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CANADA AT THE INTERNATIONAL EXHIBITION OF 1862.

The necessary preliminary arrangements for the INTERNATIONAL EXHIBITION OF 1862 have been completed. The Exhibition is to be held in London, and already upwards of one million eight hundred thousand dollars are guaranteed. Active measures are being taken in more than one British colony to secure an advantageous representation of their products and to create a favourable impression. No better means of advertising the natural resources of a country exist, than by offering specimens and illustrations to the gaze and criticism of the millions who will visit the International Exhibition of 1862. It is an opportunity for Canada of priceless value, placed as she now is, by the completion of her system of railways, in a very different position to what she held in 1851 and 1855. The Exhibitions of 1851 and 1855 opened the eyes of Europeans to the natural resources of this country. An event has lately happened—the visit of the heir of the throne of England —which for the time fixed the attention of the civilized world on Canada, and led men to discuss its position, its relations, and its future. The Canadian system of railways, the offspring of British capital and enterprise, has already made this part of North America a subject of special interest, secure for many years to come; and while every discovery and development which tends to improve the condition of the country, increase its industry, and establish it as a great highway of commerce, is hailed with delight by those who are personally interested in its welfare, so also would an honourable and striking position as a competitor among the nations of the earth establish a reputation scarcely yet won, however much it may be deserved.

The Exhibitions of London and Paris have been productive of immense benefit in many different ways. Manufacturers of all countries know their standing and to a certain extent their future, far better than they did before those splendid illustrations of the industry and skill of man opened their eyes either to their short comings or superiority, their advantages and disadvantages of position, resources, government, capital, and individual enterprise. From the unbiassed opinion of the most competent judges at the Exhibiton of 1851, we learn one secret of the success of Canada in that magnificent arena of peaceful strife and rivalry, in one department of our staple productions. SELECTION and ARRANGEMENT in exhibiting the mineral resources of Canada won for us the proud distinction of being "SUPERIOR SO FAR AS THE MINERAL KINGDOM IS CONCERNED TO ALL COUNTRIES WHICH FORWARDED THEIR PRODUCTS TO THE EXHIBITION." Why should not the same coveted honour be conferred upon our next display of the resources of Canada, as far as they go, in agriculture and the products of our forests. No doubt the material is available if sought for; and when selection and arrangement confer such marked advantages, it is not too much to expect that those artifices may be most advantageously employed in placing all our staple products in the rank they would undoubtedly acquire if justice be done to them by the Exhibitors. A whole year is available for the enterprise and energy of those who intend to enter the lists, and the action of the government in this important matter will probably soon be known.

It was a common subject of complaint at the period, that sufficient time was not given to exhibitors to prepare articles for the Paris Exhibition of 1855. In October, 1854, the then Provincial Secretary first communicated the documents received from the Board of Trade of London, relative to the Exhibition of Paris, to be held early in the following year. A Provincial Committee, composed of about 200 persons, met on the 30th October; they appointed a sub-committee, who, after due deliberation, arrived at the following conclusions:

> "That it is absolutely necessary, in order to secure the end desired, that authority should be given to the Provincial Committee to purchase such articles as they deem essential to that object. They are of opinion that any attempt to induce voluntary effort by means of local fairs would be fruitless. The experience of all who were actively engaged in promoting the Canadian Exhibition at the World's Fair in London in 1851, is, that the success of the present effort must depend entirely upon the energy and judgment to be displayed by an efficient executive to be appointed by the Commissioners."

On the 4th November, the Executive Committee published a brief report, in which they called especial attention to the three classes of the great staple products of Canada, namely, minerals, agricultural productions, and timber. The following extracts from the reports of the Jurors of the Exhibition of 1851 will convey the opinions entertained by those most competent to judge how essential it is to have a full and complete representation of these departments of Canadian industry and resources in the Exhibition of 1862.

In the report of the Jurors of Class 1, on mineral products, by Mr. Dufresnoy, Member of the Institute of France, Inspector General of Mines, &c., it is said:

"Of all the British colonies, Canada is that whose exhibition is the most interesting and complete, and one may even say that it is superior, so far as the mineral kingdom is concerned, to all countries that have forwarded their productions to the Exhibition. This comes from the fact that the collection has been made in a systematic manner, and the result is, that the study of it furnishes the means of appreciating at once the geological structure and the mineral resources of Canada. It is to Mr. Logan, one of the members of the Jury, who fills the office of Geological Surveyor of Canada, that we are indebted for this collection, and its value arises from the fact that he has selected on the spot most of the specimens that have been sent to the Exhibition, and arranged them since their arrival in London."

In the report of the Jurors of Class 3, "Substances used as food," by Dr. Hooker, it is said:

"Messrs. Lawson's collection exhibits the ear and grain of every variety of cereal, and also models of all the roots which it has been found practicable to cultivate in Scotland; the specimens are beautiful, and the arrangements scientific and excellent. No consideration of cost or trouble has been allowed to interfere with providing all that is necessary to render this collection a true and complete illustration of the vegetable products of Scotland. A council medal has been awarded to Messrs. Lawson for their admirably displayed, very complete, instructive and scientifically arranged collection of the alimentary products of Scotland."

The Jurors of Class 4, in their report on animal and vegetable substances chiefly used in manufactures, as implements, or for ornaments, by Professor Owen, say:

"Among the numerous samples of raw produce contributed by different countries, there are several collections of especial value which derive additional merit from their completeness and from the fact that they illustrate the trade and manufactures of an entire country. The importance of such collections, not only in a commercial but in a statistical and scientific point of view, is very great, and the Jury therefore, being desirous of expressing their approbation of the practical benefits to be derived from the formation and study of such collections, and the advantages which the commercial and manufacturing community may obtain by their means, have determined to recommend the award of the council medal to the governments of those countries, the natural products of which were so instructively and completely exhibited."

The entire cost to the government of the Canadian Department at the Paris Exhibition amounted to $67,300. The results obtained were valuable, and would no doubt serve to bring Canada prominently before the reading public. Mr. Taché, in his report, enumerates the following opinions of competent authorities.

The chapter under the title Canada, in the history of the Universal Exhibition, by Mr. Charles Robin, begins with these words: "The efforts made by Canada, that old French colony, to make a suitable appearance at the Great Exhibition of 1855, efforts which have resulted, moreover, in the most complete success, coupled with the undoubted importance of that fine country, whose future cannot be otherwise than brilliant, render it a duty on our part to devote to it a distinct chapter."

"*Now we can form an estimate of the value of those few arpents of snow ceded to England with such culpable carelessness by the Government of Louis XV.*," says Count Jaubert at the word CANADA, in his work entitled *La Botanique à l'exposition universelle de* 1855.

Baron Wedekin, Chief Ranger of the Duchy of Hesse, and compiler of the records of the German forests, writing to Mr. Taché, states: "In conclusion, I congratulate you upon your Canada. Although the feeling in favor of emigration has very much diminished in Germany, I would recommend Canada to the Emigrant in preference to any other country."

The standing acquired by Canada, in competing with other nations and colonies, may be inferred from the fact that the prizes received at the Great Exhibition of London, in 1851, were 67 medals and honorable mentions; at New York, in 1853, 63 similar distinctions; and at Paris this number was increased to 93; Canada being the only instance of a Colony having obtained a grand medal of honour, a distinction won but not exceeded by the nationalities of Sweden, Denmark, Lombardy, Piedmont, and Bavaria.

The experience gained by being twice placed in contact with the highest intelligence and the most productive skill of the world ought to be of vast benefit to Canada in view of the Exhibition of 1862. It has been shown that the productions of the forest, the mine and the farm, constitute our wealth and the foundation of our future position; but it has at the same time been made manifest, that we do not make a tithe of the use of the natural resources belonging to the country, which unexampled facilities place within our reach. In the productions of the forest, Spain far surpassed Canada; not so much by the practical usefulness of the products exhibited, but by the scientific skill shown in the admirable arrangement of her contributions. The collection of Spanish woods was accompanied with specimens of the bark, leaves, flowers and fruit of the trees and shrubs. When the numerous artifices employed by manufactures to give beauty or durability to forest productions are known, the advantage of fully representing the capabilities of a contribution become manifest.

Mr. Taché correctly tells us, in his report of the Paris Exhibition, that "In lumbering, as the making of timber is termed in Canada, just that amount of intelligence is brought into action which is required for the squaring of the logs and the sawing of them into the planks of commerce. None of that skill of woodcraft is exercised which turns to the best and most profitable account the various species, by attending to their several degrees of adaptation to the mechanic arts, and to the preparation to be expended on them to make them fit for market. As before observed, two things only are known, square timber and the plank three inches thick.

"Of more than sixty principal species of timber which we possess, we make profitable use of scarcely ten; the rest are left to absolute decay. In Europe, the bird's eye maple is considered as equal to the most precious of the woods used in cabinet work. It is indeed hardly attainable, and, when found, it bears a higher price than mahogany. From this cause arises the dearness of all the articles made of maple in the Parisian cabinet work, the finest in the world."

Sufficient has been said to show that the primary elements of success in the display which Canada will make in 1862, are embraced in the SELECTION and ARRANGEMENT of the products of her industry or natural wealth. Ample time exists for a complete illustration of whatever this country is capable of producing, in the most intelligent and comprehensive manner. It is one thing to show specimens of inexhaustible supplies of mineral, forest or agricultural products, but it is another to teach the eye and understanding at a glance the wide application and general usefulness of the raw materials. A table pier or a chimney piece of Labradorite, exhibiting the exquisite beauty and adaptation of that material for ornamental purposes, would arrest the attention of the most superficial observer; but rude blocks, however massive, might possess a passing interest to the scientific geologist, and would then be forgotten. So also with our marbles, soap stones, slates, and hydraulic cements; our different varieties of forest woods used by the cabinet maker; our natural dyes, and all other products which, possessing great intrinsic worth, nevertheless require skilful labour to be employed upon them before they can occupy their true position in the resources of a country.

Selection and arrangement will be, as heretofore, the key to our success in the great Exhibition of 1862, and no expense should be spared or time lost in preparing to illustrate to the utmost the adaptation to the wants of mankind of those natural productions which form such an important part of the undeveloped wealth of Canada.

EUROPEAN EMIGRATION TO CANADA.

An able writer in the last issue of the *London Quarterly Review* commences an article on "CANADA AND THE NORTH WEST," with the following quotation.

"The people of England are by no means aware how fine a country they possess here."

It is scarcely necessary to say that Canadians are but too familiar with the deplorable absence of appreciation of their country, arising from ignorance of its position, extent and resources, which exists among the masses in Britain. In many ways has this feeling found expression, and latterly in a very decided and official form.

The Select Committee appointed to take into consideration the Annual Report of the Chief Emigration Agent at Quebec, for the year 1859, reported on the 23rd April, 1860. Among the circumstances which control the European Emigration to Canada, the following all-important influence is enumerated:—"The circumstance which primarily controls the Emigration to this Province, may be said to be, THE IGNORANCE OF ITS EXTENT, INSTITUTIONS AND RESOURCES, which prevails in the emigrant countries.

"The first shocks were given to this ignorance at the London and Paris Exhibitions of 1851 and 1855, when the products of our fields, forests and workshops came under the notice of intelligent men from every part of Europe. The advantage then obtained was not however promptly followed up; for although several useful pamphlets have been issued by the Bureau of Agriculture and Statistics, and an extensive correspondence has been maintained by its efficient Secretary, Mr. Hutton, the fact still remains patent to every traveller, that the vast majority of Europeans are only familiar with one North American country—the United States—and one North American Seaport—New York."

Again, in the report of the Select Committee appointed to consider the expediency of inviting emigration from France, Belgium, and Switzerland, to Canada, the Committee truly state that "the people of the remote departments in France, are in utter ignorance as regards Canada. In the large cities it is barely known by name. The Paris Exhibition, held in 1855, in which the products of our soil figured to such great advantage, helped to dispel their ignorance in a slight degree; but the light thus momentarily afforded, must soon be obscured in the absence of established relations between the two countries."

The appointment of Resident Provincial Agents at important Sea Ports, with extensive powers for distributing information, appear to embody the most important recommendations and suggestions of both Committees. The Sea Ports named, are Christiana, Hamburg, Liverpool, at whatever Irish Ports the Canadian Line of Steamships may make a port of call, Havre and New York. There can be no doubt that this recommendation is of great value as far as it goes, and one which must be the most efficient instrument for diffusing information among those who are already determined to emigrate, and who are yet undecided in the choice of a home, whether on the American Continent or in Australasia. This recommendation, however, does not strike at the root of the evil, namely, the IGNORANCE OF

THE EXTENT, INSTITUTIONS, AND RESOURCES of Canada, which the Exhibitions of 1851 and 1855 served to dispel for a time among the more enlightened classes who visited those splendid collections of human art and wisdom, and among the masses whose attention was for the time awakened to what was meant by the word CANADA. "The light thus momentarily afforded was soon obscured," and but a dim and confused impression remained in the minds of the working classes in the United Kingdom until the visit of the Prince of Wales restored recollections, stimulated enquiry, and turned public attention to this country to a far greater extent than at any previous period. The great Exhibition of 1862 may render this interest permanent if energetic steps are taken to represent the country, and to place in the hands of the influential people in the United Kingdom, the means of distributing information which will no doubt be again eagerly sought after by many desirous of trusting their fortune beyond the seas.

It does not require a very familiar acquaintance with the social condition of the people of the United Kingdom, to know that the masses are influenced to an extraordinary degree by those occupying positions of authority and power. The country gentlemen are the oracles to whom the labouring farm classes look for advice and guidance. This is the class which should be made acquainted with "the *extent, institutions, and resources* of Canada," and through them the information will be conveyed to the intending emigrant, and from them only will such information be received with reliance, and acted upon in confidence and hope. A broadcast distribution of pamphlets and maps is comparatively useless. Information, ample, practical and illustrated, must be placed in the hands of COUNTY AUTHORITIES and COUNTRY GENTLEMEN, in connection with a full representation of our progress at the Exhibition of 1862, before we can expect a healthy return of that tide of emigration which poverty and distress contributed to swell in by-gone years, but which for the future should be the natural result of the advantages which Canada can offer to the industrious man, of winning a position of independence and security for himself and his children.

PETROLEUM, OR ROCK OIL.

No. II.

The immense importance which "Rock Oils" are now assuming, from the discovery of new sources of supply, coupled with the doubts which hang over the real origin of this important substance, give interest and value to every kind of information upon which reliance can be placed. Some fresh discoveries of Petroleum have recently been made in Ohio, and in the Township of Dereham, C. W., which appear to show that the area over which we may expect to meet with this substance in remunerative quantities, is considerably greater than was but very recently supposed. Mr. J. S. Newberry, in a paper on "the Rock Oils of Ohio," published in the *American Gaslight Journal*, (January 15, 1861,) expresses an opinion respecting the source of the Rock Oils of Ohio, which if borne out by facts, will materially extend the area in Western Canada, over which productive springs may be searched for with success. Mr. Newberry says:—

"I have said that the Waverly series or the Chemung and Portage rocks—are *the* oil rocks of Ohio. By this I mean that they are the principal repositories of oil—the source from which we are mainly to derive the millions of gallons which will be annually used in, or exported from the State—the geological level along which we must look for new discoveries of petroleum.

"That the oil *originates* in this group of strata is, however by no means certain. On the contrary, it seems more probable that it merely accumulates in them, as a convenient reservoir, when flowing from another source. These rocks are mechanical sediments, and are, in Ohio, generally destitute of organic remains, whether animals or plants. They are, however, often quite porous, and strong currents of water flow through them. The Hamilton Shales, on which they rest, contain an amount of carbonaceous matter probably equal to all that included in the coal measures. Here, I suspect, most of the oil originates. From this bituminous mass, as distilled by nature's processes, it would rise through every fissure by the pressure of the incumbent rocks, or water, which is specifically heavier. A few layers of the Waverly series are highly charged with the debris of vegetables and marine shells; and these may generate some oil; but for the most part what they contain is of foreign origin. The source to which I have referred it is so entirely sufficient, both as regards its position and character, that it seems unnecessary to look farther.* Over nearly all the northern part of the State, where the Portage and Chemung rocks are exposed, petroleum may be found exuding from them in greater or less abundance; but it is only at comparatively few points that it is found in a "paying" quantity.

"The Oil Creek region of Pennsylvania is one of these series of oil centres. There the wells are sunk from 70 to over 300 feet—often to, and sometimes apparently through the Portage group. The oil occurs at all depths. It is frequently found saturating the surface deposits, and the deepest bore has not reached beyond it. It flows in fissures with water, and that from neighboring wells differs much in quality; all of which facts seem to indicate that it is derived from a somewhat remote source below. The oil of Titusville is very thin, varying shades of brown in color, and has a specific gravity of 35° to 40° Beaume.

"Not very far distant from the Oil Creek district is that of Mecca, Trumbull county, Ohio. Here some 200 wells are being bored, and a dozen or more have been successfully pumped. The geological level of the Mecca wells is the same as that of Titusville, but they are generally less deep; varying from 30 to 200 feet, while

* In confirmation of the view that the oil of the Portage and Chemung rocks for the most part rises from the Hamilton Shales, it may be said that at Titusville, Mecca, Grafton, &c., the oil is found exuding from cracks in the surface rocks, coming up from below, and saturating the soil; and that in boring, the most abundant flow of oil is also obtained from vertical crevices at very unequal depths, in holes closely approximated.

most are about 50. The rock is a soft bluish-white sand-stone, with partings of clay-shale, sometimes quite saturated with oil. The yield of the wells is from 5 to 20 barrels each per day. The oil is much thicker than that of Pennsylvania, has a greenish brown color, and comparatively little odor. Its specific gravity is from 28° to 30°. For many miles around Mecca signs of oil are found—in the wells sunk for water, on the surface of streams, &c., and the aggregate production of oil from that district will unquestionably be very large.

"At Lowellville, Mahoning county, thirty miles south-east from Mecca, a single well has been bored to the depth of 157 feet, and it is said to be now yielding some 20 barrels of oil per day. This well is sunk through the conglomerate which is there thin, and into the Chemung. The oil is similar in character to that of Titusville; is light, reddish-brown in color, and has a specific gravity of 38° Beaume. The oil enterprise at Lowellville is, as yet, in its infancy, but it seems probable that the quantity ultimately raised there will be large.

"At various places near Cleveland, and in the valley of the Cuyahoga, oil makes its appearance; generally flowing from the Portage rocks. Whether it will be found here in abundance is, at least, doubtful.

"At Grafton, Lorain county, and in Liverpool, Medina county, adjoining townships, the Portage rocks contain much oil; a number of wells have been sunk which promise well, but operations are just commencing there and little oil has been raised. The Grafton oil is darker and thicker than that of Mecca, having a specific gravity of about 25° Beaume.

"On Duck Creek, in Noble county, petroleum has been procured for many years from the salt wells. Within a few months past, wells have been sunk expressly for the oil, with success, but how much is now raised there, or what is its quality, I have not definitely learned."

The area occupied by the Hamilton Group in Canada West, is very considerable, and it may be said according to the present state of our knowledge of the geographical boundaries of formations in Canada, to extend over the following Counties:—Lambton, part of Kent, Middlesex, Elgin and Norfolk. In Lower Canada Petroleum occurs in the Valley of the River St. Jean, and the Ruisseau Argenté (Gaspé). On another page will be found an extract from the *London American*, on the Oil Wells of America, from which some idea of the importance of this new element of wealth may be obtained. The numbers given are probably overrated, but there can be no doubt that Petroleum is destined to become a most important commercial product, and a very valuable source of wealth.

Besides the employment of this substance as an illuminator, some varieties are excellent lubricators, and all can be made to fulfil that purpose by proper manipulation. Mr. Newberry states in his paper on the Rock Oils of Ohio, that—

"As yet the attention of refiners of coal-oil and petroleum in this country has been confined to the products most readily derived from them, viz.: burning fluid, lubricating oil, and paraffine; but the European manufacturers have demonstrated that the process may be profitably carried much farther, and that other and more valuable secondary products may be derived from those first mentioned. By the re-distillation of the light oil, they obtain: 1st. *Benzole*, worth from 10 to 20 cents per pound. This is exclusively used as a solvent for india-rubber, gutta-percha, &c., and for extracting oil from wool before dyeing it, grease from clothing, carpets, gloves, &c., &c. 2nd. *Nitro-Benzole*, which has the taste and smell of oil of bitter almonds, and is used for the same purposes. This is worth $1 per pound. 3d. *Aniline*, a dye used for producing the fashionable color *Mauve*—$6 to $8 per pound. 4th. *Pure violet Aniline powder*, $250 to $325 per pound.

"All these may be obtained from the natural oils, perhaps in as great abundance, and as easily as from those distilled from coal."

CONDITION AND PROGRESS OF FOREIGN COUNTRIES IN MANUFACTURING INDUSTRY.

No. 3.—Italy.*

What is the present state of industry and commerce in Italy? As from the snowy tops of the Cenis or the St. Gothard, we gallop towards Italy, what first arrest our eyes are those impetuous waterfalls which descending into the beautiful lakes below, by numerous canals and navigable rivers spread themselves over the fertile plains of Lombardy. Nowhere has the hand of man seconded so ably the gifts of nature. Where can we find a system of irrigation more perfect than that which enriches the Milanese territory? The works of Leonardo da Vinci, Raffaelle, and Brabanti, are to this day the admiration of the world. Hence the advanced condition of agriculture in the great plains of Northern Italy. Whilst the land is in a manner forced to produce a constant succession of grass and grain, the vine and mulberry beautify the country, and give employment to the dense population. In Southern Italy the vine, the olive, and the mulberry, are the chief objects of culture; but the system of irrigation and drainage is not so perfect as in the north. Whilst some portions of land have but little water, other portions are often inundated with water, charged with an enormous quantity of vegetable matter carried from the mountains. As a whole, the agricultural riches of Italy are considerable, and her industry is well rewarded.

In mineral riches Italy is not so fortunate. The great want in Italy is fuel. Timber is dear, and the only substitute for coals is the deposits of anthracite, a mineral substance, consisting of carbon, with a minimum amount of hydrogen. Yet Tuscany abounds in copper, iron, mercury, lead, boracic acid, &c. Tuscany is to Italy what Cornwall is to England and Hungary to Austria. At best, however, the productions of the mines are indeed small. But let us pass to other industries.

The production of Silk, and the different industries attached to it, are of great importance. Northern Italy alone produces silk to the amount of £7,000,000 to £8,000,000, and of a quality far superior to the productions of any other country. China and India are now sending to Europe immense quantities of silk, yet the Italian organzine and other filatures are as much required as ever. The Straw-work manufacture of Tuscany is of great value. Tuscany alone produces the raw material, and the value of straw hats exported is well nigh £1,000,000 per annum.

* Abridged from a paper by Professor Leone Levi, published in the *Journal of the Society of Arts*.

The marbles of Carrara, the ornamental stones termed Mischio di Saravezzo, the alabaster and serpentine, are not only productions of immense value, but are the materials of industries strictly national. The manufacture of mosaics in Florence has a world-wide fame, and wherever we travel, and whether we inspect the palaces of sovereigns, or galleries of art, everywhere we find the productions of the Italian chisel, the glories of Italian art. But Italy is not only rich in works of art and articles of luxury; her fertile land and her rich pasture afford the most delicious and most nutritive articles of provisions. Much I might say of the Parmesan Cheese of Milan, Lodi, and Pavia, on the extensive production of excellent wine throughout Italy, as we well know, by the Nasco of Sardinia, the Aleatico of Tuscany, the Vino Santo, and Lacryma Cristi of Sicily; and also on the rice, grain, maccaroni, and fruits which find a market throughout Europe. Nowhere, perhaps, can we find more varied productions and industries than in Italy. But they want growth and expansion. They only indicate what they might become under more favourable auspices. Our acquaintance with Italian produce and industry is very imperfect; even the recent Universal Exhibition failed to display in a proper manner what Italy can furnish to the world. In 1851, the number of exhibitors from Tuscany, the Roman States, and Sardinia, was about 200, but Lombardy and Venice were concealed under the huge heading of Austria, and the Two Sicilies were not represented. At the Universal Exhibition of Paris, in 1855, the number of exhibitors from the Roman States, Tuscany, and Sardinia, was nearly 500, but the same deficiencies were experienced as regards Lombardy, Venice, and Naples. We shall soon see what Italy will exhibit in 1862. Assuming that the work of regeneration, and the reform of abuses, now vigorously in progress, must occupy the attention of the Italians for some time to come, it will be from 1862 that the economical progress of Italy will date. Let us hope that an effort may then be made to exhibit in a thorough manner the various resources of that gifted land, and that thenceforth our trade with Italy may double or treble the present amount. Our imports thence probably amount now to £3,000,000, not including, however, the Italian silk which arrives here through France; and our exports to Sardinia, the Italian-Austrian States, Tuscany, the Papal States, and Two Sicilies, exceed £6,000,000.

The present amount of commerce in Italy is doubtless immensely inferior to that of the United Kingdom, France, or the United States, yet if we take all the States together, the imports of Italy will amount to about £30,000,000 and the exports to £26,000,000, a tonnage entered and cleared of nearly 4,000,000 tons, with a mercantile marine of 700,000 tons. In the last decennium the commerce of Sardinia has more than doubled, but that of other States has shown but little improvement. No better evidence can be produced of the superior position of the Northern States than the fact that while Sardinia exports at the rate of 32s. per head, the exports of Tuscany average 25s., those of the Roman States 11s., and those of the Neapolitan States barely 8s. per head. As yet the exports of Italy consist principally of her own produce, and of articles prepared for manufacturing purposes. In cotton, woollen and linen manufactures, the modern wonders of mechanical power, Italy cannot think of competing with Great Britain, though she produces considerable quantities of such articles for her own consumption. There are, however, no positive hindrances to her achieving, even in these, considerable distinction. No climate is better adapted than the Italian for vividness and brilliancy of colour. Dyewoods they may have in abundance. The water is good, and as for power of inventiveness, we might well trust the land of Raffaelle, Correggio, and Carracci.

But what has become of the great Italian Republics? Their institutions are gone for ever. They are the shadow of the past. Yet some of them still preserve considerable importance. Genoa is the chief outlet for the Mediterranean of the manufactures of Switzerland, Lombardy and Piedmont; and Lombardy receives most of the foreign articles imported through Genoa. She has a population of 120,000, an excellent harbour, a commerce of importation and exportation amounting to £15,000,000, and a mercantile marine amounting to 200,000 tons. She has large manufactures of silk, cotton, wool, hides and leather, and considerable foundries and establishments of mechanical engineering. There is life in Genoa, and she will be the first to benefit from the extension of the territories in Northern Italy. Leghorn is by no means unimportant. She has a population of 100,000, and an export and import trade of about £7,000,000 to £8,000,000. Naples, also in the Mediterranean, is a large seaport, the principal port, in fact, of the Two Sicilies, with much trade and extensive manufacture. Civita Vecchia is of no great importance. In the Adriatic, Ancona is essentially a mercantile city, with a large marine; but Venice, still prostrate under the galling yoke of Austria, has but little left of her former glory. When will she rise as a man to shake off the chains of her slavery?

ECONOMICAL CONDITION OF ITALY IN 1856.

	Population.	Imports.	Exports.	Revenue.	Expenditure.	Debt.	Shipping.
		£	£	£	£	£	Tons.
Sardinia (continent) ...	4,368,972	15,852,711	12,523,164	5,438,692	5,749,074	27,224,000	177,000
" (island)	547,112	587,815	460,070				
Tuscany	1,796,078	3,006,564	2,323,236	1,265,591	1,297,029	4,662,442	31,000
Roman States...........	3,124,668	3,253,734	1,676,386	3,039,321	3,135,436	2,500,000	30,000
Two Sicilies	9,117,005	3,210,819	1,468,709	5,000,000	5,000,000	2,000,000	220,000
Lombardy................	3,009,505	2,156,892	6,205,753				
Venice	2,493,908	1,958,266	647,500	...	...	...	30,000
Tyrol	925,066	700,000	300,000				
Modena..................	600,676	250,000	53,800	300,000	300,000	...	
Parma	508,784	190,000	150,000	370,000	370,000	...	
	26,491,834	30,166,301	25,808,618	...	...	36,386,442	488,000

ARTICLES OF ITALIAN EXPORT IN 1856.

Brandy	4,000,000	galls.
Wine	8,000,000	"
Olive Oil	23,000,000	lbs.
White Lead	1,200,000	"
Bark of Pine (tanned)	2,700,000	"
Fruit (green)	28,000,0C0	"
Oranges and Lemons	1,200,000	boxes
Seed, Oleaginous	2,200,000	lbs.
Hides, wet and dry	2,300,000	"
Cotton, raw	12,000,000	"
Wool	80,000,000	"
Silk, waste	1,000,000	"
" prepared for throwing	15,000	"
" raw	8,000,000	"
" thrown	2.000,000	"
" manufactured glacé	90,000	"
" thread	250,000	"
Rice	50,000,000	"
Maccaroni	4,000,000	"
Paper	3,000,000	"
Hardware	100,000	"
Coral, wrought	45,000	"
Machinery	22,000,000	"
Lead Ore	15,000,000	"
Hemp	25,000,000	"
Stone and materials for building	50,000,000	"
Cordage of hemp	1,500,000	"
Skins and furs	700,000	"
Works of modern art, sculpture, painting, &c.	500,000	"
Works of alabaster	400,000	"
Rags of all kinds	4,500,000	"
Chestnuts	40,000	"
Raw Copper	400,000	"
Borax	3,000,000	"
Bark	10,000,000	"
Soap	300,000	"
Straw hats	500,000	"
" manufactures of	10,000	"
" plaited for hats	400,000	"
Almonds	1,000	cwts.
Argols	12,000	"
Fruits—dry figs	24,000	"
Liquorice	10,000	"
Nuts, &c.	8,000	"
Sulphur	8,000	"
Shumac	700,000	"
Cream of tartar	26,000	"
Linseed	10,000	"
Brimstone	2,500,000	"
Manna	2,800	"
Fish, salted	6,000	"
Barilla	184,000	"
Cheese	800,000,000	"
Timber for building		
Grain		
Animals, &c.		

No. 4.—Portugal.

The population of Portugal in 1857 was 3,908,861, or a proportion of 1,209 souls to the square league, one of the thinnest in Europe, but higher than Spain, which is 1000.

The contrast between the northern and southern Portuguese is as striking as that between their respective territories. The former are comparatively active and enterprising, while the latter are indolent and obstinate. The Minho province is, at least, cultivated to the extent of one-fifth of its surface, while not one-fifteenth part of Alemtejo is tilled. Still the latter province is by no means unproductive. What few attempts at improvement have been made are due to settlers from the northern provinces.

The causes of this difference between two provinces of the same kingdom, inhabited by the same race, are of very old standing. They go back as far as the Moorish wars, when the southern provinces were completely depopulated, and were constituted into extensive fiefs, or "morgados." These "morgados" were placed under a special legislation, which subsists to this day, to prevent their subdivision.

The average amount of taxation was 12s. per head in 1857 and 1858; but the whole expenses of government amounted to £3,973,134, or about £1 per head. The debt is increasing at the rate of £3,300,000 per annum.

Unlike what occurs in other constitutional countries, here the budget is not discussed or voted at all by the Chamber of Deputies. At the end of the session a law is generally passed giving the Government full power to collect taxes and pay expenditure in conformity with some former budget. This suits the convenience of the Ministry, as it virtually makes them the sole judges of what expenditure is requisite during their tenure of office. The constant increase of expenditure is not, then, to be wondered at.

With reference to manufacturing industry, there appear, by the last returns, 36 hat manufactories, 21 tanneries, 12 metal-foundries, 16 earthenware or glass factories, 28 paper-mills, 17 dyeing or printing works, and 189 spinning or weaving establishments; in all, 362 manufactories, employing 15,897 operatives of both sexes. By a manufactory is understood an establishment employing ten or more hands.

The great desideratum of Portugal is, still, means of communication. Other improvements would then soon follow. It is admitted by every Government; for immense sums have been voted at different times for the purpose of making both roads and railways, with little apparent result. Numerous contracts have been passed, with capitalists of all countries, but still everything remains to be done.

WINE TRADE—PORT WINE.

Wine is the fountain of wealth and the staple export of Portugal. The exports of fermented liquors in 1856-57 attained a computed value of £1,653,456, *i. e.*, more than that of all the other classes of exports added together. The vine disease appeared first in 1852.

The port wine district, or so-called "demarcaçao," is a strictly-defined, narrow strip of land, extending for nine leagues along both banks of the Douro, and containing a population of 64,000. No other wine than the approved wine of this small district can legally be shipped from Oporto. It was formerly divided into three sub-districts, called Feitoria, Subsidiario, and Ramo. The produce of the first alone was allowed to be exported to Europe. In 1852 they were all three agglomerated into one "demarcação." The legal distinctions were abolished, but the prime wines are still grown in the Feitoria.

Immediately after the vintage, the officers of the "Commissao Reguladora" visit every farm, in order to "enrol" and sample the wine. They carry away a sealed sample-bottle of every pipe, with the name of the grower pasted on it in such a manner as not to be visible till after the label is detached. At the fair of Pezo de Regoa, in February, the samples are all tried by jury; those "approved" for export received a "bilhete," or pass of admission to the export warehouse of Villa Nova. Here alone the approved wines can be stored.

To be "approved," Douro wine must possess certain qualities which the grape-juice alone cannot impart. It must contain body, sweetness, and color enough to qualify it for "benefitting" other wines; or, in the words of the law, "para si e para dar." This disposition is founded on a notion that port is required by us principally for blending with other wines. This has led to the production of that artificial, thick, strong, and sweet compound in such great demand for tavern use in England. A simple unloaded wine cannot lawfully receive a "bilhete," but must be shipped under a purchased one. As these "bilhetes" are objects of sale, the more delicate wines used to be passed by this means. The minimum of adventitious spirit in port wine shipped to England is 2½ per cent., but the heavy, full-bodied, so-called rich wines, cannot ever contain less than 15 to 17 gallons per pipe of 115 gallons.

The crop of 1851 (94,122 pipes) was equal, in quantity and quality, to any on record. That of 1852 was still very large. That of 1853 was the first attacked by the *oidium*, but was little, if at all, below an average. Those of 1854 and 1855 first showed any real falling off. That of 1856 was the shortest on record (14,673 pipes).

The enrolment of 1858 closed with a figure of 17,353 pipes; but it is necessary to state that 4,600 are Ramo wines, a produce formerly not exportable at all, and that a part of the remainder is not grown in the "demarcaçao" at all.

Wines, like those of the vintage, must, of course, require a more than average proportion of alcohol. This used to be supplied by the distillation of the "consumo" wine; but the latter now finds a more profitable market in the tavern supply. Native wine-brandy was till last September alone admissible to the Villa Nova stores for the purpose of blending with the export wines. Much Spanish brandy, however, has found its way thither. Fig-brandy has also been surreptitiously introduced. By a Decree of September, 1858, foreign spirits "that shall be considered fit" may be admitted there for the above purpose.

The value of port wine seems to have doubled since the year 1848, if the official Returns are to be credited, for in that year it was valued at $84.000 per pipe, and in 1859 at $171.000. The prices paid to the farmer for wines in a crude state without brandy have been;—

In 1855,	from	$48,000	to	$72,000
1856,	"	50,000	to	80,000
1857,	"	65,000	to	100,000
1858,	"	45,000	to	60,000
1859,	"	60,000	to	80,000

The export of this wine did not sensibly diminish till 1857–58, when it fell off suddenly in quantities and value. The large stocks in hand have done much to mitigate the shock caused by the long-continued failures of wine. These stocks at Villa Nova amounted on the 1st January, 1856, to 98,776 pipes, and last June, 1859, to 77,582 pipes. These deposits are for the greatest part unfit for the English market. Those which (according to the vitiated taste of the day) are considered of the best description are mostly adulterated to such an extent with elderberry, geropiga, and other ingredients, that it would be difficult to procure 20,000 pipes of pure wine among the whole quantity offered for sale. These stocks must, however, be got rid off. The shipments of late years have already had a tendency, by their inferior character, to throw discredit upon all shipments, however excellent, bearing the name of port, and to depreciate the character of the whole stock. Notwithstanding the Government guarantee of quality, fresh supplies of crude ill-fermented wines have been annually thrown into Villa Nova.

LISBON AND MADEIRA WINES.

Brazil is the greatest market for the Lisbon wines. Madeira wine is no longer produced, the year 1858 yielding only 600 pipes of inferior wine. For six years there was no vintage whatever, the *oidium* having destroyed the grape. The wine was replaced by the sugar cane. It is worthy of note that Madeira wine is counterfeited on a large scale in France, and even in Lisbon. The common "Dry Lisbon" can by a certain process of heating and storing be made to acquire a resemblance to the "East Indian Maderia."

EFFECTS OF THE VINE DISEASE.

In summing up the effects of the vine disease, it will be found that this visitation has annihilated the most expensive Portuguese wine, has reduced the annual crop of the others to a quarter of an average, has impaired the quality of this remnant and its credit in its best markets; that it has already begun to diminish the value of exports, and, as a natural consequence, has evidently checked the expansion of the import trade, which had been before advancing so rapidly. It has also caused a serious commercial crisis at Oporto, and has certainly crippled the national revenue.

CHEMICAL HISTORY OF A CANDLE.

BY M. FARADAY, D.C.L., F.R.S.

From the Chemical News Jan. 5th 1861.

LECTURE I.—*A Candle: The Flame—Its Sources—Structure—Mobility—Brightness.*

I purpose thanking you for the honor you do us in coming to see what are our proceedings here, by bringing before you the Chemical History of a Candle. I have done so on a former occasion, and if I had my own will I should do it almost every year; so abundant is the interest that attaches itself to the subject, so wonderful are the varieties of outlet which it gives into the various departments of philosophy. There is not a law under which any part of this universe is governed which does not come into play and is touched upon in these phenomena. There is no better, there is no more open door by which you can enter into the study of natural physical philosophy, than by considering the phenomena of a candle.

Therefore I believe I shall not dissapoint you in choosing this for my subject rather than any newer form, which could not be better, if it were so good.

And having said so much to you, let me say this also: that though our subject be so great, and our intention that of treating it honestly, philosophically, and seriously, yet I mean to pass away from all those here who are seniors. I claim the right of speaking to juveniles as a juvenile myself. I have done it on former occasions, and, if you please, I shall do it again. And though I know that I stand here with the knowledge of having the words I utter given to the world, yet that shall not deter me from speaking in the same familiar way to those whom I esteem nearest to me on this occasion. You know that though we make no publication of our proceedings—neither I nor the authorities—we give all facilities to those who honor us by supposing that what they hear here is worth conveying farther—we give them every facility to hear us, and write about us, but it is entirely their own act. You have here the original, in whatever shape it appears anywhere else.

And now to my boys and girls.

I must first tell you what candles are made of. Some are very curious things. I have here some bits of timber, branches of trees particularly famous for their burning. And here you see a piece of that very curious substance taken out of some of the bogs in Ireland, called *candle wood*, a hard, strong, excellent wood, evidently fitted for good work as a resister of force, and yet withal burning so well that when it is found they make splinters of it, and torches, since it burns like a candle, and burns very well indeed. And here in this wood is one of the most beautiful illustrations of the general nature of a candle that I can possibly give. The fuel provided, the means of bringing that fuel to the place of chemical action, the regular and gradual supply of air to that place of action—heat and light—all produced by a little piece of wood of this kind, forming, in fact a natural candle.

But we must speak of candles as they are in commerce. Here are a couple of candles commonly called dips. They are made of lengths of cotton cut off, hung up by a loop, dipped into melted tallow, taken out again and cooled, then redipped, until there is an accumulation of tallow round the cotton. In order that you may have an idea of the various characters of these candles, you see these which I hold in my hand—they are very small and very curious. They are, or were, the candles used by the miners in coal mines. In olden times the miners had to find their own candles, and it was supposed that a small candle would not so soon set fire to the fire-damp in the coal mines as a large one; and for that reason, as well as for economy's sake, they had candle's made of this sort, 20, 30, 40, or 60, to the pound. They have been replaced since then by the steel-mill, and then by the Davy-lamp, and other safety-lamps of various kinds. I have here a candle that was taken out of the *Royal George*, it is said, by Sir George Pashley. It has been sunk in the sea for many years, subject to the action of salt water. It shows you how well candles may be preserved, for though it is cracked about and broken a good deal, yet when lighted it goes on burning regularly, and the tallow resumes its natural condition, as soon as it is fused.

Mr. Field, of Lambeth, has supplied me abundantly with beautiful illustrations of the candle and its materials: I shall therefore now refer to them. And, first, there is the suet—the fat of the ox—Russian tallow, I believe, employed in the manufacture of these dips, which Gay Lussac, or some one who entrusted him with his knowledge, converted into that beautiful substance, stearine, which you see lying beside it. A candle, you know, is not now a greasy thing like an ordinary tallow candle, but a clean thing, and you may almost scrape off and pulverise the drops which fall from it without soiling anything. This is the process he adopted:—The fat or tallow is first boiled with quick lime, and made into a soap, and then the soap is decomposed by sulphuric acid, which takes away the lime, and leaves the fat rearranged as stearic acid, whilst a quantity of glycerine is produced at the same time. Glycerine—absolutely a sugar, or a substance similiar to sugar—comes out of the tallow in this chemical change. The oil is then pressed out of it; and you see here this series of pressed cakes, showing how beautifully the impurities are carried out by the oily part as the pressure goes on increasing, and at last you have left that substance which is melted, and cast into candles as you here see them. The candle I have in my hand is a stearine candle, made of stearine from tallow in the way I have told you. Then here is a sperm candle, which comes from the purified oil of the spermaceti whale. Here also is yellow beeswax and refined beeswax, from which candles are made. Here, too, is that curious substance called paraffin obtained from the bogs of Ireland. I have here also a substance brought from Japan since we have forced an entrance into that out-of-the-way place—a kind of wax which a kind friend has sent me, and which forms a new material for the manufacture of candles.

And how are these candles made? I have told you about dips, and I will show you how moulds are made. Let us imagine any of these candles to be made of materials which can be cast. "Cast!" you say, "Why a candle is a thing that melts, and surely if you can melt it you can cast it." No so. It is wonderful, in the progress of manufacture, and in the consideration of the means best fitted to produce the required result, how things turn up which one would not expect beforehand. Candles cannot always be cast. A wax candle can never be cast. It is made by a particular process which I can illustrate in a minute or two, but I must not spend much time on it. Wax is a thing which, burning so well, and melting so easily in a candle cannot be cast. However, let us take a material that can be cast. Here is a frame with a number of moulds fastened in it. The first thing to be done is to put a wick through them. Here is one—a plaited wick, which does not require snuffing—supported by a little wire. It goes to the bottom, where it is pegged in—the little peg holding the cotton tight and stopping the aperture, so that nothing fluid shall run out. At the upper part there is a little bar placed across, which stretches the cotton and holds it in the mould. The tallow is then melted, and the moulds are filled. After a certain time, when the moulds are cool, the excess of tallow is poured off at one corner, and then cleaned off altogether, and the ends of the wick cut away. The candles alone then remain in the mould, and you have only to upset them, as I am doing, when out they tumble, for the candles are made in the form of cones, being narrower at the top than at the bottom, so that what with their form and their own shrinking, they only need a little shaking, and out they fall. In the same way are made these candles of stearine and of paraffin. It is a curious thing to see how wax candles are made. A lot of cottons are hung upon frames, as you see here, and covered with metal tags at the ends, to keep the wax from covering the cotton in those places. These are carried to a heater, where the wax is melted. As you see, the frames can turn round, and as they turn a man takes a vessel of wax and pours it first down one, and then the next, and the next, and so on. When he has gone once round, if it is sufficiently cool, he gives the first a second coat, and so on until they are all of the required thickness. When they have been thus clothed, or fed, or made up to that thickness, they are taken off and placed elsewhere. I have here, by the kindness of Mr. Field, several specimens of these candles. Here is one only half finished. They are then taken down and well rolled upon a fine stone slab, and the conical top is moulded by properly shaped tubes, and the bottoms cut off and trimmed. This is done so beautifully, that they can make candles in this way weighing exactly four, or six, to the pound, or any number you please.

We must not, however, take up more time about the mere manufacture, but go a little further into the matter. I have not yet referred you to luxuries in candles (for there is such a thing as luxury in candles). See how beautifully these are coloured; you see here mauve, Magenta, and all the chemical colours recently introduced, applied to candles. You observe also, different forms employed. Here is a fluted pillar most beautifully shaped; and I have also here some candles sent me by Mr. Pearsall, which are ornamented with designs upon them, so that as they burn, you have as it were a glowing sun above and and a bouquet of flowers beneath. All, however, that is fine and beautiful, is not useful. These fluted candles, pretty as they are, are bad candles, they are bad because of their external shape. Nevertheless, I show you these specimens sent to me from kind friends on all sides, that you may see what is done and what may be done in this or that direction, though, as I have said, when we come to these refinements, we are obliged to sacrifice a little in utility.

Now as to the light of the candle. We will light one or two, and set them at work in the performance of their proper functions. You observe a candle is a very different thing from a lamp. With a lamp you take a little oil, fill your vessel, put in a little moss or some cotton prepared by artificial means, and then light the top of the wick. When the flame runs down the cotton to the oil, it gets extinguished, but it goes on burning in the part above. Now, I have no doubt you may ask, how is it that the oil which will not burn of itself gets up to the top of the cotton where it will burn! We shall presently examine that; but there is a much more wonderful thing about the burning of a candle than this. You have here a solid substance with no vessel to contain it, and how is it that this solid substance can get up to the place where the flame is? How is it that this solid gets there, it not being a fluid? or, when it is made a fluid, then how is it that it keeps together? This is a wonderful thing about a candle.

We have here a good deal of wind, which will help us in some of our illustrations, but tease us in others; for the sake therefore, of a little regularity, and to simplify the matter, I shall make a quiet flame, for who can study a subject when there are difficulties in the way not belonging to it? Here is a clever invention of some costermonger or street-stander in the market-place for the shading of their candles on Saturday nights, when they are selling their greens, or potatoes or fish. I have very often admired it. They put a lamp-glass round the candle, supported on a kind of gallery, which clasps it, and it can be slipped up and down as required. By the use of this lamp-glass, employed in the same way, you have a steady flame, which you can look at, and carefully examine, as I hope you will do, at home.

You see then, in the first instance, that a beautiful cup is formed. As the air comes to the candle it moves upwards by the force of the current which the heat of the candle produces, and it so cools all the sides of the wax, tallow, or fuel, as to keep the edge much cooler than the part within; the part within melts by the flame that runs down the wick as far as it can go before it is extinguished, but the part on the outside does not melt. If I made a current in one direction, my cup would be lop sided, and the fluid would consequently run over,—for the same force of gravity which holds worlds together holds this fluid in a horizontal position, and if the cup be not horizontal, of course the fluid will run away in guttering. You see, therefore, that the cup is formed by this fine, uniform, regular ascending current of air upon all sides which keeps the exterior of the candle cool. No fuel would do for a candle which has not the property of giving this cup, except such fuel as the Irish bogwood, where the thing is like a sponge, and holds its own fuel. You see now, why you would have had such a bad result if you were to burn these beautiful candles that I have shown you, which are irregular, intermittent in their shape, and cannot, therefore, have that nicely-formed edge to the cup which is the great beauty in a candle. I hope that you will now see that the perfection of a process, that is, its utility, is the better point of beauty about it. It is not the best-looking thing, but the best-acting thing, which is the most advantageous to us. This good-looking candle is a bad burning one. There will be a guttering round about it because of the irregularity of the stream of air and the badness of the cup which is formed thereby. You may see some pretty cases (and I expect you to think of these things) of the action of the ascending currents when you have a little gutter run down the side of a candle, making it thicker than it is elsewhere. As the candle goes on burning, that keeps its place and forms a little pillar sticking up by the side, because, as it rises higher above the rest of the wax or fuel the air gets round it, it is more cooled and better resists the action of the heat at a little distance. Now, the greatest mistakes and faults with regard to candles, as with regard to other points, often bring with them instruction which we should not receive if they had not occurred. We come here to be philosophers, and I hope you will always remember that whenever a result happens, especially if it is new, you should say, "What is the cause? Why does that occur?" and you will in the course of time find it out.

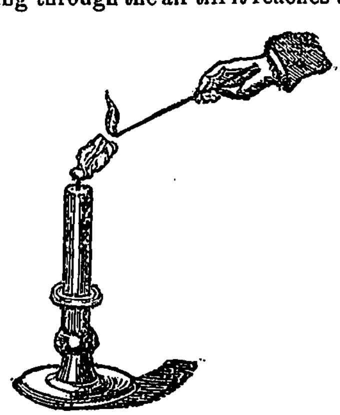
Then there is another point about these candles which will answer a question,—that is, as to the way in which this fluid gets out of the cup, up the wick, and into the place of combustion. You know that the flames on these wicks burning in candles made of beeswax, or stearine, or spermaceti, do not run down to the wax or other matter, and melt it all away, but keep it to their own right place. They are fenced off from the fluid below, and do not encroach on the cup at the sides. I cannot imagine a more beautiful and more compact thing than the condition of adjustment under which a candle makes one part subserve to the other to the very end of its action. A combustible thing like that, burning away gradually, never being intruded on by the flame,—is a very beautiful sight; especially when you come to learn what a vigorous thing flame is—what power of destroying the wax itself when it gets hold of it, and destroying its proper form even before it gets hold of it, if it come too near.

Now, how does it get hold of it? There is a beautiful point about that—*capillary attraction.* "Capillary attraction!" you say,—"the attraction of hairs." Well, never mind the name; it was given in old times before we had a good understanding of what the real power was. It is by what is called capillary attraction that the fuel is conveyed to the part where combustion goes on, and is deposited there, not in a careless way, but very beautifully in the very midst of the centre of action, which takes place around it. Now I am going to give you one or two instances of capillary attraction. It is that kind of action or attraction which makes two things that do not dissolve in each other still hold together. When you wash your hands you wet them thoroughly; you take a little soap to make the adhesion better, and you find your hand remains wet. This is by that kind of attraction of which I am about to speak. And what is more; if your hands are not soiled (as they almost always are by usages of life), if you put your finger into a little warm water, the water will creep a little way up the finger, though you may not stop to examine it. I have here a substance which is rather porous—a column of salt,—and I will pour into the plate at the bottom, not water as it appears, but a saturated solution of salt, which cannot absorb more; so that the action which you see, will not be due to its dissolving anything. We may consider the plate to be the candle, and the salt the wick, and this solution the melted tallow. (I have coloured the fluid that you may see the action better.) You observe that now I pour in the fluid, it rises and gradually creeps up the salt higher and higher; and provided the column does not tumble over, it will go to the top. If this blue solution were combustible, and we were to place a wick at the top of the salt, it would burn as it entered into the wick. It is a most curious thing to see this kind of action taking place, and to observe how singular some of the circumstances are about it. When you wash your hands you take a towel to wipe off the water, and it is by that kind of wetting, or that kind of attraction which makes the towel become wet with water, that the wick is made wet with the tallow. I have known some careless boys and girls (indeed, I have known it to happen to careful people as well) who, having washed their hands and wiped them with a towel, have thrown the towel over the side of the basin, and before long it has drawn all the water out of the basin and conveyed it to the floor, because it happened to be thrown over the side in such a way as to serve the purpose of a syphon. That you may the better see the way in which the substances act one upon another, I have here a vessel made of wire gauze filled with water, and you may compare it in its action to the cotton in one respect, or to a piece of calico in the other. In fact, wicks are sometimes made of a kind of a wire gauze. You will observe that this vessel is a porous thing, for if I pour a little water on the top, it will run out at the bottom. You would be puzzled for a good while if I asked you what the state of the vessel is, what is inside it, and why it is there? The vessel is full of water, and yet you see the water goes in and runs out as if it were empty. In order to prove this to you I have only to empty it. The reason is this—the wire being once wetted, remains wet; The meshes are so small that the fluid is attracted so strongly from the one side to the other, as to remain in the vessel although it is porous. In like manner the particles of melted tallow ascend the cotton and get to the top; other particles then follow by their mutual attraction for each other, and as they reach the flame they are gradually burned.

Here is another application of the same principle. You see this bit of cane. I have seen boys about the streets, who are very anxious to appear like men, take a piece of cane and light it and smoke it, as an imitation of a cigar. They are enabled to do so by permeability of the cane in one direction, and by its capillarity. If I place this piece of cane on a plate containing some camphine (which is very much like paraffin in its general character), exactly in the same manner as the blue fluid rose through the salt, will this fluid rise through the piece of cane. There being no pores at the side, the fluid cannot go in that direction, but must pass through its length. Already the fluid is at the top of the cane, and now I can light it and form it into a candle. The fluid has risen by the capillary attraction of the piece of cane, just as it does through the cotton in the candle.

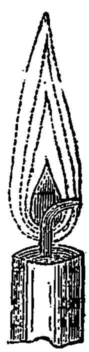
Now, the only reason why the candle does not burn all down the side of the wick is that the melted tallow extinguishes the flame. You know that a candle if turned upside down, so as to allow the fuel hot enough to burn, as it does above where it is carried in small quantities into the wick, and has all the effect of the heat exercised upon it.

There is another condition which you must learn as regards the candle, without which you would not be able fully to understand the philosophy of it, and that is the vaporous condition of the fuel. In order that you may understand that, let me show you a very pretty, but very common-place experiment. If you blow a candle out cleverly, you will see the vapour rise from it. You have, I know, often smelt the vapour of a blown-out candle, and a very bad smell it is; but if you blow it out cleverly, you will be able to see pretty well the vapour into which this solid matter is transformed. I will blow out one of these candles in such a way as not to disturb the air around about it by the continuing action of my breath; and now, if I hold a lighted taper two or three inches from the wick, you will observe a train of fire going through the air till it reaches the candle.

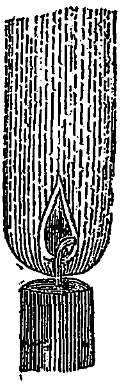


I am obliged to be quick and ready, because if I allow the vapour time to cool, it becomes condensed into a liquid or solid, or the stream of combustible matter gets disturbed.

Now, as to the shape or form of the flame, it concerns as much to know about the condition which the matter of the candle finally assumes at the top of the wick, where you have such beauty and brightness as nothing but combustion or flame can produce. You have the glittering beauty of gold and silver, and the still higher lustre of jewels like the diamond and ruby; but nothing of these comes by comparison near to the brilliancy and beauty of flame. What diamond can shine like flame? It owes its lustre at night time to the very flame shining upon it. The flame shines in darkness, but the light which the diamond has is as nothing, until the flame shine upon it, when it is brilliant again. The candle alone shines by itself, and for itself, or for those who have arranged the materials. Now, let us look a little at the form of the flame as you see it under the glass shade. It is steady and equal, and its general form is that which is represented in the diagram, varying with atmospheric disturbances, and also varying according to the size of the candle. It is a bright ob-

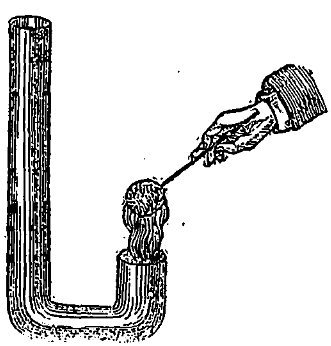


long, brighter at the top than towards the bottom, with the wick in the middle, and besides the wick in middle certain darker parts towards the bottom where the ignition is not so good as in the part above. I have a drawing here made many years ago by Hooker, when he made his investigations. It is the drawing of the flame of a lamp, but it will apply to the flame of a candle. The cup of the candle is the vessel or lamp; the melted spermaceti is the oil; and the wick is common to both. Upon that he sets this little flame, and then he represents what is true, a certain quantity of matter rising about it which you do not see, and which, if you have not been here before, or are not familiar with the subject, you will not know of. He has here represented the parts of the surrounding atmosphere that are very essential to the flame and that are always present with it. There is a current formed, which draws the flame out, for the flame which you see is really drawn out by the current, and drawn upward to a great height, just as Hooker has here shown you by that prolongation of the current in the diagram. You may see this by taking a lighted candle, and putting it in the sun so as to get its shadow thrown on a piece of paper. What a remarkable thing it is that that thing which is light enough to produce shadows of other objects, can be made to throw its own shadow on a piece of white paper or card, so that you can actually see streaming round the flame something which is not part of the flame, but is ascending and drawing the flame upwards. Now I am going to imitate the sunlight, by applying the voltaic battery to the electric lamp. You now see our sun, and its great luminosity; and by placing a candle between it and the



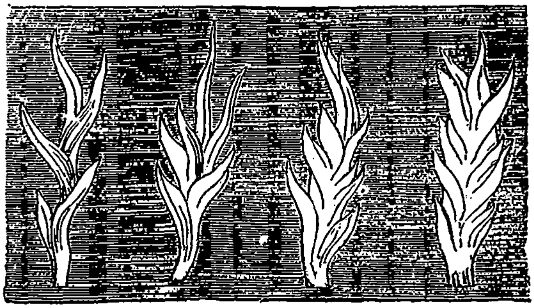
screen, we get the shadow of the flame. You observe the shadow of the candle, and of the wick; then there is a darkish part, as represented in the diagram, and then a part which is more distinct. Curiously enough, however, what we see in the shadow as the darkest part of the flame, is, in reality, the brightest part, and here you see streaming upwards the ascending current of hot air, as shown by Hooker, which draws out the flame, supplies it with air, and cools the sides of the cup of melted fuel.

I can give you here a little further illustration for the purpose of showing you how flame goes up or down according to the current. I have here a flame, —it is not a candle flame,—but you can, no doubt, by this time generalise enough to be able to compare one thing with another,—what I am about to do is to change the ascending current that takes the flame upwards into a descending current. This I can easily do by the little apparatus you see before me. The flame, as I have said, is not a candle flame, but it is produced by alcohol so that it shall not smoke too much. I will also colour the flame with another substance, so that you may trace its course, for with spirit alone you could hardly see enough to have the opportunity of tracing its course of action. By lighting the spirit-of-wine, we have then a flame produced, and you observe that when held in the air it naturally goes upwards. You understand now easily



enough why flames go under ordinary circumstances —it is because of the draught of air by which the combustion is formed. But now by blowing the flame down you see I am enabled to make it go downwards into this little chimney, the direction of the current being changed. Before we have concluded this course of lectures we shall show you a lamp in which the flame goes up, and the smoke goes down, or the flame goes down and the smoke goes up. You see, then, that we have the power in this way of varying the flame in different directions.

There are now some other points that I must bring before you. Many of the flames you see here vary very much in their shape by the current of air blowing around them in different directions; but we can, if we like, make flames so that they will look like fixtures, and we can photograph them—indeed, we have to photograph them—so that they become fixed to us, if we wish to find out everything concerning them. That, however, is not the only thing I wish to mention. If I take a flame sufficiently large, it does not keep that homogeneous, that uniform condition of shape, but it breaks out with a power of life which is quite wonderful. I am about to use another kind of fuel, but it is truly and fairly representative of the wax or tallow of a candle. I have here a large ball of cotton, which will serve as a wick. And, now that I have immersed it in spirit and lit it, in what way does it appear to differ from an ordinary candle? Why it differs very much in one respect, that we have a vivacity and power about it, a beauty and a life utterly unlike the light presented by a candle. You seen those fine tongues of fame rising up. You have the same general disposition of the mass of the flame from below upwards, but, in addition to that, you have this remarkable breaking out into tongues which you do not perceive in the case of a candle. Now, why is this? I must explain it to you, because when you understand that perfectly you will be able to follow me better in what I have to say hereafter. I suppose some here will have made for themselves the experiment I am going to show you. Am I right in supposing that anybody here has played at snapdragon? I do not know a more beautiful illustration of the philosophy of flame, as to a certain part of its history, that the game of snapdragon? First, here is my dish; and let me say, that when you play snapdragon well you ought to have the dish well warmed; you ought also to have warm plums, and warm brandy, which, however, I have not got. When you have put the spirit into your dish, you have the cup and the fuel; and are not the raisins acting like the wicks? I now throw the plums into the dish, and light the spirits, and you see those beautiful tongues of flame that I have referred to. You have the air creeping in over the edge of the dish forming these tongues. Why? Because through the force of the current, and the irregularity of the action of the flame, it cannot flow in one uniform stream. The air flows in so irregularly that you have, what would otherwise be a single image, broken up into a variety of forms, and each of these little tongues has an independent existence of its own. Indeed, I might say, you have here a multitude of independent candles. You must not imagine that because you see these tongues all at once that the flame is of this particular shape. A flame of that shape is never so at any one time. Never is a body of flame, like that which you just saw rising from the ball, of the shape it appears to you. It consists of a multitude of different shapes, succeeding each other so fast that the eye is only able to take cognizance of them all at once. In former times, I purposely analysed a flame of that general



character, and this shows you the different parts of which it is composed. They do not occur all at once; it is only because we see these shapes in such rapid succession, that they seem to us to exist all at one time.

It is too bad that we have not got further than my game of snapdragon, but we must not, under any circumstances, keep you beyond your time, It will be a lesson to me in future to hold you more strictly to the philosophy of the thing than to take up your time so much with these illustrations.

The Board of Arts & Manufactures
FOR UPPER CANADA.

PROCEEDINGS OF THE SUB-COMMITTEE.

Thursday, Feb. 28th, 1861.

The first meeting of the Sub-Committee for the current year was held at the Board Room, at one o'clock, p. m.; Present—The Vice President (Mr. J. E. Pell), Professor Hincks, Professor Hind, W. Hay, Esq., Dr. Craigie, and T. Sheldrick.

Minutes of the last annual meeting were submitted.

The Secretary read correspondence with the Society of Arts, in relation to books and periodicals ordered by the Board; also a communication from Messrs. Maw & Co., of England, notifying their having forwarded for the library of the Board copies of their pattern books of tesselated pavement, and of their intended donation to the museum of the Board of framed examples of their manufactures, shewing the effect of their complete pavement when laid; from the Smith's Falls Mechanics' Institute, enclosing the sum of $8, as its subscription to this Board for the current year; also a correspondence with the Board of Arts and Manufactures for Lower Canada, in relation to its securing an interest in the Journal published by this Board; to the World's Exhibition, proposed to be held in London in the year 1862; on amendments to the acts constituting these Boards, and other matters.

The Secretary stated that, after consulting with the President and some members of the Sub-Committee, he had made an informal offer of arrangement with the Board for Lower Canada, to publish its transactions, and to supply a certain number of copies of the Journal to said Board, on its becoming responsible for a stated proportion of the expenses connected with its publication. This proposed arrangement has been so far completed that it only awaits the confirmation of this Committee to bring it into effect.

A statement of the probable Receipts and Expenditure of this Board for the current year, was also submitted.

The Secretary reported that he had corresponded with some of the principal booksellers in Great Britain and the United States, soliciting the regular transmission to this Board of their latest catalogues of books, for the use not only of the Board but the public generally; that Messrs. Harper Brothers and D. Appleton & Co., have sent on their latest publications, and that the catalogues of many other publishers may be shortly expected.

Sundry accounts were passed and ordered to be paid; it was then

Resolved, That this Committee approve of the offer of arrangement made by the Secretary to the Lower Canada Board in relation to the Journal, and authorise its completion on the terms proposed.

Resolved, That books be appropriated to the Smith's Falls Mechanics' Institute to the value of its subscription to this Board for the current year.

Resolved, That the Secretary be instructed to effect an insurance on the books and furniture belonging to the Board, to the amount of $1000.

Resolved, That Professor Hind, W. Hay, Esq., and the Secretary, do constitute the Book Committee for the current year.

Resolved, That the sum of $250 be appropriated for the purchase of books of reference, and that said amount be placed at the disposal of the Book Committee.

Resolved, That W. Hay, Esq., Dr. Craigie, Professor Hincks, and Professor Hind, do constitute the Journal Committee for the current year.

Resolved, That the Secretary be instructed to address circulars to the Presidents of the several Mechanics' Institutes in Upper Canada, requesting them to appoint, on behalf of this Board, canvassers for the Journal in their respective localities; and also to request that the managers of these Institutions would endeavour to secure as wide a circulation of the Journal as possible amongst their members.

Resolved, That the President, the Vice President, and the Secretary, be appointed a Special Committee on Amendments to the Act Constituting this Board, and on the Patent Law Amendment Act.

Resolved, That the Vice President, Professor Hind, Professor Hincks, and W. Hay, Esq., be a Special Committee to draft a series of suggestions in relation to the International Exhibition of 1862, and to report to the Committee at its next meeting.

Resolved, That the Secretary be instructed to inform the Sub-Committee of the Lower Canada Board of the appointment of the last named Committee, and to request information as to what has been done by said Board in relation thereto.

Resolved, That this Committee adjourn till Thursday, the 14th of March, to receive the report of the Special Committee on the International Exhibition, and for other business.

W. Edwards, *Secretary.*

Members of Mechanic's Institutes, and of other public bodies, subscribing for this Journal through their respective Societies, will have their copies addressed to them direct from the office of the Board.

The Free Library of Reference, and Model Rooms, are open to the public daily, from 10 a.m. till noon, and from 1 to 4 o'clock, p.m., at the Board Room, No. 79 King Street West, Toronto.

The regular meetings of the Sub-Committee of the Board are held on the last Thursday of each month.

The Board of Arts & Manufactures

FOR LOWER CANADA.

PROCEEDINGS OF THE BOARD.

Board Rooms, Mechanics' Hall,
Montreal, 8th January, 1861.

The Board met this day according to adjournment at three o'clock P. M.

Present:—Dr. Dawson, President, in the chair, the Vice-President, Messrs. Rodden, Bartley, Murray, Perry, Bulmer, Munro, Stevenson, Bertram, and Lyman.

The minutes of the last meeting were read and confirmed.

A letter was read from W. Rodden, & Co., in reference to the action taken on their letter of the 10th October last, and after some discussion,

It was moved by A. Stevenson, seconded by H. Lyman:—That the letter be received, and the Secretary be authorised to write to Messrs. Rodden, & Co., giving them the necessary explanations of the previous action of the Sub-committee.

The acting Secretary then read the quarterly report of the Sub-committee, as follows:—

Board Rooms, Mechanics' Hall,
Montreal, 28th Dec., 1860.

The Sub-committee of the Board of Arts and Manufactures for Lower Canada, have the honour to report to the Board:—

Since the last Quarterly Meeting your Sub-committee have been engaged principally in arranging the accounts of the Exhibition, and of the building, and in securing the latter for the winter.

The Building Committee has presented a final report on the contract for the building, showing a balance of $11,428 85, which will be due on the completion of certain parts mentioned in a schedule attached to the report. This report is herewith submitted, and it is recommended that a mortgage for $11,000 be given to the contractor, and that the sum of $428.85, be paid on completion of the work above mentioned. These sums to be in full of all claims of the contractor.

The accounts of the Exhibition itself have for the most part been paid, and it is hoped that the Sub-committee will very soon be able to present a complete general statement of the whole expenses.

With respect to the future operations of the Board, the following subjects have engaged the attention of your Sub-committee, and are recommended to the attention of their successors.

1st. The pressing on the Government of the claims which the Board can now put forth to an increase of the annual grant, adequate to the due maintenance of its operations.

2nd. The organizing, in conjunction with the Upper Canada Board, of an Exhibition preparatory to that to be held in London in 1862, and the securing of means for that purpose.

3rd. The opening of the building as early as possible in the spring, as a museum of the industrial resources of the country, and the securing in this the co-operation of Government, of Public Boards and Departments, and of Manufacturers.

4th. The transference to the building of the Board of its Office and Library, and in connection with this the provision of adequate means for heating it during winter.

5th. The extending of aid to evening classes in connection with Mechanics' Institutes, and especially to that now in active operation in connection with the Montreal Institute.

6th. A course of Popular Lectures. A special committee has been appointed on this subject, and it seems probable that a course of six to ten lectures can be commenced about the end of the present month.

7th. The issue of a periodical publication devoted to Arts and Manufactures has often engaged the attention of the Sub-committee, but hitherto the pressure of other duties has prevented its being seriously entertained. We observe with much pleasure, that the initiative in this most important matter has been taken by the Upper Canada Board, and it is suggested that in the mean time arrangements be made with them for the publication of matters relating to this Board, and their circulation in Lower Canada.

In conclusion, your Sub-committee would remark, that the great enterprise of providing an adequate Exhibition to represent the manufacturing interests of Canada, on the occasion of the visit of his Royal Highness, the Prince of Wales, has taxed to the utmost the resources of the Board, and demanded an expenditure of time and labour which they trust will not be required of their successors. Notwithstanding the many shortcomings inevitable in such an undertaking, with so limited time and means, your Sub-committee believe that a result so creditable and satisfactory could not have been secured otherwise than through a Board of this nature, and they trust that the Board has earned a claim to the gratitude and confidence of the country, and has provided facilities for its future labours, which will enable it in the coming year to advance rapidly towards the full attainment of the important objects for which it was instituted.

The whole respectfully submitted.

It was moved by H. Lyman, seconded by H. Munro.—That the report be received and considered.—*Carried.*

After discussion upon some of the details of the report, it was moved by A. Perry, seconded by H. Lyman :—That the report under consideration be adopted. *Carried;* seven for and three against the motion.

The President of the Montreal Mechanics' Institute sent in a duly certified list of 440 mechanic members, and a certificate of the election of the following delegates to represent that Institute at this Board for the year 1861, viz: William Rodden, H. Bulmer, W. P. Bartley, Dunbar Browne, Robert Forsyth, N. B. Corse, A. A. Stevenson, Jonathan Findlay, Alfred Perry, James Shearer, B. Chamberlin, William Rutherford, A. Cantin, Henry Lyman, A. Ramsay, P. McQuestin, John Wood, John Redpath, Alex. Murray, Alex. Bertram, Geo. A. Drummond, E. E. Gilbert.

It was moved by Mr. Rodden, seconded by Mr. Bartley:—That the returns of the Mechanics' Institute be received, and placed on record.—*Carried.*

The Board then proceeded to the election of Office-bearers and Sub-committee, for the year 1861.

Messrs. Browne and Stevenson were named as scrutineers.

On the ballot for President being taken, sixteen votes were cast, of which twelve were for J. Redpath, Esq., who was declared duly elected.

On the ballot for treasurer being taken, sixteen votes were cast, of which twelve were for W. Rodden, Esq., who was declared duly elected.

On the ballot for treasurer being taken, sixteen votes were cast, of which fourteen were for N. B. Corse, Esq., who was declared duly elected.

On the ballot for Secretary being taken, 15 votes were cast, of which 14 were for B. Chamberlin, Esq., who was declared duly elected.

On the ballot for the Sub-Committee being taken, 14 votes were cast, which stood as follows:—For Professor J. W. Dawson, 14; Messrs. A. A. Stevenson and H. Bulmer, 13 each; A. Murray, 12; R. Forsyth, N. B. Corse, B. Chamberlin, 10 each; H. Lyman and Dunbar Browne, 9 each; and the above-named gentlemen were declared duly elected.

Messrs. H. Munro and R. Forsyth were unanimously appointed Auditors for the year.

It was moved by J. Wood, seconded by J. Findlay:—That the thanks of the Board are due, and are hereby tendered to the retiring President, Officers and Committee, for their valuable services during the past year.—*Carried.*

Mr. Wood gave notice that at the next regular meeting of the Board, he would move that an amendment be made to the By-laws, to the effect that at all meetings of the Board, nine members shall form a quorum.

It was moved by H. Bulmer, seconded by W. P. Bartley:—That the President and Secretary be authorized to sign a mortgage in favor of the Contractor for the Exhibition Building, (D. McNiven,) for the sum of eleven thousand dollars, on the conditions and in accordance with the report of the Sub-Committee of the late Board just adopted, and that the mortgage be for a period of not less than two years, and bearing interest at the rate of seven per cent. per annum.—*Carried.*

It was moved by Professor Dawson, seconded by H. Lyman:—That the Sub-Committee be instructed to take immediate action in conjunction, if possible, with the Upper Canada Board, in reference to the passing of Amendments to the Act constituting the Board, proposed in the last Session of the Legislature, and especially for giving to the Board an independent position.—*Carried.*

It was moved by D. Browne, seconded by A. Murray:—That the Board stand adjourned to the 11th February.—*Carried.*

The meeting then adjourned.

B. Chamberlin,
Secretary.

Montreal, 11th February, 1861.

The Board met according to adjournment, this day, at three o'clock, P. M.

The Secretary read the following Report from the Sub-Committee:—

The Sub-Committee have to report—That the accounts for the past year have been audited and found correct, but the auditors have submitted some suggestions with respect to the vouchers to be used in future, of which the Sub-Committee have approved, and will see them carried into effect.

The Sub-Committee have drafted a report to the Government, respecting the recent Exhibition, which they herewith submit for the approval of the Board.

The accounts with the Contractor for the Exhibition Building, have been finally closed; the mortgage in his favor has been signed as directed, and all the Exhibition accounts, with a very few exceptions, finally settled.

The Committee would suggest that memorials be prepared and forwarded to the Provincial Government and Legislature, urging the need of an increased grant to this Board; the amendment of the law establishing it, in the same manner as prayed for during the last Session of Parliament; for the amendment of the Patent Laws; for a measure of Sanitary Reform, which will secure more healthy homes for the working classes; and that measures be taken to have Canada fitly represented at the Great London Exhibition of 1862.

Arrangements have been made for a course of six Free Lectures, to be delivered at the Mechanics' Hall, on Tuesday evenings, to commence on the 19th instant, the course being opened by Principal Dawson.

A Committee has been named to revise the bill to amend and consolidate the Patent Laws, prepared and sanctioned by the Board last year.

It is proposed forthwith to open the Free Library of Reference of the Board, to the public, and to give notice of the fact in the several city papers.

The Sub-Committee is in correspondence with the Upper Canada Board on the subject of the publication of the proceedings of this Board in its journal, and hope to make a favorable arrangement.

The Report was then adopted.

The Secretary read the copy of a letter sent to the Secretary of the Society of Arts, London, respecting the Exhibition of 1862.

A partial report of the Special Committee to revise the Patent Law Amendment Bill, was submitted, whereupon,

Mr. Findlay, seconded by Mr. Ramsay, moved to refer the amendments to the Patent Laws back to the Special Committee, and that members of the Board be given notice and enabled to attend the meetings of such Special Committee.—*Carried.*

Moved by H. Lyman, seconded by Mr. Browne:—That the President and Secretary be authorized to prepare and forward the memorials referred to in the report of the Sub-committee.—*Carried.*

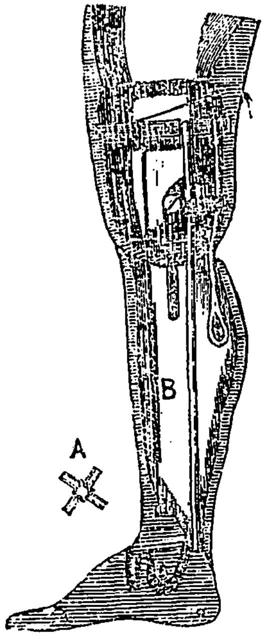
The Secretary read a statement of the receipts and expenditure of the Exhibition and Building Fund.

The meeting then adjourned.

B. Chamberlin,
Secretary.

EDITORIAL NOTICES.

NORRIS BLACK'S IMPROVED ARTIFICIAL LEG WITH AN UNIVERSAL JOINT AT THE ANKLE.



The improvement is upon Mr. Palmer's of Philadelphia, and consists in using the device A, to give motion in all directions to the ankle joint; two arms are embedded lengthwise in the foot; the leg is fitted down on the transverse arms; through the hole in the centre a strong cord passes, that serves to hold the two parts together, this forms the universal joint; the heel-cord, ham-string and plan of the knee joint are similar to Mr Palmer's· Instead of a separate coiled spring controling each joint, an elastic cord B, is placed in the leg, and connected by a strong cord to the foot, in front of the joint; by another cord passing in front of the centre of the knee it is connected with the thigh—this cord passes on to the outside of the thigh, at the back, where it is tied, and may be tightened when necessary. It will be seen that the elastic cord just described, will flex the ankle, and extend the leg perfectly.

The advantages claimed for the improvement are, that the spring is adjustable, does not squeak, and can be replaced when worn out, by the person wearing the limb. The universal joint at the ankle allows the foot to accommodate itself to uneven surfaces—gives more ease to the wearer, and a more natural action to the limb.

PETROLEUM IN GASPÉ.

The importance which the recent discoveries of Petroleum, or Rock Oils, in the United States and Canada is now assuming, may be gathered from the article on this subject which appears in the present issue of the Journal, as well as in the number for February. It may be well to call attention to the fact that Sir William Logan, in his enumeration of Canadian minerals, states that Petroleum is found in the valleys of the River St. Jean and the Ruisseau Argenté of Gaspé. The discovery of a Gaspé rock oil region would give an extraordinary stimulus to the settlement of that peninsula; and it may be remarked that rocks of the same age as those which yield petroleum in parts of Pennsylvania, Ohio, Kentucky and Virginia, are found in Gaspé. It is well to remind those who are attracted by the apparent facilities for realizing wealth by means of Rock Oil, that the wells or springs in Pennsylvania are beginning to show signs of a diminution of yield, and that an unbiassed and wholly uninterested opinion respecting the increase, or continuance even, of the present supply of this material, based on geological grounds, can scarcely be in favour of the expectation that the industry is at all likely to be a growing one in any one locality, but there is every reason to suppose that it will be general and intermittent over wide areas.

BOARD OF ARTS AND MANUFACTURES FOR LOWER CANADA.—FREE LECTURES.

Among the duties prescribed by Law for the guidance of the Boards of Arts and Manufactures in the Province, is the selection of competent lecturers on subjects connected with the Mechanical Arts and Sciences. The Lower Canada Board has recently commenced a course for the present year, and the opening lecture was delivered by Mr. Principal Dawson, on Tuesday, February 19th.

PROCEEDINGS OF THE LOWER CANADA BOARD.

We have much pleasure in informing the readers of this Journal that arrangements have been made by the Boards of Arts and Manufactures for Upper and Lower Canada, for the publication of the proceedings of the Lower Canada Board in these pages. It has long been the wish of the Board for Lower Canada to issue a journal of its own, but the expenses involved in the publication of a serial in the English and French languages, which would be necessary in Lower Canada, has hitherto deterred them from taking so responsible and expensive a step. The present arrangement will, we hope, be found conducive to the mutual advantages of both Boards, and at the close of the present volume it it may become a matter of consideration whether the issue of this journal should not be changed from monthly to bi-monthly, and a different title, more fully representing its official character be adopted. We trust that we recognize in this step taken by the Boards, an initiation to that unity of action which will be required in order to carry out the objects so ably and eloquently advocated by Mr. Principal Dawson in his opening lecture in Montreal, referred to in the foregoing paragraph, and which we would desire to see transferred at length to these pages.

Correspondence.

To the Editor of the Journal of the Board of Arts and Manufactures.

SIR,—Amongst the educational wants of the Province is that of a system of schools in which our mechanics, apprentices and others may receive instruction in those branches of physical science which bear upon their respective departments of industry.

In every branch of art and manufacture some of the natural forces are brought into action; and the more perfectly the artificer is acquainted with the laws which govern those forces, the more directly can he bring them to bear upon his work; the more readily simplify his processes, and the more economically produce his results. Thus improvements are made in the industrial arts, misdirected labour prevented, and wealth increased. The wealth and progress of a community is in proportion to the well-directed industry of its individuals.

This is a consideration which should lead the Board of Arts and Manufactures to regard the importance of supplying the want I have mentioned. The establishment, by the Chief Superintendent of Schools, of a School of Art, will, as you say, relieve the Board of an expensive and difficult undertaking. This relief will give it more ample opportunity to attend to other departments of its duty, and I do not know of any that have more urgent claims than this. I am aware that the present means of the Board will not suffice for such a work; yet I think that a representation of its importance brought before the public, the municipalities and the legislature of the province, might procure such endowment as would enable the Board to establish in each of our large towns a free evening school, in connection with its Mechanics' Institute, for the study of physical science.

The failure of the many attempts which have been made to establish classes in Mechanics' Institutes for the study of this and other subjects, is, I think, attributable to the fact that they have been made upon a wrong principle. It is supposed that there ought to be in the expected pupils a sufficient desire for instruction to give them energy and perseverance to establish and sustain the class themselves: but I think the truth is, that although they may possess a taste for science, and be ready to respond to a well-directed effort to draw it out, yet no inducements exist sufficient to overcome the difficulties which belong to a course of private study. It is obviously the duty of some central recognized authority to establish schools, and by means of them to assist and cherish a taste for their objects. You are aware that in order to establish an efficient school of natural science a great preliminary effort must be made, requiring capabilities and resources far beyond the means of those who are to be instructed. A laboratory must be fitted up, apparatus procured, a teacher provided, &c. This must be done by some public agency which can afford to advance the means, and wait for the results. We cannot expect the full fruits of such an enterprise at once. At first but few may avail themselves of its benefits, and it may take a long time before its value is fully appreciated; but its ultimate effect upon the working classes of Canada cannot be doubted.

May not the expectation be entertained, that through the medium of the Board of Arts and Manufactures, a school for practical science may be established and conducted in such a manner as to bring the advantages it is capable of conferring within the reach of the working classes?

Your obedient Servant,
S.

Toronto, February 8, 1861.

Selected Articles.

ON SALT AND OTHER MINERAL CONSTITUENTS OF FOOD.

BY EDWIN LANKESTER, M. D., F. R. S.*

To-day, according to the announcement in the prospectus, I wish to bring before you what I have called the Mineral Constituents of our Food,—to which, generally speaking, we attach very little importance. Persons who prepare our food—cooks in the kitchen, ladies who superintend cooks and order dinners for large families, and people who consume food from day to day,—never think of asking whether food contains mineral constituents in the right proportions to secure health, and without which babies get rickets, young ladies get curved spines, fathers get gouty, and mothers get palpitations; and they do not think of ascribing these to the food which has deprived them of the proper mineral constituents. I think I can show you that the importance of this consideration can hardly be over-rated.

In order to illustrate the importance of these things, I must shew you the elementary constitution of human beings. Suppose we take a human being, put him in a retort, and apply heat to him; we shall find that, first, 111 lbs. of water will actually rise up from a body weighing 154 lbs.; and the next thing that comes off will be carbonic acid gas; then there will be ammonia; and then you might get a little sulphuretted hydrogen phosphuretted hydrogen, and gases of that sort; but you will at last get a quantity of ashes. Now, in the water you get the oxygen and the hydrogen. In the carbonic acid gas you get carbon and oxygen, and in the ammonia you get nitrogen and hydrogen. In the ashes which are left we get phosphate of lime, carbonate of lime, fluoride of calcium, chloride of sodium, sulphate of soda, carbonate of soda, phosphate of potash, sulphate of potash, peroxide of iron, phosphate of iron, phosphate of magnesia, and silica. These are the things of which I shall have to talk to you to-day, without which we cannot live. And if you will persist in having only refined sugar and the whitest flour, rejecting the brown; if you will persist in rejecting the salt and avoiding the liquor in which the meat is boiled, you may get albumen and fibrine, but none of these mineral substances; and then the first attack of fever or cold may prove fatal. Four men shall be

* Delivered at the South Kensington Museum.

travelling outside of an omnibus,—one may get acute inflammation of the lungs, another bronchitis, and the other two shall come off free. Was it the riding outside of the omnibus that did it? No; it was the state of their blood. They had lived somehow irregularly. So you may find half-a-dozen children all exposed to the contagion of scarlet fever; two take it, one dies, and the other four are free; but the two that have caught it, have lived in such a way that their blood has readily taken in the contagious disease; and the one that died has got in such a condition as to produce death. Hence the importance of attending to these subjects thoroughly,—not getting a little knowledge of them, but a knowledge of what is necessary to the feeding of men. If not, we shall somehow or other suffer.

Now, I shall just take up these constituents according to their importance, and, probably, according to your general knowledge of them. You cannot expect me to go into an exhaustive chemical analysis of this subject, and I may say we are not in a condition to do so. But I will go into it as well as I can in the time allotted. I have taken up the first substance—Salt. This is the only substance which we take directly from the Mineral Kingdom. All the other things we get through plants or animals; but Salt is a substance which we take direct from Nature to satisfy the demands of our system. Now, this salt is composed of two substances—chlorine, a gas, and sodium, a metal. These two substances combined together, constitute this salt, which you know determines the life and form of things in the ocean. Withdraw the salt from the ocean, and you will have none of the life which now exists there. Herrings, mackerel, cod-fish, and all the forms of fish that we get out of the sea would retire, and we should then have the fish of our rivers, such as roach, dace, and the other varieties. Thus you see how this salt influences life, and the form of life. We get it for our use from the sea, and from those deposits of salt which the sea has left. When obtained from the sea, the sea-water, containing from 400 to 500 grains of salt to the gallon, is evaporated. But the sea in former time has formed bays, and those bays have been gradually silted up, and the land has retired from the bay, and the bay now becomes a lake. This lake is a salt lake. We have many such salt lakes. The Dead Sea is a salt lake, removed a long way from the sea, like the salt beds in our new red sandstone in Cheshire.

Now, not only do the animals that live in the sea require salt, but man requires it also. We find that man bears a tax on his salt, and we find this the most convenient way of taxing India for the last century, and I believe that tax is still continued; and man must and will have his salt. Now the question comes as to how this salt acts upon the system. How do we know anything about its action? You see here is the quantity of it contained in a human body that weighs 154 lbs. It is not much, 3 ounces 376 grains; but you see it is a good deal if compared with the other things. When we take away the phosphate of lime and the carbonate of lime, we have only left about 10 ounces of the ashes, and of those 10 ounces the chloride of sodium, or salt, is 3¾ ounces. Now the question is where this salt exists. If you take the muscles or the nerves of animals you do not find that they contain salt; but if you take the blood you will find it there. I do not wish to produce upon your minds any disagreeable reflection, but those of you who have tasted your own blood must recollect that it tastes of salt. We find three drachms of salt in a gallon of human blood; and that is the quantity in nearly all animals. Now you may ask, What good can it do? You may be sure that it does good. There are some people who are foolish enough to believe that man has been wrong in all ages, and that salt has done wrong. There was one gentleman who died because he thought salt was the forbidden fruit eaten in the Garden of Eden. He died a very few months ago, as I understand, quite a victim to his folly. Now if I were to take a vessel and divide it into two parts by a membrane such as is in our own body, and put salt and water on this side and spring water on the other side, when they were first put together they would be level, but in the course of time you would find that the spring water would go down and the salt and water would rise and flow over. Well, this is effected by a process which we call endosmosis, and which is greatly assisted by the presence of this chloride of sodium, or common salt. There is no other means of introducing chlorine into the system than through the medium of chloride of sodium, and we find that the chlorine becomes separated from the metal. We find in the gastric juices that there is a quantity of hydrochloric acid consisting of hydrogen and chlorine. Then, it seems to facilitate certain changes in the system which are beneficial to health, which are difficult to explain exactly, though I will just say that an experiment of this kind has been performed. Two sets of oxen have been taken by a great French chemist. He fed one set with, and one set without salt. For a short time there appeared no difference; but at the end of a month the cattle that had the salt were sleek and well-favoured, while the others were rough and in bad condition; and so it went on for two years, and, on the whole, there was no doubt that the healthier animals were those who had the salt.

If you take a very small quantity of hydrochloric acid and salt, and put it into water, and put the white of an egg into the water to which you have added the hydrochloric acid and salt, and then expose it to a temperature of 98°, it begins to dissolve; but if you put into water without salt it does not dissolve. So that you see there is this first action; in small quantities it assists digestion; so that you see the propriety of adding small quantities to our food. There are some persons who will not take it, but those persons are preserved by the cook putting it into puddings and cooked meats, and the baker putting it into the bread. Now, I need not, I think, dwell further on salt. I have notes here, showing how very early in past ages mankind directed attention to salt. We find that the Jews used it in their sacrifices. The Arabs put it on the table as a mark of hospitality; in Abyssinia he carries it in his pocket, takes out a lump and offers it to a friend to lick as a mark of respect and esteem. Then the Hindoos swear by their salt, and many of you may recollect that during the late war in Hindoostan, when the English officer wanted to bring the guilt home to the delinquent, he said, "Remember, Sir, you swore by your salt to defend the Queen of England," and so on. Then again, it was a mark of distinction in England in olden time: persons who sat above the salt were higher in dignity than those who sat below the salt. I will just say, finally, that although we may, by preventing its getting into food, take too little, yet there are provisions for getting rid of an excess.

The next thing is the phosphate of lime, which forms the principal part of the earthly matter of the bones. Of this phosphate of lime, there are 5 pounds 13 ounces in a man weighing 154 pounds. Now this phosphate of lime must be a very important thing, or it would not occur in such large quantities. I draw your attention to it in the first place as constituting the earthy matter of the bone. If we suppose that there are 5 pounds 13 ounces in the system, at least 4½ pounds of that will be contained in the skeleton. I shall have occasion again to refer to the composition of bone; but bone contains about 40 per cent. of gelatine, 50 per cent. of phosphate of lime, 10 per cent. of chalk, and 1 per cent. of fluoride of calcium.

I should give here a very wrong idea of the importance of this phosphate of lime, and especially of the phosphoric acid which is contained in it, if I left you to suppose that the only important thing was its existence in relation to the lime in the bones; for the fact is, we find phosphoric acid in the blood, in the brain, and in the nerves, in a free condition. It is introduced into the system as phosphate of lime, or perhaps phosphate of soda, or phosphate of potash; but during the changes, we find phosphoric acid playing a very important part. Now that is an important thing to recollect, because we may be constantly taking a diet which excludes the necessary phosphate, or taking a diet in which it abounds. If we have it in too large a quantity, we are almost sure to kill ourselves: no sort of medicine that I know of will in any way correct this. Now how do we get those phosphates? I have shown you that this phosphate of lime is the most important, but other phosphates are found in the system,—phosphate of potash and phosphate of magnesia; for example. How do we get these? There are two sources of phosphates in our food. The first source is found in the cereal grasses, and the second in animal food. When I say cereal grasses, I mean all those grasses which belong to the grass order of plants eaten by man. Wheat is the most important; but barley, oats, rye, rice, maize, all contain phosphates. Animals, you know, eat grass of various kinds, and they thus get into their system these phosphates, and when we eat the blood, the nerves, and the muscles of animals, we eat phosphates. It is in wheat bread that we get the largest quantity. Now, a very interesting question has arisen out of our recent knowledge of these facts, and that is, "What is the best way of supplying those necessary phosphates to the human body?" and it has been found that the best way is from these grasses. But those grasses must have the phosphates before the animals themselves can have them, and it was pointed out by the great German chemist, Liebig, that one of the great drawbacks to the growth of wheat was the want of phosphates in the soil, and one of the great drawbacks in the development of animals and of man was the want of phosphate in the food which they eat. This has led to the discovery that we may apply phosphate of lime, not merely by the agency of animal and vegetable manure, but by the agency of what are called artificial manures. By means of these this phosphate of lime is supplied to the plant, and from the plant we receive it into the system, as we need it for the sustenance of our own bodies. There is one question which I will just mention here, which is of some practical importance. How do plants get a supply of phosphate of lime? That explanation will give you an idea how it is that certain substances act upon our own systems in conveying certain phosphates to our blood. I told you in my last Lecture that carbonate of lime was soluble in water containing carbonic acid gas: so is phosphate of lime, and, when the water comes down to the earth which contains this phosphate, it actually dissolves it, and then the little plant can take up the water and the phosphorus, and apply it to its own use. So in the same way, if we take it into our stomach, and add to our food carbonic acid gas, we assist the solution of those phosphates. Thus it is that we prefer liquids which contain carbonic acid gas in them, and the taking carbonic acid gas is found by experience to be beneficial. Thus we take bottled beer, which contains a considerable quantity of carbonic acid gas; we take champagne, which owes its sparkling properties to the carbonic acid gas.

Now, I must leave the phosphate of lime, important as it is, and call your attention to a third group, the salts of Potash. Just as we find sodium in plants that grow in the sea, we find potash in plants that grow away from the sea. Those plants contain large quantities of potash, and hence the name potash, from the fact that wood which is used for boiling the pot contains this in its ashes, and, hence those ashes are called "pot-ashes." Now, there are some plants which are called potash plants, and I do not know a more important practical point than that certain plants contain potash, and that the exclusion of these from diet is a very bad thing. Potatoes contain potash; now I do not know whether any of you have speculated upon the reason why Europe should have seized with such tenacity upon that plant which is foreign to its shores; but there are philosophical writers who trace the cessation of plague and other epidemical visitations to the use of the potato. When we come to examine the potatoe we find it contains not so much starch as rice, and very little nutritive matter. It seems that, at the first glance it was a matter of very little importance whether we ate potatoes or not as long as we got flesh-forming substances; but here are these ashes in the proportion of 1 per cent., and what are they principally?—Potash. The quantity of ashes in a pound of potatoes is not much; but that quantity seems to be explanatory of the great fact that the health of Europe has improved since the potatoe has been eaten. Other vegetable foods—asparagus, radish, turnips, carrots, parsnips, —are "potash plants," and all those who exclude these things from their diet do wrong; they also do wrong who throw away the water in which they are boiled. It is better to make vegetable soups of the water and let children be encouraged to take them. Watercresses may be eaten by them, and lettuce, chicory and endive, and a variety of salads when they can be got fresh; and, when they have been dried, these things may be used in the form of soups, with carrots, turnips, and such like. I was lecturing on this subject a little while ago, and my friend Dr. Noad informed me that he had made an analysis and found that water, after boiling one pound of potatoes, contained 17 grains of carbonate of potash, and the sulphate which he obtained from cabbages was 21 grains, and he found the same with regard to carrots; and if he had gone through the whole range he would have found, I have no doubt, salts of potash in all of them. I would not advise you to substitute carbonate of potash from the doctor's shop for the potatoes, cabbages, water-cresses, and those things, although I believe, medicinally, that that substance sometimes saves a man's life.

If you feed men on chloride of sodium, and do not give them salts of potash, you will give them a disease which more than decimated our navies up to the year 1780,—scurvy. That disease broke out in the utmost intensity during the potato famine, and although the people were supplied with rice and other things, the disease went on; thus showing that the potash alone could arrest certain changes that went on without it.

In the year 1780 Sir Gilbert Blane discovered that lemon-juice would cure scurvy, and now, since that time, if a ship goes out for six weeks without lemon-juice or lime-juice, a fine of 5*l.* a day is incurred. The worst part of it is that ships are sometimes supplied with something which is not lime-juice at all, but sulphuric acid and water. It is not the acidity that is wanted, but it is a citrate of potash that is required.

There are one or two other considerations that are very interesting. Thus if you take potash with citric acid, the citric acid is destroyed and the potash remainsin the tissue. Destroyed, how?" I shall show you, when we come to the next Lecture, that starch and sugar are not unlike citric acid, and the way in which they act is to supply animal heat.

I come now to the carbonate of lime. Well, that is an important thing. Not so important, perhaps, as the other two, but when I tell you we have got 1 lb. of it in 154 lbs. you will see that there is quite a sufficient quantity of it to make it of importance, and I could not say that phosphate of lime would make up for carbonate of lime. We get it from the water we drink. I showed you in our last Lecture that nearly all the water we got from wells contained carbonate of lime; but there are a number of plants which contain considerable quantities of carbonate of lime. Beans and peas contain it, and also clovers and vetches, and plants of that sort, which only grow on chalk soils. When we take it in the form of the water which we drink, then we take it dissolved in carbonic acid, which I referred to just now.

There are some other substances to which I have not yet referred: Peroxide of iron is one. It exists in very small quantities—in not more than 150 grains in the human body. Now that substance is contained in the blood, and that small quantity seems to be necessary to the health of our body. We meet with persons with pale faces indicative of the want of iron; we administer iron, and they recover their good looks and their roses, and all arising from the iron getting into their blood. The French are sometimes in the habit of performing the process of incremation on their dead friends—that is to say, they burn them instead of burying them,—which is a much more wholesome process. The Romans burnt their friends, and collected their ashes in an urn; but the Frenchmen,—and they would not be Frenchmen unless they could improve upon the old Roman plan, —after burning their friends, take their ashes, and extract the iron from them, and convert it into a ring to wear in memory of their dead friends.

I have nothing further to say with regard to the iron, than that it may be supplied medicinally.

Now, then, there are some other substances which are perhaps not so material. Here is Silica, which you see exists in the small quantity of three grains in the human body—it is distributed in the nails, but more especially it is found in the enamel of the teeth. Teeth have a coating of enamel, which is formed of a certain quantity of silica, so that you see it seems to be necessary to the comfort and welfare of a man. Again, we find that Magnesia exists commonly in the soil of Scotland. It is taken up by the oat-plant, and conveyed to the blood of Scotchmen, and Scotchmen have been found to contain magnesia in their blood.

If you do not get enough iron, then almost any of these metals will supply its place. Even mercury will supply its place for a time, and every man is the better for taking a blue pill now and then. Copper has also been found in human blood, but that is accidental; but it appears that we are in the habit of eating pickles, and bought pickles frequently contain copper, which is added to them to make them green and inviting to the eye. Throughout Europe there is a quantity of these coppered pickles consumed.

Then there is this beautiful substance Iodine, which exists in a solid body at the ordinary atmospheric temperature, but is vaporised at a higher temperature; and this exists in the sea-water, with chloride of sodium and bromine; and thus it appears that it occasionally enters into the human system, and it is found in small quantities in the human breath—and there has been a dispute whether it exists in the human body. Now, this iodine has been found in the bodies of Frenchmen, but not in the bodies of Genoese; and this accounts for the fact that the Genoese have *goitre*. This bronchocele, or swelling of the glands of the neck, is called *goitre;* and this is the substance which, in the Frenchman, prevents him getting *goitre*, when he is among the Genoese, who are suffering extensively from this complaint. This disease is common among the Swiss mountains, and the Pyrenees. There are individuals in our country who are constantly suffering from the enlargement of the neck, and we know that the iodine is a remedy. It has also been found in watercresses, especially those watercresses which grow near the sea. I have recently examined some watercresses in London that had none.

I have shown you that in cooking you are very likely to get rid of these mineral constitutents. In cooking care must be taken against throwing away the water. The substitute is salads, or raw fruit, and thus we take oranges, of which children can hardly take too many. Then, soups and stews, in which the salt has not been thrown away, are good. —as also are preserves, whether in oil or sugar. You preserve their mineral constitutents; and if you apply these practical hints, you will be better in health.

ON THE ANTIQUITY OF THE HUMAN RACE.

BY PROFESSOR D. T. ANSTED, M.A., F.R.S.

I suppose if there is one department of Geology mor particularly interesting than any other, it is that which relates to the border-land between the present and the past—the passage from that which is to that which was; the connection, if such exists, of the races of to-day with those of yesterday, and the means available for tracing the resemblances and the differences between what has been called the Ancient World, and our own modern and personal experience.

The human race was at one period, and that no distant one, regarded as coeval with the first introduction of life on a very recently-created world. Step by step the careful and unprejudiced observers of the great truths of nature have become convinced that man not only was not coeval, or nearly coeval, with life on the earth, but that the world is of extremely ancient date—

that numerous tribes of animals and vegetables had preceded man by long intervals—many large groups and entire races having succeeded each other, the earlier ones dying out very long before he appeared. If anything can be said to be known in geology, or proved by incontestible evidence, it is that our forefathers, whenever they came upon the stage, and however they were first introduced, formed an addition to groups of animals which then peopled the various lands. They entered on an inheritance prepared for them, and have since continued to cultivate and rule over it. It becomes a question to be determined by natural history evidence, in which part of the great series of organised beings did they first appear?—who were their early associates?—what geological events have occurred since their introduction?—and at what point in the general geological sequence are we to write:—Here are the first indications of the existence of intelligent beings; at this stage of animal life the human intellect first dawned?

I trust it is altogether needless that I should apologize for introducing to you in this place a question of science so legitimate. The question is one in which the evidence must be calmly and carefully weighed, and the conclusion accepted to which the balance of evidence points. On the one side there is a written document of the highest authority for the purposes and in the matters it was intended to teach; but notoriously, and by almost universal consent, not binding upon us in respect to matters of experimental science and observation, these requiring only the fair and honest exercise of human reason for their elucidation. On the other side is the great volume of Nature, written by a sure hand, engraved in tablets of stone, which, if broken, are not defaced, and which are capable of interpretation, if we will only exercise patience and care. These two sources of truth cannot really be at issue, although we may be unable to see how they agree. We must not close our eyes to the truth, from whichever source it is obtained; and in the question we now enter upon—the Antiquity of the Human Race—whatever facts can be discovered bearing on the subject, must be accepted, and we are bound also to accept the fair inferences to be drawn from them.

Assuming, then, that the evidence of human antiquity is to be derived chiefly from the discovery of human remains in various deposits, and this being almost the only means open to us when we endeavour to extend our researches beyond written history, we are bound to accept it as given by Nature, examining it carefully, and getting the results as we best can, admitting that we must look to geology to determine this great archæological problem. Now, it seems to me that the points to be made out in this matter of the antiquity of the human race, are of this kind:—We must first obtain a starting point—some object buried beneath deposits, or associated with other contemporaneous things elsewhere so buried; we must make sure that time was required for forming such deposits as overlie it, and, indeed, that the deposits we find over it are of such a nature as to require a considerable lapse of time in order to produce them. The way in which the evidence will then come out I will explain to you. But first, the mere fact of finding deposits overlying the discovered object and each other, will not alone amount to much; we must show that they were formed in such a way as to require time. Take, for instance, a broken flint. One side of such a flint may have been recently broken, and the other side worn in a manner which must be a result of exposure for a very long time to the action of the weather. When, therefore, we find a specimen with appearances of this exposure, we are at liberty to assume that time was required in order to produce it.

We have also to prove that any remains that we may find in rocks of this age really were produced by human agency. We must carefully examine the evidence on that head.

We must next prove that they were really found in those beds that we have already proved by independent evidence to be of very great antiquity.

We must also satisfy ourselves that, if found as supposed, the objects in question were not placed there for the purpose of our finding them, or by any accident, whose result would be to make us imagine that what was really produced at one time belongs to another. Before the Romans conquered Britain there certainly were people who lived in these islands in an extremely rough and savage state, sometimes even in houses dug out of the earth. These people may have dug pits and lived in those pits; and it is possible to imagine that specimens we now obtain from what seem to be gravel-beds, were really dug out of such habitations. We must satisfy ourselves, therefore, that the broken flints were deposited contemporaneously with the bed in which they occur, and were not subsequently inserted.

Now, in order to obtain the starting-point that we require, we must limit ourselves to geological events of a very recent date. The more recent of the various deposits accumulated during a long succession of ages at the bottom of seas which once covered what is now Western Europe, were either themselves small or in patches, or have since been extensively removed by the action of water. Among them are mixed heaps of fine sand, and large angular or rounded blocks of stone, resting indifferently on, all the underlying rocks. These so-called blocks, or boulders, include a variety of fragments of rock, some removed for hundreds of miles, and others only from the near neighbourhood. With them are stones of various sizes, often placed among the sands in such a way as to render it impossible that all can have been beaten and rolled together for a long time in water. The stones are not unfrequently furrowed and scratched, and the rocks beneath, if hard, are similarly marked. This is the deposit called by geologists *boulder clay*, and believed by them to have been produced at a time when large icebergs floated or drifted over the land where such materials are now deposited. These are, therefore, remains of an icy or glacial period, or periods, during which most of the present land of Western Europe was under water; when icebergs came down from the Arctic Circle to our latitudes; and when the land that did exist was for the most part in a different position from that which now exists. These beds are the old glacial drift of Northern Europe. They belong to a climate probably much warmer than any we now have north of the Mediterranean (except, perhaps, that of the South of Spain); and, during this earlier period, the land of Southern Europe was peopled by animals resembling those now inhabiting Northern Africa, and ranging through the whole of that great continent. The shells of the adjacent seas were also those of the warmer parts of the Mediterranean. Most of the quadrupeds, and many of the shells before the the time of the boulder clay, or old glacial period, are different from those of the more recent period. I propose, for the sake of convenience, to take this old glacial drift, or boulder clay, as the starting-point for my present purpose. In itself it generally contains few fossils. A great deal of the material lying over it, or at least deposited more recently, is what is called gravel or drift, and includes the objects of the present inquiry. Some of this is ancient, some more modern; some is of fresh-water origin, and some has certainly been formed in the sea. Some beds contain delicate shells, and have been deposited in calm water; some appear as if they had fallen down in a turbulent ocean. Whenever occurring, gravel is a deposit amongst the newest of those talked of by geologists. It is hardly even admitted to rank among the newer of the three great groups of deposits called *Tertiary*. It belongs to what Continental geologists call *Quaternary Rocks*. It is widely dispersed, but rarely in large deposits.

It is important for my purpose that you should recognize the antiquity of the boulder clay or old glacial drift, our starting-point. Relatively, or compared with underlying deposits, it is modern; compared with it even the beds of crag beneath it are exceedingly ancient. The chalk below the crag belongs altogether to another world, and yet the chalk is but a thing of yesterday compared with large series of stratified rocks common throughout Europe. The London clay, which is very much more modern than the chalk, belongs to a time when there scarcely existed a species of animal, and very few plants, identical with those now inhabiting our country. In the yet older rocks—those below the chalk—we lose nearly all record of existing creation. Under the boulder clay, then, there is a long series of deposits, of which the most recent is of much earlier date, and during which the climate was exceedingly warm in this part of the world. After that there appears to have been a series of considerable elevations in Northern Europe, producing a great amount of cold over almost all the land then above the water. This was followed by a remarkable period of northern depression, during which icebergs disappeared, and the climate became again warm. Afterwards there was another elevation in the north, and another period of glacial drift took place; and finally, there were depressions of very considerable extent, allowing the upper beds of the drift to be deposited.

These facts are proved in various ways, and I shall explain to you presently in what way the evidence is obtained. At any rate, I must suppose you to admit that the boulder-clay period is of great antiquity, and preceded the last great changes of climate, during which many of the animals appear to have changed. There was a time when elephants, hippopotamuses, and other animals now belonging to warm latitudes, ranged so far north as actually to have been caught by the ice in the Arctic Circle. There are instances where even the flesh and the contents of the stomach have been preserved. When these animals ranged over the whole of the land in Northern Europe, the temperature must have been exceedingly different to what it is now; for at present there is no food within many hundreds of miles of their ancient haunts, whilst of the animals themselves the woolly hair covering a thick hide was evidently adapted to cold climates, and marks the climatal condition of the period which preceded the boulder-clay. Assuming, then, that the boulder formation itself is of great antiquity, we must now consider the state of the different beds that lie over it. It is here that we find those curious remains which are believed to have been formed by human agency, and we must therefore understand clearly what were the beds thus characterised. [The Lecturer then directed attention to a section representing the condition of the country between Norwich and the sea.] Along the coast of Norfolk, and in the interior of the country for some distance, the boulder clay is met with on and near the shore, but seen only occasionally, and at low water in a submerged forest, the remains of a considerable quantity of tree vegetation, which has been entirely buried long enough to allow all the other deposits to accumulate over it. The boulder clay lies over it, and over this clay is the upper drift. The history of the submerged forest is curious, because the state of things to which it points exactly corresponds, as far as can be made out, with what is known in other parts of Europe, where also there is evidence of a much warmer period having preceded the boulder-clay period than characterised that period itself. The deposits overlying the clay here and elsewhere may be considered to form three distinct groups. There is, first, the group of cavern deposits, then the raised beach deposits, and then the group of superficial gravels and sands, and I must say a word or two with regard to each of them.

By caverns I understand natural open spaces in rocks occurring in various parts of the earth, often partially filled by deposits of various kinds drifted into them. When such an opening has been exposed to the action of a river or the tidal action of the sea, or is open above so that animals can get into it, there will be drift carried in and deposited, while, at the same time, remains of animals will accumulate in it, and there will be a mixed series of deposits. Should the rock in which the cavern occurs be a limestone, the water that trickles in from the crevices will be loaded with carbonate of lime. On dropping down on the floor of the cave, such water will evaporate and carbonate of lime will be left to form what are called *stalagmites*. The appearance and peculiar conditions of such caverns will be illustrated by the two or three diagrams I have here. [The Lecturer then referred to a series of drawings of well-known and interesting caverns chiefly in Sommersetshire and South Wales. He afterwards referred to another diagram representing a cavern in Sicily, near Palermo, recently described by Dr. Falconer. He then proceeded to describe their contents as follows]:—

In the cavern at San Ciro, near Palermo, there is an enormous deposit of bones. Twenty tons' weight of the bones of the hippopotamus have actually been taken from it within a very recent time for the sake of burning into animal charcoal. Now, it is quite clear that there can have been no accumulation of bones of this kind by human agency. All the hippopotamuses ever brought into Italy by the Romans, if accumulated together, could hardly have sufficed to fill this one cave; and, not far off, bones of 300 individual hippopotamus have been found in another cave. It is quite clear that the cavern existed for a long period as the habitation and burying-place of the large quadruped whose bones are so abundant. In our own country the caverns have been used for similar purposes. In the limestone rocks in Yorkshire, Devonshire, and elsewhere, there is good proof that they served as dens; for we find in them the remains of bears and hyænas in enormous numbers, and occasionally remains of elephants, rhinoceroses, and hippopotamuses. To illustrate the appearance and condition of the cavern-bones, I have drawn upon the resources of your own museum. Among the specimens before you are teeth and bones of the ordinary inhabitants of caverns. Generally speaking, each cave seems to have been inhabited by one group of animals, and as the caverns have generally been partly excavated by water and partly filled up by aqueous drift, so, in some instances, they have been entirely filled up, and almost obliterated. The Sicilian cave of Maccagnone is a remarkable proof of the accumulation of these bones. There is a bony breccia on the bottom of the cavern, and on the roof of the cavern is another mass, which is really a part of the same breccia as that found on the floor. The whole of this cavern must at one time have been filled with this breccia, which has since been partially carried away by the sea. Now, it is a remarkable fact that human remains have been found mixed up with the fragments of bones at the top of the cave. It seems impossible that they could have got there except as part of the original deposit.

We come next to the raised beaches, of which a large number are known to range round our own coast. An old beach is seen [pointing to a diagram] some feet above the level of high-water; above that there is a deposit of limestone. In this case there is an elevation of only three feet; but in some parts of the coast of

Wales the old beach is 1,300 feet above the present sea level, and yet it is quite impossible that the accumulation of rolled pebbles and shells so far above the sea can have been deposited in any other way than by slow accumulation at the sea level, at a time when the sea was limited by an ancient coast and cliff, now a mountain side. The whole has since undergone elevation, which has brought the beds up to their present level. As a matter of fact all the way round our own coast, on various parts of the coast of Scandinavia, along the western parts of Europe, and in the Mediterranean, there are unmistakeable evidences of change of level going on, although it is difficult to understand how such changes could have gone on without producing great breaks. There is, however, no break in the succession of life; the animals that belong to one part of the period are traced through all the series of deposits, or else have died out gradually as we get nearer to the new deposits. The raised beaches generally contain shells which we would find at the present day on the actual beach adjacent. There is no possibility of these shells having been carried there by man, for they often cover several square miles of surface, and occupy exactly such level portions eaten by the sea waves out of a cliff which could be easily covered before the elevation. The cliff often presents a succession of steps, produced by the alternate elevation and repose during the time I have alluded to. Raised beaches, therefore, mark great changes during a long time, and the sands, gravels and marls indicate the time during which such changes were going on. Since, however, we can trace the history of cliffs for hundreds of years, and find the change very small, it becomes difficult to imagine that the same causes can have acted for a sufficient period to effect the amount of change we see. The remains of animals belonging to the period in question are some of them such as are now only to be found in Africa. We know, indeed, that such animals can live in much more extreme latitudes, and we have a remarkable proof of this in the discovery of the complete carcase of an elephant in the Arctic Seas, provided with a warm coating of hair, showing the adaption of those animals to a climate perhaps not at all warmer than we have now. However the case may be with regard to climate, we have the remains of the elephant, the rhinoceros, the bear, and the hippopotamus, lions, tigers, and hyænas, and also other animals now altogether extinct, remains of several large kinds of cattle, antelope and deer, one approaching to the reindeer, and others diverging from that type, but all belonging evidently to climates admitting a considerable amount of vegetation, but not necessarily warm.

We come next to the other contents of the caves. Associated with and among the bones of these animals that are almost all extinct, so far as this country is concerned, are found such specimens as are on the table before you. These three, for example [the Professor pointed to some trays before him], contain a number of specimens of flints found among the bones in these localities. When you examine these, I think it will be impossible for you to come to any other conclusion than that they were formed by human agency. Some of the specimens, taking them alone, would be sufficient to show that they were constructed by a number of blows probably of another flint, each blow chipping away a small portion. It is possible, though barely so, that one such specimen should have been formed accidentally; but, if you observe them, you will find all are chipped away in the same manner, and by a peculiar method. They have been formed by blows, one striking on the right, and the other on the left; they all have very definite shapes, being rounded at one and pointed at the other; and, generally spreading, they have a depression on the under part. If, as is the case, we find such specimens, not only here and there, but in masses of fifty or a hundred together in one locality, the accumulated evidence evidently derived from their artificial character is quite sufficient to show that they were formed by some intelligent being. We know that no animals are formed in a way as to be able to construct these flints, and we are therefore bound to consider that they were formed by human agency. It is not necessary to detain you with any account of the peculiarities of these things, but it may be interesting just to allude to the way in which flints used to be manufactured for muskets; and these will show you how precisely the same effect is produced by artificial means. I have also here a specimen of one of the weapons used by the natives of Port Essington, in Australia, which is of a similar character. Another specimen [showing one] was broken off by a gun-flint maker; and looking carefully at it, you may recognise the artificial character of the fractures. Next let us take up a number of the flints recently found in gravel and caverns. I think you will not be inclined to doubt, when you see them, that they must have beeu the weapons and instruments used be men; and no one, I believe, can honestly arrive at any other conclusion. Seeing their evidently artificial character, we are bound to assume that they are human productions, and that is a point which I shall take for granted.

We must now consider what proof there is that they were really found accumulated in the gravels belonging to a period very different from our own. You may say they were perhaps made by the Druids or the Celts, or the inhabitants of England immediately preceding the Danes, Saxons, or Romans. Now, it is a singular fact, that there was found, and carefully described and figured in a well-known antiquarian work, in the year 1797, an implement so exactly like those I am showing to you, that if you had it before you would not be able to distinguish one from the others; and since then several others have been found in the same locality. This deposit is in Suffolk, and the bed containing the flints is covered with sands and marls and red brick-earth. About twenty years after this discovery, a gentleman living at Amiens had a sort of instinct that there existed human remains in the gravel in his country, and he made up his mind to find them, and did find them. The three diagrams to which I now direct attention show the condition under which the remains were found, and several of the specimens themselves are before you. Where these were found the underlying rock is chalk; above the chalk is a series of beds of various kinds; and in the lowest of these beds about 100 feet above the present valley of the Somme, are found the objects in question. A gravel similar to that in which they occur is accumulated in various patches all over the country. It is not necessary to mention the different places where they occur. It is enough to know that there are at least half-a-dozen places in the same neighbourhood, where patches of gravel have been found containing similar worked flints. These beds contain also remains of Elephants, hippopotamuses, and rhinoceroses, in some abundance. There appear, in some cases, to have been pieces of wood immediately associated with the specimens themselves, presumed to have been the handles buried with them, and decayed. Pieces of bone found in the neighbourhood are supposed to show, in some cases, actual marks of weapons; and it is said that they could not have been broken accidentally in the way in which they are found, as they are bruised and broken with a dent, as if by stone knives or similar instruments. Above the beds containing the flint remains are several newer deposits, some of the uppermost of which contain other human remains, not of the same kind, though certainly belonging to a very ancient race. In the lower beds the weapons are roughly hewn, with other stones;

but in the newer they are less roughly manufactured, and sometimes perfectly smooth and polished. In the upper beds of all there are remains of the Romans; while in the bottom deposit the human weapons are mixed with the remains of extinct animals totally different from those which now inhabit the country. Between the two are beds of sand, brick-clay, and earth, containing remains of animals much nearer the present time. Above that are the deposits containing remains of the Romans, and above that, vegetable soil.

(*To be continued.*)

NEW INDUSTRIAL PROCESSES.

Patera's Process for Extracting Silver from its ores.

By Clement Le Neve Foster.

The process in question was originally suggested by Dr. Percy, F.R.S., of the Government School of Mines, and has of late years been taken up and carried on, on a large scale, by one of the most celebrated metallurgical chemists in Austria, viz., Herr von Patera. This process is of special interest, on account of the analogy it presents with the well-known "fixing" in photography, which is nothing more than dissolving out the chloride of silver (which has not been acted on by light) by means of hyposulphite of soda.

In the metallurgical process this property is made use of in the following manner:—The ores which contain the silver in combination with sulphur, or with sulphur and arsenic, are roasted with green vitrol and common salt, and thus is produced a chloride of silver which may be dissolved out by a solution of hyposulphite. The silver can then be precipitated by sulphide of sodium, falling down as sulphide of silver. All that is necessary to be done then is to heat the sulphide in a muffle in contact with the atmosphere; the sulphur escapes in the form of sulphurous acid, and the silver remains in the metallic state. It is then melted in plumbago pots and cast into ingots for the mint. Such is a rough outline of the process which is now, and has been for some years, in operation at Joachimsthal, on the the northern frontier of Bohemia. The ores which are subject to this process are rich in silver, containing on an average two per cent., but often as much as 10 per cent. Ores containing less than one per cent. are melted down with pyrites in a cupola blast furnace for regulus or *matte*, which is then treated as the ore.

The advantage of this process are manifold, 1stly, Ores containing large amounts of arsenic can be thus successfully treated, when Ziervogel's process would fail. 2ndly. the expense of heating a strong solution of salt, as in Augustin's process, is got rid of, as the hypo-sulphite is used cold. 3rdly. The hypo-sulphite filters quicker and better than the brine in Augustin's process, for the dissolving power of hyposulphite being great, a weak solution may be used. 4thly. The solution of hyposulphite may be used over and over again, for it is being continually renewed, as this is one of the peculiar points in the process, it deserves particular attention. The precipitation of the silver is effected, as has been before stated, by sulphide of sodium, and this is a polysulphide, for it is prepared by calcining soda with sulphur and then boiling it with sulphur. In this manner a polysulphide of sodium is formed, but in contact with the air some hyposulphite of soda is generated, and thus, each time that the silver is precipitated, some hyposulphite of soda is added to the solution. In this way Herr von Patera, who commenced with 14lbs. of hyposulphite of soda (and who yearly extracts more than 3,000lbs of silver), has never needed a fresh supply, and has, in fact, been obliged to throw away quantities of solution, as his stock was always increasing. The expense of this process is not great; the extraction of a pound of silver from the ore costs, on an average, only 9s. 9d., whilst by the method of smelting formerly in use, the cost of production of a similar quantity of metal was no less than 16s. —*Journal of the Society of Arts.*

Preparation and Uses of Neutral Sulphite of Lime.

Anthon, a manufacturing chemist, of Prague (*Oesterr. Gewerbeblatt.* 1860. No. 1), makes sulphite of lime by passing gaseous sulphurous acid over hydrate of lime spread upon hurdles to the depth of one or two inches, and arranged in a close chamber; or he places the hydrate of lime in a barrel, which is made to revolve, and passes the sulphurous acid into it. The absorption of acid by the lime takes place quicker when the latter plan is adopted. It is only necessary to wash the sulphourus acid when it is contaminated by sulphuric or some other strong acid. When the lime is kept well in motion, the saturation is completed in from four to eight hours, and is recognised by the white colour of the hydrate changing to a pale yellow.

The principal use of sulphite of lime, which the author points out, is the ready preparation of a pure sulphurous acid.

New Fusible Alloy.

Mr. Wood has found that cadmium is preferable in many respects to bismuth in rendering a mixture of metals easily fusible. He prepares an alloy fusing at +76° centigrade by melting together 1 or 2 parts of cadmium with 2 parts of tin, 4 parts of lead, and 7 or 8 of bismuth.

Clarifying Coal Oils.

Messrs. Dumoulin and Coutelle have been making a series of experiments with a view of rendering heavy oils suitable for ordinary lighting purposes, and have succeeded in producing a magnificent light, free from smoke and smell, and adapted in all respects for burning in a room. The following is their process:—In a close vessel are placed 100 lbs. of crude coal oil, 25 quarts of water, 1lb. of chloride of lime, 1lb. soda, and ½ a pound of oxide of manganese. The mixture is violently agitated, and allowed to rest for 24 hours, when the clear oil is decanted and distilled. The 1000lbs. of coal oil are to mixed wilh 25lbs. of resin oil; this is one of the principal points in the manipulation, it removes the gummy parts from the oil and renders them inodorous. The distillation spoken of may terminate the process, or the oils may be distilled before they are defacated and precipitated.—*Le Genie Industriel.*

A New Use for Paraffine.

Every chemist has experienced the annoyance of finding the stopper of his liquor potassæ bottle hard set. Greasing the stopper would only afford a partial remedy, and moreover, would be objectionable chemically, inasmuch as the liquor potassæ would suffer contamination. Paraffine is unobjectionable; not only does it not dissolve in alkaline leys, but its lubricating properties are sufficient to prevent all jamming of the stopper.

Perchloride of Iron as a Deodorizer.

From the experiments of Dr. Hoffman and Professor Frankland, it appears that perchloride of iron far surpasses both "chloride of lime" and lime, for deodorizing sewage water.

NOTICES OF BOOKS.

A Practical Treatise on Coal, Petroleum, and other distilled Oils, by ABRAHAM GESNER, M.D., F.G.S. New York: Balliere Brothers, 440, Broadway.

This work will, no doubt, be eagerly sought for by many interested in Petroleum, who would be led by its title to suppose that it entered thoroughly into the discussion of the purifications of the natural oils as well as the coal oils. This is not the case, and the book on the whole is disappointing, although it ought to find a place on the shelves of our Mechanics' Institute Libraries. But while it does not satisfy the requirements of the present day, it will be found very useful in directing the practical manipulator to discover for himself the best method of purifying the natural oils (of which there are many varieties) he may chance to work.

The Manufacture of Vinegar; its Theory and Practice, with especial reference to the Quick Process. By CHAS. M. WETHERILL, Ph.D., M.D. Philadelphia: Lindsay & Blakiston, 1860.

A very useful work for vinegar manufacturers. The theoretical part is divided into four chapters, which treat respectively of the Chemical Principles involved in the Manufacture of Vinegar—Sugar—Alcohol and Acetic Acid. The practical part describes, in five chapters, the General Details of the Processes Employed—The Slow Process—The Quick Process—Examples of the Practice of the best European Factories—Conclusion.

MISCELLANEOUS.

Importance of Ventilation.

Passing from the private shop to public institutions we are compelled to admit the same radical fault—the want of that element which is "the breath of life." In our churches, schools, and assemblies, people who go there suffer more or less from this evil. It is proverbial how persons, young and old, suffer from colds, bronchitis, and influenza; all of which are said to be "caught" when they return from some public place of assembly. The question naturally arises, How is this? The answer is that it is caused by the sudden change which the body undergoes in passing from a heated impure air to that of the natural temperature, containing also its proper proportion of elements. Man requires for his health one gallon of air every minute of his life; the individuals of a church congregation are rarely, if ever, supplied with that quantity. Only at the cathedrals is the air space in proportion to the worshippers. A man of large lungs inhales about twenty-five cubic inches of air at each respiration; he breathes 11 times a minute, and thus requires nine and a-half cubic feet of air every hour. Now, when there are a thousand persons under one roof (some of the metropolitan churches and chapels containing 2500 persons) for a couple of hours, it is evident that twenty thousand cubic feet of air are required to supply that which is necessary for existence to these thousand persons in a pure atmosphere, so that of course a much larger quantity than that is required in order that a current can be established to remove the effete matter of exhalation. The evils of vitiated air are also more to be guarded against, because persons can live in it without being aware of its danger, as far as their sensations are concerned. When we enter a crowded assembly on a cold day the air is always at first repulsive and oppressive; but these sensations gradually disappear, and we then breathe freely, and are unconscious of the quality of the air. Science, however, reveals the fact that the system sinks in action to meet the conditions of the impure air, but it does so at the expense of having the vital functions gradually depressed, and when this is continued disease follows. No disease can be thoroughly cured when there is a want of ventilation. It is related that illness continued in a family until a pane of glass was accidentally broken, and then it ceased; the window not being repaired, a plentiful supply of fresh air was admitted. The practice of building sepulchral vaults under the churches was fraught with the greatest evil to the health of those who went into the edifice for sacred purposes. But with few exceptions it is now interdicted by the Legislature; still a great deal in the way of improvement has to be done. Nearly all the churches in the empire require some artificial means of ventilation to render them physically fit receptacles for the body during a prolonged service. The Sunday-schools also, as a general rule, are very ill ventilated; and lessons in the second hour are far worse rendered than in the first, solely arising from a semi-lethargic coma that comes over the pupils breathing a carbonic air which has already done duty and been inhaled by others several times. However it is to be regretted, it is yet true, that people will, sometimes, sleep during the sermon. Now, the minister must not be twitted with this, for with the oratory of a Jeremy Taylor or a Tillotson people could not be kept awake in an atmosphere charged with carbonic gas, the emanations of a thousand listeners. The churchwardens should ventilate the churches, and see that the congregations have sufficient air for breathing; if people go to sleep, they are more to blame than the preacher.—*Piesse's Laboratory of Chemical Wonders.*

Coloured Liquids.

The gradual decoloration of coloured alcohol by the influence of light and the precipitation consequent on on the chemical change produced, is of importance to the druggist anxious for the showy appearance of his windows. The following remarks will therefore be read with interest and benefit:—Solutions of various salts or metals in hydrochloric acid are, some of them, of very great intensity and beauty. Thus, a yellow liquid is obtained by dissolving 3 parts of perchloride of iron, or hydrated peroxide in 100 of hydrochloric acid: the colour may be heightened by adding some hydrated oxide. Various colours are produced with the solution of carbonate of cobalt in hydrochloric acid. The salt of cobalt used must be pure, especially free from iron or nickel, which would prevent the formation of the blue and red shade. The green cobalt colour is obtained by dissolving 3 parts of the protocarbonate in 100 parts of the acid, and filtering. By the addition of a few drops of the above yellow liquid the colour is deepened, and loses the bluish tinge. A blue colour is prepared by dissolving six parts of the protocarbonate of cobalt in 100 parts of the acid, and boiling for about two minutes to remove the carbonic acid or chlorine held in solution. Neither of the above two colours should be diluted with water, as this would change them to red. The violet colour is obtained by dissolving 34 parts of the protocarbonate of cobalt in 100 parts of the acid, mixed with 5 of water, and boiling before filtering. A very fine red liquid is obtained by dissolving 45 parts of the protocarbonate of cobalt in 100 parts of the acid, diluting with 45 parts of water, and boiling. All the cobalt colours change by heating the solutions, which gives them more or less a blue tinge; but, on cooling, this gives way to the colour intended. The solution of carbonate of chromium in hydrochloric acid evaporated until it becomes solid on cooling, and dissolved in alcohol in the proportion of 25 parts of the salt and 100 of the spirit (to which are added 5 parts of acid,) furnishes a fine deep green. Four parts of crystalized acetate of copper, dissolved in a mixture of 50 parts of ammonia, and 50 of alcohol, give a durable blue.

Table of British Colonies, with the date of their acquisition.

South Australia.........	obtained by settlement in		1836
Western Australia......	"	"	1829
Antigua	"	"	1632
Ascension	"	"	1827
Barbadoes	"	"	1609
Bermuda	"	"	1609
Bahamas..................	"	"	1629
Ceylon	"	capture	1795
Canada (E. and W.) ...	"	"	1759
Cape of Good Hope ...	"	"	1806
Columbia	"	settlement	1858
St. Christopher		"	1623
Dominica	"	cession	1803
Gambia....................	"	settlement	1631
Gibraltar (Military) ...	"	capture	1704
Gold Coast	"	settlement	1661
Granada	"	cession	1763
St. Helena................	"	"	1673
Heligoland	"	"	1814
Honduras	"	"	1670
....	"	settlement	1742
Hong Kong................	"	cession	1842
Indian Presidencies ...	"	"	1859
Ionian Islands	"	"	1814
Jamaica	"	capture	1655
Labuan	"	cession	1846
St. Lucia..................	"	capture	1803
Malta	"	"	1800
Mauritius	"	"	1810
Montserrat................	"	"	1632
Natal	"	settlement	1824
New Brunswick......	separated from Nova Scotia		1784
Nova Scotia...	obtained by settlement and capture		
Newfoundland	obtained by settlement in		1608
Nevis	"	"	1628
New South Wales	"	"	1728
New Zealand	"	"	1839
Prince Edward's Island	"	"	
Queensland ...	separated from New South Wales		1859
Sierra Leone............	obtained by settlement in		1787
Tasmania	"	"	1804
Tobago	"	cession	1763
Trinidad	"	capture	1797
Turk's & Cairo's Island,	formerly incl. in Bahamas		
St. Vincent	obtained by cession in		1763
Victoria.........	separated from New South Wales		1850
Virgin Islands	obtained by settlement in		1666

Cost of Relaying Rails.

It is stated by Mr. Reid, the Engineer of the Great Western of Canada, that the relaying of a mile of single line of rails in Canada, including new rails, sleepers, and joint fastenings, and a fresh supply of ballast, cannot be done, at present prices, under a cost of £1140 a mile, whereas the same could be performed in England, for £725 a mile. Rails subjected to the influences of a Canadian winter and spring, will always give way many years before the same quality of iron is worn out on an English railway.—*Eng. Journal.*

The Oil Wells of America.

The *London American* says the present yield of the wells in Pennsylvania and New York is more than 85,000,000 gallons a year. Discoveries in other States are reported and the amount produced may safely be estimated at 15,000,000 gallons more during the present year. making an estimate amount of 100,000,000 gallons to be gathered up during 1861. This oil readily sells by the wells in its crude state at 25c. per gallon, making the value of the whole amount 20,000,000 dollars. In market it sells at 40c., and when purified at 75c., making its commercial value 75,000,000 dollars, or more than £15,000,000. This oil is said to be valuable for lubricating purposes, no less than for illuminating. Should this prove the case, it will be exported largely to England. Adding this article to the United States list of exports will have a strong tendency to keep the balance of trade favourable to that country. It is now sent to Australia, and it promises to rank second only to cotton on the United States list of exports.

Consumption of Fuel by Locomotives in the U. S.

In the United States it is estimated that there are 9000 locomotives in use, their total mileage being about 175,000,000 miles. The average cost of fuel at ten cents a mile (the average in the State of New York is 18 cents) would be 17,500,000 dollars. A saving of only two cents a mile would reduce this sum to 3,500,000 dollars.

A New Alkali-Metal.—The New Metal Cæsium.

MM. Bunsen and Kirchhoff announce definitely (*Anall. der Physic und Chemie*) that they have discovered a new alkali-metal, the fourth member of the group of potassium, sodium, and lithium. At present they have only found it in very small quantities in the mineral water of Kreuznach, in the saline water of Dureckeim, and in one of the sources of the Bade—the Umgemach.

The chloride of the new metal differs from those of sodium and lithium by the yellow precipitate which it produces in the presence of bichloride of platinum. It is distinguished from potassium by its nitrate being soluble in alcohol. Introduced into a flame, and examined with a prism, the vapours of the new chloride show a very interesting spectrum, consisting of two blue lines, one of which, the fainter, almost corresponds with the blue of strontium; the other, also a well defined blue line, is situated a little further towards the violet extremity of the spectrum, and rivals the lithium line in brightness and distinctness of outline.

At the last meeting of the Chemical Society, Dr. Roscoe gave a short account of Professors Kirchhoff and Bunsen's spectrum researches, and mentioned that the new alkali-metal which they had discovered by that means had been named *Cæsium*, from the Latin word *cæsius*, signifying grayish-blue, that being the tint of the two spectral lines which it shows. By working with the residues from twenty tons of the mineral waters of Kreuznach, Professor Bunsen had succeeded in obtaining about 250 grains of the platinum salt of the new metal. Cæsium is closely allied to potassium in its chemical characters, the chief point of difference being the solubility of its nitrate in alcohol. Its equivalent number is 217,—exactly three times that of potassium. —*Chemical News.*

The Alpaca in Australia.

The Sydney (Australia) papers, are computing the value of the introduction of the Alpacca into that country. Considerable flocks of that useful animal have already been introduced to Australia Commencing in 1861 with 280 animals, of which 220 are females, and making deductions of a liberal nature, according to the present ratio of increase there would be, in fifty years, 9,760,000 head, the wool of which (an average of 7lbs.) at 2s. per lb., would amount to the sum of £6,832,000 per annum.

Those who are familiar with the extraordinary increase of the sheep in that country, will not be surprised at the results of these computations, based as they are upon observed facts.

Spontaneous Decomposition of Chloride of Lime, or Bleaching Powder.

Dr. Hoffman gives the following account of an explosion of a bottle of Chloride of Lime in the *Quarterly Journal* of the Chemical Society:—"One morning, I think it was in the summer of 1858, when entering my laboratory, which I had left in perfect order on the previous evening, I was surprised to find the room in the greatest confusion. Broken bottles and fragments of apparatus lay about, several window-panes were smashed, and all the tables and shelves were covered with a dense layer of white dust. The latter was soon found to be chloride of lime, and furnished without difficulty the explanation of this strange appearance.

"At the conclusion of the Great Exhibition of 1851, M. Kuhlmann, of Lillie, had made me a present of a splendid collection of chemical preparations which he had contributed. The beautiful large bottles were for a long time kept as a collection; gradually, however, their contents proved too great a temptation, and in the course of time all the substance had been consumed. Only one large bottle, of about 10 litres capacity, and filled with chloride of lime, had resisted all attacks; the stopper had stuck so fast that nobody could get it out; and after many unsuccessful efforts—no one venturing to indulge in strong measures with the handsome vessel—the bottle had at last found a place on one of the highest shelves of the laboratory, where for years it remained lost in dust and oblivion, until it had forced itself back on our recollection by so an energetic appeal. The explosion had been so violent that the neck of the bottle was projected in the area, where it was found with the stopper still firmly cemented into it.

"I have not been able to learn whether similar cases of the spontaneous decomposition of chloride of lime have been already observed."

Battle's Vermin-Killer

Is found to consist of flour, sugar, strychnia and Prussian blue. Ten grains of the powder furnished upon analysis 23 grains of strychnia, a quantity that represents 23 per cent. of the poison. A frog is sensibly affected by the two thousandth part of a grain of strychnia, a quantity so small as scarcely to be perceptible by the naked eye.

Writing Ink.

I.—M. de Champour and M. F. Malepeyre, in their Manual, say that Ribaucourt's ink is one of the best at present in use. The formula for its preparation, which may interest some of your readers, is as follows:—

Aleppo galls, in coarse powder......	3	ounces
Logwood chips	4	"
Sulphate of iron......................	4	"
Powdered gum-arabic..................	3	"
Sulphate of copper....................	1	"
Crystallised sugar	1	"

Boil the galls and logwood together in 12lbs. of water for an hour, or till half the water has been evaporated; strain the decoction through a hair-sieve, and add the other ingredients; stir until the whole, especially the gum, be dissolved; and then leave at rest for 24 hours, when the ink is to be poured off into glass bottles and carefully corked.

II.—Mr. J. Horsley, gives the following receipt:—Triturate in a mortar 36 grains of gallic acid with 3½ ounces of strong decoction of logwood, put it into an 8-ounce bottle, together with 1 ounce of strong ammonia. Next dissolve 1 ounce of sulphate of iron in half-an-ounce of distilled water by the aid of heat; mix the solutions together by a few minutes' agitation, when a good ink will be formed, perfectly clear, which will keep good any length of time without depositing, thickening, or growing mouldy, which latter quality is a great desideratum, as ink undergoing that change becomes worthless. It will not do to mix with ordinary ink, nor must greasy paper be used for writing on with it.—*Chemical News.*

To Discharge Ink.

All traces of writing ink may be obliterated by washing the paper alternately with a camel hair-brush dipped in a solution of cyanide of potassium and oxalic acid. When the ink is discharged wash the paper with rain water.

Waterproof Glue.

Fine shreds of Indian-rubber, dissolved in warm copal varnish, make a waterproof cement for wood and leather. Take glue, 12 ounces, and water sufficient to dissolve it; then add three ounces of resin, and melt them together, after which add 4 parts of turpentine. This should be done in a water bath or in a carpenter's glue-pot. This also makes a very good waterproof glue.

TO INVENTORS AND PATENTEES IN CANADA

Inventors and Patentees are requested to transmit to the Secretary of the Board short descriptive accounts of their respective inventions, with illustrative wood cuts, for insertion in this Journal. It is essential that the description should be concise and exact. Attention is invited to the continually increasing value which a descriptive public record of all Canadian inventions can scarcely fail to secure: but it must also be borne in mind, that the Editor will exercise his judgment in curtailing descriptions, if too long or not strictly appropriate; and such notices only will be inserted as are likely to be of value to the public.

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to Industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURERS & MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation by transmitting descriptive accounts of LOCAL INDUSTRY, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside,

TO PUBLISHERS AND AUTHORS.

Short reviews and notices of books suitable to Mechanics' Institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.