. Heavy rails, very deep, and steeled on the tables, keyed or bolted into large chairs, bedded on solid blocks of stone carefully, rammed and ballasted, would supply just such a track. But the conditions under which engines and vehicles can alone proceed with success, introduce the element of elasticity, which stone blocks and heavy rails do not supply. And in the reconciliation of these contending points lies the real difficulty of the question. If we retain the stone blocks, wood, felt or india-rubber cushions must be introduced, either between the stone sleepers and the chairs, or between these last and the under surface of the rail. These cushions, in order to discharge their functions, must permit some play in the rail; and this once begun, cannot, by any arrangement yet adopted, be restrained within legitimate limits. Hence a very short time suffices to destroy the elasticity of the cushions. The spring of the system is then converted into jar and concussion, and the rapid destruction of the whole follows as a matter of course. Every plan which has been hitherto proposed for fixing rails to rigid sleepers has failed, and, in consequence, the employment of those which possess enough elasticity to prevent the necessity for separate springs, is all but universal. Timber has thus become as necessary for the formation of the substructure of a line of railroad, as iron for the superstructure; and the selection, preservation, and depositation of this rather perishable material becomes a matter of primary importance. Considered in the abstract, however, wood is anything but a good substitute for stone, its first cost and rapid decay rendering it very objectionable. Whatever system is adopted, when flat-footed rails rest directly on timber sleepers, they sooner or later sink into them by crushing the fibres. The holding-down bolts, screwed up tightly at first, soon become too long in consequence; and the rail, no longer kept in firm contact with the wood, springs up and down on the passage of every train, acting to some extent as a hammer on the already weakened fibres, which absorb water like a sponge. The under surface is scarcely better off. Seldom or never packed up equally, hollows form between the wood and the ballast, which becomes hardened by the temporary pressure of the sleeper when deflected by superincumbent weight. Water collects in these hollows, and the wood rots from its effects. The crushing of the fibres is aggravated by the longitudinal system, to such an extent, that thin cross-boarding between the sleeper and the rail-foot has been used with considerable advantage; but this introduces an item of expense, and is, after all, but a sorry expedient. In the absence of chairs, it is better in all cases to place the sleepers across the track. A tolerably good line may be made in this way on good ballasting. The Great Southern and Western of Ireland is laid with 92 lb. rails, on this system, without fishes. The Chemin de Fer du Nord has several hundred miles laid with 74 lb. rails—carefully fished however in the same way. Both these lines are worked by heavy engines—the Engerth Tank engines on the latter being, perhaps, the heaviest in the world, weighing 63 tons. Far more attention is paid to ballasting in France than here: the official report in 1857 showing that 17 per cent. of the whole cost of formation of the French railway had been for ballast. The cost of maintaining a cross-sleeper line laid with ∩ rails will bear favourable comparison with almost any of the other systems; but it is seldom so easy on the rolling stock as it should be.

The double-headed rail, combined with cast iron chairs, is so thoroughly habitual in Great Britain, that we need not dwell on the well-understood imperfections of a system with which our readers are familiar. Regard the matter as we will, we find the elastic sleeper arrangement defective, in that it entails the use of a destructible material, that it permits and indeed presupposes a considerable amount of deflection or yielding in the track without securing its proper elasticity, and that it is expensive both in first cost and maintenance.

When rails sink under the tread of the wheels, they add materially to the expenditure of power required for the transport of a given load. In this, we find one reason why light locomotives do more work—especially on a weak road—proportionately, than those which are heavier; the deflection of the rail producing a resistance corresponding with the ascent of a continuous incline. All attempts at the use of a rigid substructure have, however, hitherto failed; and we are, to all appearance, as far from possessing anything like the theoretically perfect permanent way which we have described at the commencement of this article, as we were in the days of Stephenson the elder.

Now this is the case solely because we have for the last thirty years endeavoured to fit the rails to the carriages, instead of the carriages to the rails.

We employ heavy vehicles, in the first instance, which so far injure the permanent way that it becomes unfit for those of lighter and perhaps weaker construction. Heavy carriages require heavy locomotives; and the permanent way is thus taxed to the utmost limit of endurance. Heavy rails are considered the only panaceæ, and expenses are increased without making the line really good. Starting with the conviction that elasticity between the wheel and the real support, the ballasting, is absolutely essential, it is not difficult to see that this may be as well attained by making the bearing of the wheel tyre elastic on the rim proper, as by making the bearing of the rail elastic on rigid supports; with this difference, that, whereas the latter is impossible from mechanical exigencies, the other is quite practicable. We must observe that no necessity exists for making the rail elastic, neither does there for making the tyre; it suffices that the rail rest on a spring cushion, and the same is true of the tyre. A case somewhat analogous may be found in the substitution of wheels for sledges. So long as the surfaces of rails are kept smooth and carefully lubricated, so long will a carriage mounted on runners travel along them with ease. These conditions are impossible of fulfillment, and the wheel becomes an expedient by which the friction is transferred from the surface of the rail, where smooth surfaces and efficient lubrication are not attainable, to the axle-box, where they are.

Now, if the element of elasticity cannot be secured between the rail and its support, the stone sleeper, it remains to introduce it between the tyre and its support, the felloe of the wheel. The experiments conducted lately on the St. Helen's Railroad demonstrate the perfect practicability of such an arrangement; and it would be well worth while to try an engine suitably fitted, over a mile or so of road laid as rigidly as heavy rails and stone sleepers could secure. The outlay would not be much; and if successful—which we do not doubt—the experiment would be the harbinger of a revolution in railway practice which would lead, in the course of a few years, to a saving in the expenses of maintenance which would tell most favourably on dividends.—*Mechanics' Magazine.*

PHOTOGRAPHY—THE CARBON PROCESS.

BY THOMAS SUTTON, B.A.

On February 15th of the present year, the following notice appeared in the *Times*:—

"Mr. John Pouncy, of Dorchester, who was awarded a silver Medal and 400 francs for his 'Carbon Process' by the Photographic Society of France, has just taken out a patent for an important improvement, by which he has brought ordinary printer's ink into the service of photography. This ink is mixed with certain chemicals, and spread completely over the paper intended to be submitted to the action of the rays of light through a 'negative'; and the secret consists in rendering it so sensitive that an indelible photograph may be fixed on the paper leaving the other portions so free as to be easily washed off. The time required for exposure is comparatively short, and the advantage is besides that of permanence, the fact of the subject being fixed, developed, and, as it were, completed without the various manipulations required under the old system. The superfluous ink is removed by spirits in ten minutes or a quarter of an hour, displaying a picture for delicacy of tone, beautiful gradation of light and shade, and minuteness of detail, fully equal to anything heretofore obtained in photographic printing."

Instructions for Working the Process.

In the common methods of Positive-printing, with the salts of silver and gold, there are six operations, but in Carbon-printing there are only three, viz.:—

1. To apply the sensitive black coating.
2. To expose the sensitive surface to light.
3. To develope the picture with turpentine.

A few words first respecting the nature of the surface upon which the picture is to be taken.

This must be either entirely or partially transparent and extremely thin. The thinnest glass that can be made, and such as they manufacture in China, would do but for its extreme fragility. Mica is as good as glass, when free from scratches and defects and it is very strong and flexible and not easily broken, besides being extremely thin. A perfect sheet of mica is therefore the best known substance upon which to print in carbon.

The next best substances would be very thin sheet gutta percha or gelatine but for the mechanical difficulties which attend the use of them.

The most transparent kind of tracing-paper will be found at present the most suitable vehicle for large pictures; and in the directions which follow it is assumed that tracing paper is used. It can be procured from Mr. Harding, No. 11 Thavies Inn, Holborn, or from any repository of artists' materials. Some kinds of tracing paper require to be gelatinized before applying the pigment, but others do not.

First Operation.

The Sensitive Pigment and the mode of applying it.—The sensitive pigment is composed of the materials mentioned in Mr. Pouncy's Specification, viz., asphaltum, benzole, printers' ink, and fatty matter; to which may be added occasionally bichromate of potass. It is doubtful, however, whether the addition of the latter substance is attended with any good effect. The various materials must be added together in a jar and incorporated by heat. When thoroughly mixed, the compound should be strained, and is then ready for use. The best proportions between the ingredients are still a matter for experiment, and the only precise information I can give is that there should be more ink than asphaltum, the compound should be about as thick as cream, and that it should give an opaque coating when applied to glass or mica. I have to warn the reader also that there are some kinds of asphaltum with which the process entirely fails. His first experiments had better be made upon paper prepared by Mr. Pouncy, and which he can procure from him of guaranteed good quality.

The black pigment must be applied to the paper by means of a broad camel's hair brush; and it would be found a good plan to keep the brush in the pigment when not in use, with its handle passing through the cork of the bottle.

The paper dries in a few minutes, and may then be put away in a portfolio until required for use. It may be kept for several months in this way without losing its good qualities.

It is scarcely necessary to say that the paper must be prepared in the photographer's dark room because it is sensitive to light. The sensitive pigment should also be kept in a bottle perfectly screened from light.

Second Operation.

The Exposure to Light.—The plain side of the paper must be laid against the film of the negative and the light must pass first through the negative and afterwards through the paper before it reaches the sensitive pigment. This is necessary in order to get good half-tones. A piece of paper should be laid against the blackened side of the prepared paper when it is put into the printing-frame.

Before using the prepared paper, examine the back, and if you see any small round black spots of pigment upon it, remove them by means of a rag moistened with turpentine. These spots occur wherever there is a pin-hole in the paper, and they are produced by the black stuff passing through the hole from the other side, and spreading upon the back.

With a good collodion negative of the ordinary density, the time of exposure in full midday summer sunshine requires to be about three-quarters of an hour. In strong diffused light about three hours will be necessary.

There are no means of ascertaining, except by developing the picture, whether the exposure has been sufficient, because the light produces no visible change in the paper. The pressure-frame may therefore be made of the simplest construction, and need not open at the back. A good guess may, however, be made at the right time of exposure by means of small strips of the same paper exposed during the same time under small negatives, and developed occasionally.

I am inclined to think that negatives of the right density for silver-printing are rather too dense for carbon-printing, and that a feeble negative will give the finest carbon-print. On this point however, I cannot yet speak with certainty.

The Third Operation.

To Develope the Picture.—The picture is developed by immersing it in turpentine, and the theory of of the operation seems to be this:—

The light, acting on the asphaltum in contact with air, causes it to absorb oxygen and become oxidized; in which state it is no longer soluble in turpentine. When the asphaltum is oxidized, the black pigment is obstinately retained in a state of mixture with it, and cannot be dislodged by so feeble a solvent as turpentine; it therefore remains and forms the dark parts of the picture in those places which have been exposed to light, whilst in those parts of the picture where the light has not acted, the turpentine removes the asphaltum, and with it the black pigment, leaving the paper as clean as it was at first.

The turpentine in which the paper is first immersed becomes black, but it may be used again and again until it is too thick for the purpose. It is only necessary to wash the print in fresh turpentine at last, in order to remove all traces of the pigment. When this has been effected, the print should be put in an inclined position upon a sheet of blotting-paper and allowed to drain. It is necessary also to lay a strip of blotting paper against the bottom edge, in order to absorb the draining, which would otherwise produce a stain along the bottom. The print dries very quickly in this way; and when dry, is ready to be mounted. The black material which forms the shadows of the picture is not firmly fixed to the paper, and it may be easily smeared whilst in the turpentine, either by contact with the finger or by allowing hard particles in the turpentine to flow backwards and forwards over it It is important therefore to handle the print very carefully, and always to filter the turpentine back into the bottle through cotton wool or tow.

Should the paper which was laid against the blackened side of the prepared paper in the pressure-frame stick too firmly to it, they must both be put into the turpentine together, and then it can be easily removed.

The development does not in general occupy more than about five minutes.

The print is now finished, and any one of the following three things may be done with it, viz.:—

1st. It may be mounted upon cardboard.

2nd. It may be exhibited as a transparency.

3rd. It may be transferred to paper, stone, or other surfaces.

Before mounting it upon cardboard it is necessary to consider which side of the paper is to be laid against the card-board. If the side which has the pigment is stuck to the cardboard, then the picture will be seen non-reversed; and conversely. In either case the picture must be varnished with spirit varnish, in order to prevent the blacks from being rubbed, because even when dry they are not very firmly attached to the paper. This spirit varnish is the same as is used for varnishing collodion negatives. It may be applied cold by means of a brush. When the print is to be viewed through the paper, it will be an improvement to varnish the back with paper varnish, such as is used for maps and drawings, in order to render the paper more transparent and removes the dimness which it sometimes has.

If the print is to be exhibited as a transparency, the picture side only will require to be varnished with spirit varnish. Should the shadows appear too thin and feeble, the effect will be heightened and the shadows intensified by cementing two transparent prints together so that the details exactly coincide.

Transparent prints, mounted upon paper, have a soft and very peculiar appearance, which is scarcely artistic unless the prints have been taken upon mica. It seems to me therefore very advisable that the method of transferring the print from tracing-paper to white cardboard should be perfected, and generally employed instead of the other. The following is the best way of proceeding, so far as is known at present:—

First, apply to the tracing-paper a thick solution of gum arabic, and let this dry before laying on the black stuff. Then, when the print is finished, without varnishing it, lay the picture side upon a damped sheet of cardboard or plate paper, and pass it through a lithographic press. The two pieces will adhere tightly together, and in order to remove the tracing-paper it is necessary to damp it with a sponge, after which you can peel it gently off the other. It comes off clean, leaving the whole of the ink upon the cardboard. You have then a carbon-print, non-reversed, upon a white ground and presenting the appearance of an engraving.—*Photographic Journal.*

Miscellaneous.

A Novel Mode of Telegraphing by Solar Light.

A simple and we believe a new method of telegraphing by signals, has just been brought to our notice by Messrs. Abner Lane and Sherman Kelsey, of Killingworth, Conn. These gentlemen have recently instituted a series of experiments to ascertain the possibility of communicating intelligibly between remote points. Having become satisfied of the practicability of their scheme, they have filed a caveat in the United States Patent Office, and secured this discovery to themselves. The principle of this telegraph is that of reflected light. A common looking-glass of any suitable size (the power of course varying with the dimensions) is so held in the sunlight as to project a pencil of rays in the direction of the person to be communicated with. When the beam of light passes the eyes of the second party, it is readily distinguished, and the message is sent by intermitting the time between the flashes. Thus, if one movement of the mirror is made, that will denote A; two movements, B; and so on through the alphabet. In transmitting sentences or lengthened conversations, it is necessary, of course, to begin indiscriminately in the alphabet, commencing to spell a word. Thus, if the word Light is to be sent, the glass is moved for a b c d e f g h i j k *l*. Then a longer interval; then moved for a b c d e f g h *i*; when another interval occurs, and the glass is again moved for a b c d e f *g*—interval—then for a b c d e f g *h*—interval—then for a b c d e f g h i j k l m n o p q r s *t*—then cease. Operator No. 2 repeats as he sees the flashes, a b c d e f g h i j k *l*. He knows *l* is the first letter; then repeats a b c d e f g h *i*—*i*, then. is the next letter. Then a b c d e f *g*—then *g* is the next. Then a b c d e f g *h*—*h* the next. Then a b c d e f g h i j k l m n o p q r s *t*—*t* the next. He then has the word Light.

From the above it can be seen how any message can be sent, or how any conversation can be carried on. For operator No. 2 can have a mirror and send back messages or answers in the same way. An experimental trial of this system of telegraphy was made by the parties interested a short time ago. The scene of the experiment was between Falkland Island and the mainland, (Connecticut) a distance of 15 miles intervening between the operators. It was satisfactorily ascertained that simple sentences could be transmitted with the greatest ease, and the inventors conversed for an hour and a-half on topics concerning family matters. The principle can be applied in many ways. The flashes can be repeated an unequal number of times, and at different intervals, to represent certain letters and sounds. Also two or more flashes may be repeated, in quick succession with a single flash, at different intervals and in different orders, to represent letters or sounds. Instead of moving the mirror, it may be stationary, except to move as the sun moves, so as to throw light in the right direction. The rays may be also intercepted periodically by a screen or other device. The light may be continued for any length of time, either in a single flash or as long as desired.

An alphabet of the character of the "Morse alphabet" may also be used. Mr. Lane states that he has devised an alphabet by which messages can be conveyed with the same facility and despatch as by the electro-magnetic telegraph with the "Morse" alphabet. So also coloured light may be used in connection with this system of telegraphy.

The means by which the ends are attained are simple, and require no apparatus beyond an ordinary mirror. For army and navy purposes we should think this mode of telegraphing is peculiarly adapted.—*Scientific American.*

Injurious Action of Lead Pipes on Water.

The importance of discovering a really efficient means of preventing the injurious action of lead pipes on water is universally acknowledged, and the experiments of Dr. Crace-Calvert have proved beyond question that no proposition hitherto brought forward has been calculated to remedy the evil complained of. A discovery, however, has now been made, through which the water supplied by leaden pipes may be obtained by the consumer as pure as from the original source. Dr. H. Schwartz, of Breslau, has discovered a means by which the portion of the lead forming the interior surface of the pipe may be converted into an insoluble sulphite; the natural consequence being that the water passing through will be as free from contamination as if glass were used. The means by which Dr. Schwartz effects this conversion are extremely simple. He merely passes a strong solution of the sulphide of an alkali through the pipe to be acted upon, and the process is completed. This solution, which is either a sulphide of potassium or of sodium, is used at a temperature of about 212°Fah., and is allowed to act upon the metal for from ten to fifteen minutes. It is stated that, in practice, a boiling solution of caustic soda and sulphur is found to answer every purpose.

High Temperature of the Season.

The Abbé Moigno, in *Les Mondes*, of the 13th August, speaking of the temperature of Paris, says that Sunday, the 9th of August, was one of the hottest days known for many years. The heat was stifling in the streets, with little or no circulation of air. The pavement actually burned the feet, and the asphalte almost melted under the direct rays of the sun. The leaves of the chesnut trees in the avenue leading to the Observatory looked as if they had been burnt, and in some cases had entirely disappeared from the trees. In a garden in the Rue Notre Dame des Champs, though enclosed, but far from the house, the thermometer in the shade, and distant from the wall, showed, at 2.30 p.m., 39½ degrees centigrade (130 Fahrenheit), and at 4.30 p.m., 36 degrees centigrade (96·8 Fahr.).

It has rarely happened that the heat of Paris has exceeded 36 deg. centigrade. Since the commencement of the present century, it has only once reached as high as 37·2 deg. centigrade, namely, on the 18th of August, 1842. In the previous century, higher temperatures than this have been observed, as recorded in the tables prepared for M. Arago. The thermometer was then, however, differently placed from what has been the plan adopted for the last 60 years. The highest temperature recorded in these tables are 30 deg. centigrade, 19th of August, 1763; 39·4 deg. centigrade, 14th August, 1773; 40 deg. centigrade (104 deg. Fahr.) the 26th of August, 1765. Thus it appears that for 158 years the temperature of the present year has been exceeded but once. The temperature of the 9th of August, as recorded at the Paris Observatory, was 36 deg. centigrade (96·8 deg. Fahr.).

In England, it appears from the Registrar-General's report for the week ending Saturday, the 15th inst., at the Royal Observatory, Greenwich, the mean temperature of the air in the week was 65·1 deg., which is 3·5 deg. above the average of the same week in 43 years. The mean daily temperature was above the average on every day except Friday. The highest day temperature was 84·9 deg., and occurred on Sunday (9th). The lowest night temperature was 50·1 deg., and occurred on Wednesday. The range of temperature in the week was, therefore, 34·8 deg. The mean daily range was 24·3 deg. The difference between the mean pew-point temperature and air temperature was 10

Liebig on Sewage Manure.

From exact calculation of the liquid and solid voidings of London (the detail of which would be out of place here) we may conclude that 42 tons of ammonia, 10 tons of phosphoric acid and 7½ tons of potash find their way into the London sewers daily. These 42 tons of ammonia are contained in 247 tons of guano, the ten tons of phosphoric acid in 83·3 tons guano; thus 163·7 tons remain in which the phosphoric acid is wanting; or, what is the same thing, if to the sewage obtained daliy from London 100 tons of superphospate of lime (at 20 per cent) be added, the value of the daily voidings of the metropolis, or the sewage of London, is made equivalent to 247 tons Peruvian guano; or, by the addition yearly of 36,500 tons of superphosphate, we may acquire the value of 90,155 tons guano, at £13 12s. 6d.=£1,228,364. Deduct the price of 36,500 tons of superphosphate, at £5 5s. =£191,628, and we have £1,036,736 as the money value of the sewage. To this should still be added the worth of the potash in the sewer water. Potash is the manure which the farmer obtains with the most difficulty; it is that element, too, which renders his stable dung (the amount of phosphoric acid and ammonia being the same) of greater value and efficacy. In 247 tons of guano about 1½ tons of potash are contained; but every day 7½ tons are obtained in the sewer water, which gives a surplus of 6 tons, corresponding to 11 tons of sulphate of potash, giving yearly 4,015 tons, which, at £18 per ton, shows a money value of £72,270. Add this to the sum above given, and we have, as real annual money value of the of the London sewerage, £1,109,006.

The surplus potash won from the sewer water daily corresponds to the amouut contained in 886 tons of stable dung. Without the addition of the superphosphate, the value of the sewage of London would only be £304,045. In the calculation of the value of sewer water, there is one factor doubtful —viz., the absolute amount of phosphoric acid, ammonia, and potash which a ton of said water contains. It might, probably, be found that some sewer water was richer, another more diluted or poorer in these component parts, but in the relative proportion I do not think that any very great difference would be found. Sewer water will, in the average, contain more potash than I have allowed for, inasmuch as the fluid voidings of horses are to be added, which increase the amount of potash. We may assume that one-third of the population of Great Britain, or ten millions of men, live on corn and agricultural produce imported from abroad. For this a pretty considerable number of millions of pounds sterling must be paid, besides another pretty considerable number which must be earned by the nation in order to pay for the purchase of manures to produce the food of the remaining 20,000,000 of inhabitants. Many superficial observers appeal to statistics, which appear to show that much of the land yields one-third more than it did in the last century, and this is not, they say, a sign of decrease; but they forget at what costs their larger crops are obtained, and that they are due to an enormous expense of capital for the purchase of foreign manure. It is a sign of a poor or an exhausted soil, if, in order to get high returns, we have to add large quantities of manure from without; a rich or fertile soil does not require such an addition.

Saxifragine—A New Blasting Powder.

This is a newly-invented powder for blasting and quarrying purposes, which is said to have already gained considerable reputation on the Continent, and to have been patented in various countries. The Russian patent is stated to have been sold to the Government of that country, and in Belgium and Prussia that companies have been formed for producing the material. It has been practically tested in various quarters, and certificates have been given by engineers, mine-owners, iron-masters, &c., bearing testimony to its efficiency and good qualities. The following are some of the objections to the use of the ordinary blasting gunpowder, alleged by the promoters of saxifragine:—Gunpowder is difficult and expensive to transport, on account of its very explosive nature, and the precautions that it requires. Some of the expenses for the conveyance of a small quantity being as great as for a large, storage is involved, which is very inconvenient and dangerous. Gunpowder being adapted to gunnery and sporting purposes is often purloined. Gunpowder presents great danger to the workmen by scattering fragments with great force. It causes thus interruptions of work. It is pernicious to the health of the men, by the smoke and sulphurous gas after explosion. Saxifragine is composed chiefly of nitrate of barytes, in place of saltpetre, of which only a very small percentage is introduced; sulphur is entirely dispensed with. The cost of the material is thus much reduced. Its merits are enumerated as follows by the promoters:—Saxifragine contains no sulphur; it contains only a very small proportion of saltpetre, and is composed of matters that may be easily procured; it is less dangerous to carry and to store than gunpowder; is not likely to be purloined, as it cannot be used for firearms; it does not interrupt the occupation of the men, nor produce thick smoke or sulphurous gas; while it blasts the rock as well as or even better than gunpowder; its theoretical force, as compared with that of the ordinary powder, is calculated as 18 to 11 in its favour; owing to its superior force and density, it occupies less space in the hole, so that the centre of gravity of the charge may be placed equally low with a shallower hole, and equal tamping; it is much less expensive. The method of blasting with saxifragine is similar to that adopted with gunpowder. The report of the explosion is less, although the expansive powers is greater than that of gunpowder. The fragments detached are not cast to a distance. The promoters say it may be used in mines, and even in some collieries, where from the danger attending the use of gunpowder, blasting has, at a great sacrifice, been abandoned. This the promoters allege, is confirmed by the manner in which saxifragine burns in the open air. Cannon powder spread on a stone and lighted, ignites instantly, and rises in smoke, leaving only a little dust behind it; but saxifragine takes fire upon all the surface which it covers, makes no explosion, but burns with an immense vivacity, and developes an enormous quantity of gas, which is the cause of its great expansive power; and as it leaves behind it a certain blackish residue, it cannot be used for firearms. Saxifragine, it is added, is not hygroscopic, and hence is easily preserved, and is not more dangerous to keep than tow, hay, or any other combustible matter. When fired, this powder leaves a bulky ash, nearly as large as its original volume, unless the explosion has had sudden vent (as in the rending of a rock), so as to scatter it.—*Practical Mechanics' Journal.*

Probable Existence of an Enormous Cavity in the Earth.

A most singular and unexpected discovery has recently been made by M. Otto Struve, the Russian Astronomer of the Observatory of Moscow. It was found that upon calculating upon astronomical data the most rigid and exact, the latitudes and longitudes of several of the principle points of the great Russian triangulation, and deducing thence the colatitude of the Moscow observatory, that it differed by no less than eight seconds from the the same deduced directly from the same points by geodetic methods. The result has been a careful recomparison of the positions of many points at various distances, amounting in extremes to several leagues around Moscow, deduced by both geodetic and astronomic methods; and it has come to light (to pass at once to a result), that the plumb line, at all points around Moscow, but chiefly along lines to the north and south of the city, is *deviated away from it*, the greatest deviation being produced at about twelve kilometres distance from the observatory. It follows from this, that beneath the almost unbroken rolling plain upon which Moscow is situated, either there are mineral masses of enormous bulk and density around the city or there are masses of extremely low specific gravity directly beneath it or there is an actual cavity—*i. e.*, no solid matter at all beneath it. According to M. Schweitzer, the Assistant Astronomer of Moscow, this deficiency of matter, supposing it all of the mean density of the earth's superficial crust, must equal in bulk a cube whose side is one fifteenth of a mean degree of latitude. That is, taking the mean degree at 45° as 60,752 fathoms, as calculated by Lambton, there is probably a cavern somewhere at no great depth beneath Moscow equal in bulk to a cube of 2,700 feet. Nothing is more probable, sustained as it is by the character of the subjacent formations, by the enormous caverns known to exist to the south and west in Europe, and by the fact of the great depressions or fallings in of the earth's crust represented by the Dead Sea and the Caspian Basins. M. Struve is engaged in further investigating the subject. An artisian boring, of two or three thousand feet deep, might possibly pierce into this vast Russian Hades beneath their sacred city, or failing to do so, might elate all Pansclavism with the hope that to the north and south of the ancient capital, they possessed beneath the surface enormous banks of platina or gold, wolfram or lead, or some such heavy material.

The Annamite Ambassadors in Paris.

The Annamite Ambassadors are objects of great curiosity in Paris. Their appearance cannot be said to be prepossessing, and cleanliness they seem to look upon as a crime. Like the Chinese and Japanese they dispense with pocket-handkerchiefs, but the square pieces of paper which the former use as a substitute, either have not found their way to the kingdom of Annam, or are considered there as one of the superfluities of exaggerated civilization. The consequences are not pleasant to witness, the change of climate having affected some of the distinguished visitors with *coryza*. It has also been seen with surprise that the chief dignitaries among them alone wear shoes—rank with the Annamites being outwardly marked by the covering for the feet. They are great smokers, and are hardly ever to be seen without a cigar or cigarette in their, mouth, and they are said to show a lively appreciation of French *cuisine;* they are fond of champagne and truffles in particular meet with their approbation; they are even said to prefer this savoury tuper to their favourite dish at home—pickled caterpillars. Like other countries, the empire at Annam possesses several orders of chivalry—the Order of the "Elephant's Tusk," and that of the "Horn of the Rhinoceros" being the principal. These honorary marks of distinction are not, it is stated, greatly coveted, as the insignia weighs, according to the various classes, from 15 to 100 pounds, so that a grand cross is exposed literally to sink beneath the the weight of his sovereign's favour.

Death from the Bite of a Fly.

One not unfrequently reads in French papers of deaths occasioned by the bite of a fly that has been feeding on some putrid substance. A case of this kind occurred a few days ago at Pessac, a village in the department of the Gironde. The man bitten paid no attention at first to so trifling a matter, but violent inflammation and pain came on the same night, and on the second day he died. The papers are continually impressing upon the country people the importance of burying carcases and offal, which are too frequently left in the fields and in the ditches by the road-side. In several departments the prefects have found it necessary to decree the interment of such noxious substances. [A similar fatal result from the bite of a fly occurred in Toronto during the last summer.]

Novel Application of Water Power.

Just forty years since, M. Fourneyron commenced a series of experiments in water power, which resulted in his invention of the turbine or horizontal water-wheel. Since that period considerable improvements have been made in the turbine by different persons, the chief and most useful having been effected by Mr. Schiele, of Manchester, whose ingenious applications of mechanical curves seem to have been fully adapted by him for the production of this form of motive power. One form of his arrangement for supplying power we have recently seen (working the bellows of a powerful organ) at the residence of a citizen of Manchester, where the impression was given that, if all the results achieved by Mr. Schiele be equally successful, a new feature will be rapidly developed in applying water power, especially in cases where a small amount of power may be required at irregular periods; as in the case of working the bellows of organs, driving small lathes, fans for ventilation, printing and other presses, sewing machines, washing machines, &c. In the house referred to, a water-wheel, 4 ft, in diameter, consuming 15 gallons of high pressure water per minute, formerly employed to work the bellows of an organ in the drawing-room over the cellar wherein the water power was produced, has been replaced by a turbine only 1¼ in. in diameter, with a 3-in. case 1¼ in. wide, supplied by a ⅜-in. pipe, and consuming less than a gallon of water per minute. An ingenious and yet very simple economical regulator, invented by Mr. Eccleston, organ builder of this city, works in connection with the apparatus just mentioned, by means of which the organist may easily supply his instrument with the required wind by simply turning a handle near the organ. By availing themselves of the ample supply of high pressure water secured to the city by our Corporation, all persons using machines requiring a small amount of power appear, now to have supplied to them by this invention the means of working their machines with no trouble and at a trifling cost: while at the same time this kind of turbine appears to be equally well adapted for turning large mills and works, even when they require several hundreds of horses' power. Orders are now being executed by Messrs. Schiele & Co. for the construction of 50 small turbines, to be used as direct-action fans (the turbine and fan being on one spindle) for the production of the new gas obtained from petroleum. Several powerful turbines will shortly be at work in this locality, when our readers will be able to see and judge for themselves of the extraordinary yet simple effect of this new water engine, which seems to be equally suited for the requirements of the sewing machine in a lady's boudoir, the washing machine and mangle in the laundry, or the hydraulic press and hoist in our huge warehouses. In fact wherever our Corporation waterworks will enable persons to turn a water tap, and thus to supply at a moment's notice the power required, these machines will be available; while all the risk from fire and the cost and troube of steam boilers and engines will be avoided. —*Manchester Guardian.*

Preservation of Meat.

It is worth knowing at this time of the year that meat may be kept sweet for a long time in an atmosphere strongly impregnated with acetic acid. The meat is placed on a wooden support, or suspended, in a close vessel, on the bottom of which some strong acetic acid is poured.—*Dingler's Polytechnic Journal.*

The Effects of Congelation upon Water.

Dr. Robinet, a member of the Academy of Medicine, Paris, has published an account of experiments conducted by him to test the effects of congelation upon drinking-water. It is well known that the ice which is formed in the sea yields nothing but fresh water, all the salt having been eliminated by congelation. In the northern parts of Europe this property is turned to account for the extraction of salt from sea water; for a large sheet of the latter having been left to freeze, the ice is afterwards cut away, and the unfrozen water left below is so rich in salt as to require very little evaporation to yield it in a solid state. This property will also serve to analyse wine. Suppose it was required to determine the quantity of water fraudulently added to a certain wine; by exposing it to the action of artificial refrigeration, all the water would be alone and the wine left in its purity. By a similar process, ships at sea, being short of water, might be supplied with this necessary article. We will suppose the temperature of sea water under the tropics to be 30 deg. centigrade. If a quantity be exposed in a vessel to the action of a mixture of sulphate of soda and hydrochloric acid, two very cheap commodities, the temperature of the water will fall to 10 deg. below freezing point. Let it then be exposed to a second mixture of the same kind, generally eight parts of sulphate to five of the acid, and the temperature may be lowered to 17 deg. below freezing point. Congealed water is then obtained free from salt, and may be used with impunity. Dr. Robinet has added a new fact to this theory by showing that the water of springs and rivers loses all its salts by congelation. These salts are chiefly those of lime and magnesia. The water subjected to experiment was that of the lakes of the Bois de Boulogne, the ice of which was found to be entirely free from the above-mentioned salts. Such, indeed, is the chemical purity of the water thus obtained, that it may in most instances be substituted for distilled water.

The Pennsylvania Oil Wells.

A correspondent of the New York *Evening Post*, writing from Titusville, Pa, furnishes the following in reference to the oil region in that State:—

"Almost as old as the hills surrounding it are the springs which once gave it the name of Oil Creek, and now make its fame world wide. There is but one king here, and all are its subjects. The head and front, the root and branch of every species of business, in its legitimate callings—as well as specutation in its most rampant form—is Oil; consequently you see, in close proximity on every side, oil depots, oil refineries, oil derricks, oil tanks, oil shippers and the everlasting inevitable oil team—at once a nuisance and a necessity, as you may judge from the fact that two thousand of them have passed over a given point or bridge, where a market was kept, in one afternoon, cutting up the roads in a frightful manner, and reducing them to such a state that, between mudholes, stones and stumps, you may well suppose that pleasure riders are not the order of the day. * * * For bustling activity and teeming population, we resemble western towns; while dreams of wealth, wilder and more fabulous than the Arabian Nights, have been realized in a day. What do you think of 'the big well' which flows two thousand barrels a day, bringing its owners an income of two dollars a minute, and supplying one-third of all the oil sold here? There has been a million dollars paid by its owners for this well—one small share having been sold for fifteen thousand dollars. These are only a few facts out of the many of the wealth accruing privately and collectively to individuals. The well owned by the Dalvell Brothers brings them eight hundred dollars a day, and a sixteenth of the Sherman well a hundred dollars a day. The revenue which accrues to the Government is five millions a year.

Waste Substances in Cities.

A Company is being formd in Paris called La Campagnie Generale des Chiffons de Paris. The object of this company appears to be to bring capital to the rescue of the waste substances that are cast idle in all our large cities, for want of patronage and attention requisite to make them useful in our industrial arts. The company propose to organize *les chiffoniers de Paris*, who number upwards of 25,000, and institute a demand for rags, bones, paper, broken glass, and other waste substances. From their extensive sphere of operations, it is contemplated that they will bring to light many tons of material which would otherwise be overlooked and neglected. The projectors of the company are sanguine of very excellent results, from the fruitful field they have before them. They hold out the very tempting prospect of a 25 per cent. dividend to the shareholders.

New Iron Vessel for Petroleum.

A new iron vessel, expressly built for the conveyance of petroleum, was launched on Saturday at Newcastle. The ship has, properly speaking, no hold, but a series of iron tanks extended from deck to keel. In contradistinction to the principle often necessarily adopted in many vessels built to suit particular carrying trades, neither the necessity of economizing space nor the nature of the intended cargoes have necessitated the builders of the "Atlantic" to depart from the most exact rules of taste in marine architecture; and the result is that, viewed from every point, the greatest elegance is visible in the design of their ship. Her length over all is 145 ft.; breadth of beam, 28½ ft.; and depth, 16 ft. 9 in. The launch was extremely successful.

New Gun Metal.

Messrs. Deville and Caron have lately been making experiments on the properties of a new gun-metal, a compound of silicium and copper. When copper contains rather less than five per cent. of silicium, it presents a fine bronze colour, is fusible, and rather harder than bronze, but is perfectly ductile, and can be readily worked without clogging the tools as bronze does. Its tenacity is remarkable, being equal to that of iron. Silicium is the basis of sand, and the manufacture of its compounds with copper may be made by fusing together a mixture of sand, sodium, and copper, with some common salt and fluor spar as flux.

Death of Mitscherlich.

This venerable chemist died at Berlin in August last.