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FOR UPPER CANADA.

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FLAX IN CANADA.

Flax is indigenous to the American Continent. The *Linum Virginianum* has been found growing wild in several of the States, and the plant has been discovered growing wild in California; though it probably is not the same species of plant as the *Linum usitates simum*, or common flax, which appears to have been imported from Europe probably by the Puritans at the time of whose emigration from England it was attracting attention. How it was introduced into Canada does not appear, but it was cultivated extensively in Lower Canada under the French rule. "The Paris document" notice its existence in 1719—and it is probable from them that Bouchette takes his information when he writes that, "The *habitans* of Lower Canada were attached to flax. In 1717 Lower Canada produced 45,967 lbs., and in 1721, 54,650 lbs."

In 1734 there were 14 mills in operation in Canada for the production of Linseed oil, and there was also produced 92,246 lbs. of flax. "In 1806 the British Government offered a bounty for the importation of flax and hemp from the North American Colonies." "In 1827 there were in Lower Canada 13,243 looms, and, 1,058,696 French Ells of linen woven." "Few farmers cultivated more than half an acre of flax seed the growth of which supplied them with ample material to manufacture their home linen." "Flax grew with great luxuriance in Canada." Upper Canada, which was set apart as a separate Province, in 1791, had at that time only about 10,000 inhabitants; and we have not any special accounts of what extent of flax was cultivated in it in those early days of settlement. Agricultural associations had been formed in the Counties of York, Ontario, and Peel so early as 1825. A Provincial Agricultural Association of Upper Canada was formed and held its first meeting in 1846, and the Board of Agriculture for Upper Canada was formed under an act passed in 1850. In 1849 commenced the publication of the "Canadian Agriculturist," under the proprietorship of Mr. (now the Honourable Provincial Secretary) Wm. McDougall, and acted in a semi-official capacity for the Board of Agriculture of Upper Canada. This Board collected reports from the Associations of the various Counties in the Province, and published some of them with the reports of its own proceedings. The Bureau of Agriculture was within the last few years added to executive departments of the Province, and has made reports from time to time. These, the census reports, and the various local newspapers are the only sources from which information can be attained with regard to flax statistics, until lately; and even the latest returns are not to be relied on. In the census reports flax and hemp are both enumerated under the one head, and it is impossible to distinguish the quantities of each.

From these sources, meagre as they are, we find that in 1818 "there was much flax cultivated in the Niagara district, all manufactured by hand." "In 1829 a patent was granted in Canada to Robert Hoyle for an improved machine for dressing flax," "in the early settlement almost every farmer cultivated a small field of flax which almost invariably furnished the family with a good supply of linen—*and such linen*" "in 1849 flax was shown at the Exhibition held at Kingston;" in 1847 a patent was granted to James McGee of Toronto for "a method of rotting flax and hemp in a vat or tank to be nearly filled with cold water and then heated by steam to about 90°; this in about 15 hours caused fermentation, and in three days produced decomposition of the glutinous matter." In 1850 another patent was granted in Canada for "machinery for dressing flax and hemp" by a combination of a toothed cylinder, a trunk, and an endless apron, all arranged to operate together." "Flax was cultivated to some extent in Prince Edward's County, and 880 yards of linen were manufactured in it, in 1848." "In 1849 there was imported into Canada, linen to the value of £20,000 "Stg."

The Counties of Ontario, Peel and York produced flax "in 1848—5,712 lbs., 1850—5,017 lbs., and 1852—12,672 lbs." In the early settlement every farmer cultivated a small field of flax, which almost invariably produced a good supply of linen." "The girls of Peel of the present day (1852) are sadly deficient in that useful accomplishment." Spinning flax is sown in small quantities for domestic use," "383 yards of linen and 922 lbs. of hemp and flax" were produced in County Peel in 1851. "466 lbs. of hemp and flax, and 337 yards of linen were in same year produced in the County of Grey. In 1850 "14,955 yards of linen and 50.650 lbs. of flax and hemp were produced in Upper Canada. "Flax and hemp had been tried 1851-2 in County Wellington, and both appeared to grow luxuriantly." "In the County of Hastings in 1851 there was produced 125 yards of linen—the climate and the soil seem to be well adapted, but the farmers will not go into the cultivation of it until they see some prospects of being able to get it scutched and prepared for market." "The Canada Company" in 1851 offered "handsome premiums to growers of flax, and had imported machinery for preparing it," and "it was hoped that the cultivation of it would be extensively undertaken and prove profitable" The President of the Board of Agriculture in the annual address delivered by him in 1851 makes favorable mention of the advantages of cultivating flax.

The census of 1851.2 shows 59,689 ℔s. produced in Upper Canada, and 1,189,018 ℔s. in the Lower Province, making a total of 1,248,709 which at 300 ℔s per acre, would give about 4,000 acres to the latter and 2,000 to the former; yet we find larger importations of textile fabrics and the products of flax into the country, whose population was then about 2,000,000; and Mr. Kirkwood then estimated the use of linen in the Provinces at 1s. 10d. per head.

At the great International Exhibition held in London in 1851, only one sample of flax from Canada was exhibited, and it was from Lower Canada.

At the Provincial Exhibition held in Upper Canada in 1853, the President in his address made special reference to the importance of flax growing. The agitation of the subject resulting from the London Exhibition of 1851, led to an interest being taken in it for a time; and the Minister of Agriculture in 1853, sent Mr. Kirkwood as a special commissioner to Europe to make inquiries and report on the systems of cultivation and preparation of flax. He visited Belgium and the British Isles, and after completing his investigation made a report which was subsequently published in the proceedings of the Legislative Assembly of Canada, 1854–5, in which he estimates the flax produced in Lower Canada in 1852, at 1,867,016, off 3,426 acres; and in Upper Canada at 50,350 ℔s., off 92 acres, making the total growth of flax in all Canada under 3,500 acres; notwithstanding which he showed that a large quantity of money was annually going out of the country for linens imported, viz., in 1850, £68,562; 1851, £113,637; 1852, £84,175; and that there was linen to the value of £180,000 yearly used in the Provinces. The commissioner reported that he had samples of Canadian flax prepared in Europe, and that the result proved Canadian flax to produce a fair average yield, and to be of good quality. In his report he goes largely into details pointing out the great value of flax commercially and agriculturally, yet he did not advocate the cultivation of flax, but states, "many years will no doubt elapse before the introduction of flax into Canada." "If (he writes) a capitalist builds a mill he as naturally expects a supply of flax; here is the great difficulty, when this is surmounted the Gordion knot is cut."

About the time of sending this commissioner to Europe to investigate the subject of flax, another commissioner Mr. McDougall, was sent to the United States to enquire as to the state of machinery and agricultural implements, &c.; and in his report on the subject, when treating of flax machinery, he goes into the question of flax cultivation, and states, "The more general cultivation of flax might not be productive of injury to the soil or to the pocket of the Canadian farmer; but, it may be safely affirmed, that neither the one or the other has received much benefit from the cultivation of it; for textile purposes the experiment has not been confined to a few cases nor to a single township." At the Paris Exhibition held in 1855 two samples of flax, two of flax thread, and one of linseed were exhibited. Mr, Perrine, a gentleman from the United States, notwithstanding the discouraging reports of Mr. Kirkwood and Mr. McDougall. soon after that began to cultivate flax in Upper Canada, and set an example which is being followed throughout the Province. The reports of the Board of Agriculture inform us that "in 1852 Prince Edward county produced 55,121 yards of fulled cloth and flannel, but no flax or linen. Flax was cultivated in small quantities for domestic use. In the county of Welland flax was once extensively grown and manufactured; it has almost ceased to be cultivated; it, however, grows luxuriantly.

At the Provincial Rxhibition held in Cobourg in 1855, the usual prizes of the Association were awarded for flax and flax seed, but there was only *one* entry for the Canada Company's prize for the best 112 ℔s. of flax, and on this the judges made no report. The reports of 1856-7 make no mention of flax. The subject seems to have gone to sleep during those two years, but it was in 1858 awakened by the President, in his address delivered at Toronto, strongly recommending its cultivation. In this year the "Agriculturist" advocated the cultivation of the crop, but states "the great want is a ready market." Another paper, the "Protectionist," this year writes, "The great difficulty in the way of this crop in Canada was the want of modern machinery;" and that Ulster, in Ireland, by its flax and linen trade, maintained a population of 2,000,000; and that "four of the winter months spent in idleness in

Canada, would, in the manufacture of flax, afford remunerative employment to the farmers and their families, by hand looms and spinning wheels." In 1859 both the "Agriculturist" and "Protectionist" contained articles on the subject, and in 1860, in the former paper, it is stated, "Flax is attracting much attention in various parts of the Province. The want of mills and markets is felt." The American war causing a short supply of cotton and a consequently increased demand for flax gave an unexpected impulse to this long neglected crop in Canada. One American journal, the *Scientific American*, called upon the people to prepare to sow "a million acres of flax" next year. The crop of cotton in the United States in 1860 had been 2,079,230,800 lbs; this supply was in a great measure cut off, and a substitute was required for it. The Canadian *Agriculturist*, and the Upper Canada *Board of Arts Journal*, in this year 1861, placed the subject and its advantages before the public. Mr. MacCrea, an experienced and extensive north of Ireland farmer, well skilled in the cultivation of the flax crop, had visited Canada, and seen some of the growing crops of that plant, and knowing the demand for the raw material which then existed in Ireland, upon his return to that country brought the matter before the public, and pointed out to flax spinners that Canada was a source from which they might derive the supply which they then so much wanted, and were using expensive efforts to promote the cultivation of in the East Indies. He asserted that "Flax could be grown equally good in Canada as in Ireland. Canada flax, if properly prepared, would be as good as could be produced in Ireland. He would sacrifice the seed, and not ripen the flax so much, to save it. By too much ripening the fibre was made coarse. The reason why steeping had not been adopted in Canada was that the market was always in the United States, as this article was good enough for it; the water rotting would be more expensive, and by it the seed would be lost." At a meeting on the subject held at Belfast, Mr. Ewart, a flax spinner, stated that "he was satisfied that they might expect better flax from Canada than from India or Russia."

Shortly after, the emigration agent of the Canadian government, being in Ireland, brought the matter before a meeting of gentlemen in Belfast, interested in procuring large supplies of flax for spinning. He urged on the Belfast spinners to send out to Canada an instructor to teach the Canadian farmers how to manage this crop, but they declined to do so, well knowing that if they expended a large sum of money in teaching the Canadians to produce a good fibre, they would have no guarantee that they would get any of the crops produced—the probability being that the demand for it existing in the United States would draw it over into that country, and none of it would ever reach Ireland to repay them for teaching Canadians to produce it. The cultivation and preparation of flax has since grown to great dimensions, but no steps have been taken to improve the quality of the article.

The census returns of 1851 and 1862 show that in 10 years Upper Canada had extended her production from 59,689 lbs. to 1,225,934, an increase of 1,166,245 lbs., whilst Lower Canada had decreased from 1,189,018 to 975,829, being a decrease of about 20 per cent. In 1862 an association for growing flax was formed in the County Elgin, and application was made to the Board of Agriculture for assistance, which, failing to obtain, they were unable to carry out their project to any extent worthy of notice. *The Board of Arts Journal* for Upper Canada (vol. 3) in an article in support of the cultivation of flax, details some of the encouragements given to aid its culture in Canada, and amongst others, mentions the annual prizes offered by the Canada Company, the Hon. Geo. Alexander, and others, the Agricultural Association's medal; Mr. Kirkward's report; Mr. Donaldson's letters; the Elgin, Sherbrook, and other flax associations; seed and machinery imported by the government; and lectures caused by them to be delivered in 1862 on the cultivation of flax.

The Canadian publications and journals of 1863-4 contain much information as to progress made by farmers to cultivate this crop; and by merchants and manufacturers giving out seed and establishing factories. The Board of Agriculture for Upper Canada, Mr. Donaldson, Mr. Walker and others have also, either by the delivery or publication of lectures, essays and letters, and pamphlets of instruction, endeavoured to promote the cultivation of flax, and urged upon the government to make appropriations for the purchase of seed, or to adopt other modes of encouragement; and many public meetings have also been held for the promotion of these objects. Mr. Letellier the Minister of Agriculture in his report for 1863 states that "upon examining the reports of the Agricultural Societies it is to be noticed that in general the prizes granted by these societies are chiefly for animals and grain," and adds, "it would I conceive, be highly advantageous so to amend the laws which govern these associations as to compel them to apply a portion of the funds at their disposal for the clearing of waste lands, for the improvement of the soil, and for the improved cultivation of garden produce and *textile plants.*" "The cultivation of the latter, though far less advanced than it ought to be, has, however, since the increase of the price of American cotton caused by the civil war, begun to assume proportions which are deserving of the most earnest attention. During the last year, several thousands of acres of land were added to the quantity already devoted to the cultivation of the plant in question, the advantages resulting from which are now more highly appreciated, as it is well known that our soil and climate are eminently adapted to the "growing of hemp and flax, the only obstacle to the increased cultivation of these products is the difficulty of finding a market for the raw material or manufacturing it."

A Committee of the Legislative Council appointed to make enquiry reported in June 1864, showing that they had prepared a series of questions to ascertain if the soil and climate of Canada was adapted to the growth of flax, and would its extensive cultivation tend to the advantage of the farming interest. That they had before them Mr. Donaldson, and appended a letter of his to their report; and the committee suggested "that a similar committee be appointed early next session to continue and extend the work now begun."

Mr. Donaldson in a letter appended to that report states: "That the soil and climate of Canada are admirably adapted to the growth of this valuable plant." "The great secret in producing the finer qualities of fibres that will command the highest price in the market, is the knowledge acquired and practiced of either dew rotting or water rotting." "The great difference of the price of flax in Ireland and other flax growing countries where the price ranges from £50 to £200 Stg. per ton, is evidence of the skill attained in producing finer qualities. It is quite common (in Ireland) for farmers to get £30 or £40 per acre for flax on the ground before it is pulled." "The average quantity of clean scutched fibre (produced in Canada,") is 300 lbs., worth from $8 to $10 per 100 lb., according to quality." "The average quantity of seed produced to an acre is 12 bushels, worth last year, $1 50 per bushel." Showing a nett amount per acre for both seed and fibre of $48.

The Minister of Agriculture in his report for 1864 on the subject of flax, states:—"This important branch of agricultural industry has made great progress during the last few years, and especially during the year 1864. The progress is due mainly to two causes, first, the American war by which the cotton supply has been much lessened, and the price of cotton consequently increased. Second, the disposition manifested by wheat growers to depend less on that single and not always certain crop." "This industry, therefore, which had been one of the staples of agriculture in Lower Canada under the French, and during the early part of the English rule, seems likely to resume its former relative importance in the agriculture of both sections." He alludes to a letter of Mr. Donaldson's, published in the appendix to that report in which is pointed out that "the importation of new Riga seed into the country would be an immense benefit, and many farmers would be willing to pay back the first cost in case the government would import a quantity of sowing seed.

For several years past farmers in Upper Canada have been urged to grow flax, and at last have begun to do so; if they find it pays them, of course they will continue it. The importance of this crop to a country circumstanced as Canada is is scarcely estimated at its value by the political economists of the Province, nor is the fostering care with which it has been nursed in other countries to secure its advantages sufficiently known in Canada. Those who have for years past advocated its merits, may well be proud of the success which has attended their efforts in persuading the people to cultivate it; and it would be to be regretted if a relapse should take place.

At no previous time has a better opportunity occurred, than now, for the legislative wisdom of the Provincial Parliament to adopt measures which may secure the full development of one of the most valuable of Canada's industrial resources. Aspirants for popular favour may prove their ability to be practically useful to their constituents, by procuring substantial assistance to aid the extension and improvement of flax cultivation. The high rate of profit derived for the products of that plant have prompted to individual exertion, and a general desire to enter upon the business. Farmers will endeavour to produce the crops most remunerative, and it may be alleged that they will, without aid, grow flax if they find that it is profitable for them to do so. No doubt they will; but to make it so an amount of skill more than is possessed by most Canadian farmers is required. Machinery and skilled workmen to prepare it, and a market in which to dispose of the produce are necessary.

Were the extension of flax growing and the production of fibre and seed for manufacturing purposes calculated to benefit merely a class, or a number of individuals, it should be left to private enterprize to deal with it; but it is not a matter of such trifling importance. Experience has proved the valuable resources this crop contains within itself for the production of wealth in a nation, and it is as worthy the consideration of the political economist to devise a mode of developing its resources, as it would be to contrive plans to promote immigration, encourage fisheries, the clearance of woods, the settlement of wild lands, or the working of mines.

The population of the two provinces may be presumed now to amount to 3,000,000, a great portion of which is totally unemployed during at least four months in the winter of each year. It has been estimated that in Great Britain and Ireland upwards of 4,000,000 are employed annually throughout the year in the manufacture of flax, or ministering to the wants of those so employed, including their families, supported from the earnings of this branch of business.

The prospect of increased extent of the growth of flax in Canada cannot be expected to cause much increased demand for agricultural labour, inasmuch as it will be grown as a substitute for wheat or some other crop, and not in addition to such crops hitherto grown. The nature of the crop no doubt requires for it more labour than a grain crop would; but it may be reasonably expected that, by a little extra exertion, the farmer will be enabled to complete the cultivation and harvesting of a flax crop (after the fashion such work is now done in Canada) by the aid of his family and ordinary labourers, and without the employment of extra hands. But after the farmer's labours are ended by harvesting, and the crop has passed into the hands of the purchaser, it has to undergo processes of preparation and manufacture, by which its value is increasing as it proceeds from stage to stage, until it has increased and multiplied to an amount many-fold the value of the raw material. The increase in its value represents the manufacturer's profit and remuneration for expenditure in labour, and interest of capital embarked in the business; and this profit and remuneration for labour should be secured and retained within the Province, contributing to its wealth, in addition to what the farmers may make by the cultivation of the raw material.

In our first article on this subject it is argued "that the Government of Canada might aid and extend the cultivation of flax without involving any financial loss." It is not meant by this that such can be done without outlay. Any money advanced by the government to further this or any other object by a loan would of course have to be repaid with interest. and no loss should ensue from advances to township municipalities or incorporated companies to purchase foreign seed, machinery, or for other useful purposes. Loans to individuals could be secured on their property, which they would expend after the manner provided for by Lord Naa's bill in Ireland. Any advances made for such purposes by the government would be merely a loan of governmental credit, for the money would be supplied by capitalists in Canada, or in England, at a moderate rate of interest. If an act be passed authorizing the loan for these especial purposes, the money will soon be forthcoming. But the government should not confine itself to mere loans; it should contribute largely by grants to the Board of Agriculture, or, perhaps, it would be better still to give such to a "Board for the Improvement of Flax."

It will be said, "Where is the money to come from to give away in such grants?" To this a reply is at hand in the fact that the import duties annually received by the treasury for linen, cordage, sails, cables, flax, hemp, tow, oil cloth, and other imported goods, composed of textile fabrics, probably amount to upwards of $200,000; let that in the first place, or an equivalent for it, be appropriated to encourage flax, which may thus be produced at home, lessening—as the production here increases in extent—the importation of those articles for which it may be substituted. Of course the deficiency in the revenue (if any) occasioned by this application of these *duties*, would have to be made up in some other way; but this could be done, and a sufficient fund in aid of this object could be obtained by a small additional duty on such noxious luxuries as whiskey and tobacco.

To deal with the details of any such financial measures, or of the working out of projects to assist and encourage the measures now advocated, would be a work too extended for the bounds of an article like this, which is offered merely as a suggestion to prompt public men into action on the subject.

It is an easy task to criticise, cavil at, or object to any proposed plan; but it is a greater and better work to aid in devising projects to promote the welfare of the state and the happiness of the people. To arrive at the best plan all at once need not be expected, but a beginning should be made; legislators and statesmen should give some consideration to the subject. It is peculiarly the duty of the representatives of agricultural constituencies (as are most of the members of the Canadian Parliament) to bring forward measures to benefit the interests of their constituents, and by doing so in this they will also be largely promoting the welfare of the Province.

Heav'n acts by human means. The artist's skill
Supplies in war, as in mechanic crafts,
Deficiency of tools.—*Scott.*

THE BALANCE OF TRADE.

The *Scientific American* in an article showing the imports of Great Britain to have exceeded the exports, for the year 1864, some 61 millions of pounds, says:

"Those who argue that a preponderance of imports over exports is opposed to the commercial prosperity of a nation, receive a practical refutation of their theory in these conclusive figures."

The conclusion arrived at in the above quotation is true in regard to some countries, but not so when applied to others. In the case of Great Britain, for instance, although there is an apparent balance against her of £61,000,000 for the year, yet in reality it is not so. Her imports mainly consist of raw products for her manufacturers, and food for their sustenance; her exports, of British manufactured goods. These exports are estimated in value at the manufacturer's lowest wholesale prices, and are shipped to foreign countries by British merchants, who realize in many cases immense profits, and in all cases—it is to be presumed—fair remunerative returns, which realized *profits* added to the first cost at which the goods have been entered, constitute, in reality, the actual total value of the year's exports. The greater portion of this commerce with foreign nations and her own colonies, is also carried on in British ships, with British sailors, thus realizing to the nation the whole of the profits resulting therefrom; and again, when we consider the immense amount of capital loaned, or invested, in foreign countries by British capitalists, for which the interest is continually pouring *in* to her treasuries, we cease to wonder how it is that, with this large balance of imports over exports against her, she still so rapidly increases in wealth.

In the case of Canada almost everything is reversed. Her imports are mostly manufactured goods, and mere luxuries, from which she derives no profit from additional labour she may expend thereon, and then re-sell to other countries. Her exports are almost exclusively raw material or agricultural products, with the least possible labour expended upon them, and consequently of less advantage to the country than would be the case if such raw materials were manufactured into expensive goods before being exported; and then, these articles of export are shipped off in foreign vessels, so that the profits of the ocean freight do not add to our wealth; and even in the case of our inland carriage, the very works constructed to accommodate it have been built with foreign capital, so that whatever profits there may be realized by our railway and canal business, over and above working expenses, goes out of the country.

Not only are our railways and canals built with foreign capital, but the very land is cultivated, and our commerce carried on, to a considerable extent, with funds borrowed from "Trust Loan" and "Landed Credit" companies, and Banking institutions, of which the capital is mainly furnished from abroad.

It has been stated, and no doubt truly, that it takes annually all the wheat Canada exports to pay interest on borrowed capital. If these things are so, and we do not think they can be gainsayed, it is clear that as a people we cannot prosper while our imports so far exceed our exports as they have heretofore done, averaging, as per tables given in former numbers of this Journal, some $9,000,000 per annum for the last fourteen years. We must export more, import less, give greater encouragement to our Home Manufacturers, secure a larger proportion of immigrants of wealth, or of moderate financial resources, and depend less on borrowed foreign capital, or plunge yearly more deeply in debt until we eventually arrive at a state of national bankruptcy. If true to ourselves, encouraging what is of home production, rather than the foreign which is so often sought after because it is foreign, although in many cases inferior; improving our systems of agriculture as well as manufactures, so producing more and superior in quality, and thus increasing our exports in addition to better supplying home demands; and exercising a judicious economy in all our expenditures, our country cannot but—under the blessing of God—arrive at a state of happiness and prosperity.

PUBLIC BUILDINGS AND PLACES OF AMUSEMENT.

A bill is now before the British House of Commons, for "the regulation and construction of Theatres and other places of amusement," which is intended "to secure that due provision be made in the construction and arrangement of places of public entertainment for the safety, in case of fire or other accident, of persons resorting thereto." The rules laid down in the proposed bill provide that the halls, or passages, in a building to accommodate not over five hundred persons, shall be not less than five feet in width, and one foot additional width for every one hundred persons over that number; and the door-ways connecting therewith to be of widths equal to the width of the passages. It also provides that all doors are to open outwards; the halls and corridors to be maintained free and clear, and unobstructed with barriers, in the direction of egress; and that all gangways in those parts of the building where the public are placed, are to be kept clear of seats and other obstructions to free ingress and egress, and are to be used for passage only.

The *Builder* complains that the width of corridor is to narrow; that the bill does not provide for the erection of such buildings upon *only* isolated sites, so as to stop the danger of communicating fire to or from other buildings; and also so as to enable the architect to provide a sufficient number of properly distributed ways of egress, which is of as much importance as width of halls and corridors; and that the bill also omits to provide for properly constructed staircases, still permitting so far as this act is concerned, well-holes, winders, narrow treads to the steps, and insufficient handrails; and especially, the same staircase or corridor serving more than one part of the house, thus involving meeting currents. The Journal referred to calls the attention of architects and others to this measure, before it shall pass the committee of the House, with a view to obtaining as perfect a bill as possible.

It is important that our Provincial Parliament should take up this subject at an early day. Churches and places of public entertainment are everywhere being constructed, and in but few instances is any regard paid to the safety of the public, in the event of fire or any other sudden cause of excitement. The doors for egress are generally all placed at one end of the building, and almost invariably open inwards, so as to afford the the best possible chance of choking up and causing loss of life. It is just as easy to have them open outwards as inwards, and can be so constructed in quite as good taste. The doors leading from the main staircase into the Music Hall, in the Toronto Mechanics' Institute, swing clear both outwards and inwards, and the main doors of the building open outwards. We also notice that in one of our churches, recently injured by fire and now being restored, the main doors have been changed to open outwards.

We have on record many cases, of the most frightful character, the result of the present barbarous and unnecessary modes of construction, in reference to both doors and staircases; the first becoming choked up and incapable of being opened, while human beings are trampled upon, suffocated, and even roasted alive behind them, and the latter giving way during a rush and precipitating their hundreds into one mass of dying, wounded, and struggling humanity.

Then again in the matter of ventilation, greater ignorance is shown than it would be possible to believe, did not our senses make it manifest to us. Buildings containing accommodation for many hundreds of persons, are constructed without any provision whatever being made for the admission of pure air, or the passing off of the impure, except such as takes place through the doors and windows, which, during the winter months, is trifling indeed compared with what is required. In many churches the windows are packed during the winter, so as to perfectly exclude the smallest amount of fresh air, and the doors are only occasionally opened during the space of 1½ hours at each service; and at the usual evening service, in addition to the crowd of human beings consuming the limited amount of oxygen the building contains, there are large numbers of gas or other lights adding to its rapid consumption. The atmosphere also, in many cases, is rendered more impure by some ill-devised hot-air machine with which the building is warmed. No immediate fatal results ensue, and the danger is unobserved; yet the health of those who attend is destroyed, and foundations for colds and consumption are laid.

In urging Legislative action for Canada, it may be answered that our public halls are few, and not crowded by other buildings, as compared with older countries; but this is no argument for delay, but should rather induce us to make haste and enact laws necessary to compel a proper construction of such buildings, and of the numerous school houses that will also be required, in the future. Both beauty and economy are more perfectly secured by making proper provision at the time of construction, rather than to have to alter a building after it has once been completed.

Notices of Books.

GEOLOGY OF NEW BRUNSWICK.

The *Morning Telegraph* of St. John's, New Brunswick, of a recent date, contains a long and elaborate notice of "a prelimary report on the Geology of New Brunswick, together with a special report on the distribution of the Quebec Group in the Province," by Professor H. Y. Hind, till recently Professor of Chemistry and Geology in Trinity College University, Toronto, and Editor of this Journal for the first three years of its existence. Several maps in manuscript, illustrating the Geology of particular parts of the Province, were submitted to the Legislature at the same time as the report.

We have not yet received a copy of the report, but the *Telegraph* says "The introduction contains a notice of what has been done by other geologists in relation to the rocks of the Province;" and after referring specially to the valuable labours of some of them, speaks of "a correspondence between Professor Hind and Sir W. E. Logan, in which Sir William most generously agrees on behalf of himself and his colleagues, Professor Hunt and Mr. Billings, 'to institute a comparison between the Geology of Canada, and that of her sister Colony, and in some degree to make available our ascertained results in forwarding your (Professor Hind's) investigations and promoting the development of her mineral resources.' Sir William also states that, 'In making serviceable in the investigation the experience and practice we have acquired on the Canadian Survey, we should be only carrying out a suggestion which has already been placed before the respective Governments of these Colonies, by the adoption of which the labour of the investigation would be shortened and the cost cheapened, while a unity of design would be given to the whole subject, rendering the result, both economic and scientific, intelligible to the world with much less study than would otherwise be required.' Sir William asks no recompense for this laborious undertaking, and even offers to defray the expenses of the transmission of the specimens to Canada, if they become the property of the Geological Museum at Montreal. He adverts to the existence of the 'Quebec Group' in New Brunswick, and points out its immense importance to the Province."

The nomenclature adopted by Professor Hind is essentially the same as that adopted by Sir Wm. Logan in Canada; he quotes Sir William in support of the necessity for employing names already well known in America and Europe, in preference to new names—the reasons for which are obvious.

We have not room for a more lengthy notice of this interesting Report.

THE AMERICAN ARTISAN.*

We have received Numbers 1 to 7 of the new series of this Journal. Although the 1st volume was very neatly got up, this new one is a great improvement, both in size and appearance. Each weekly number contains 16 pages, and is sufficiently illustrated with superior wood-cut engravings of new and important inventions and machines, and letter-press descriptions; the official list of claims of patents issued from the United States patent office; and also numerous original and selected articles, and useful recipes, of value to the inventor and mechanic, and indeed to all classes. A recent number contains the following, which we commend as worthy of consideration, merely suggesting that "Hint" No. 12 will be improved by adding to it "The Journal of the Board of Arts and Manufactures for Upper Canada:"—

TWELVE HINTS ON THE FORMATION OF A SELECT LIBRARY.

1. Are you deficient in *taste?* Read the best English poets, such as Gray and Goldsmith, Pope and Thomson, Cowper and Coleridge, Scott and Wordsworth.
2. Are you deficient in *imagination?* Read Milton, and Akenside, and Burke.
3. Are you deficient in the *power of reason?* Read Chillingworth, and Bacon, and Locke.
4. Are you deficient in *judgment and good sense in the affairs of life?* Read Franklin.
5. Are you deficient in *sensibility?* Read Goethe and Mackenzie.
6. Are you deficient in *vigor of style?* Read Junius and Fox.
7. Are you deficient in *patriotism?* Read Demosthenes, and the "Life of Washington."
8. Are you deficient in *conscience?* Read some of President Edward's works.
9. Are you deficient in *piety?* Read the Bible.
10. Are you deficient in *political knowledge?* Read Montesquieu, the "Federalist," Webster, and Calhoun.
11. Are you deficient in a knowledge of many "*histories and mysteries*" *of the human heart?* Read Shakespeare.
12. Are you deficient in a knowledge of *the most recent inventions and discoveries made in the arts and sciences, at home and abroad?* Read the American Artisan—a weekly journal devoted to the interests of artisans, machinists, manufacturers, miners, engineers, farmers, inventors, and patentees.

*Brown, Coombs & Co., No. 212 Broadway, New York. (See advertisement on cover of Journal.)

Board of Arts and Manufactures
FOR UPPER CANADA.

ARREARS OF SUBSCRIPTIONS.

Subscribers in arrear for the Journal, either for the past or present year, are respectfully requested to remit the amount due, to the Secretary of the Board, at as early a date as possible. The Journal is published at a considerable annual loss to the Board, so that prompt payment of the trifling annual subscription, 75 cents, is of importance.

FINAL EXAMINATIONS.

We had intended to publish in this number of the Journal the results of the Final Examination of Candidates, held by the Board during the early part of June; but the whole of the reports not having been received at the time of going to press, we have been obliged to defer it for the next issue. In the meantime we publish a portion of the examination papers.

Examination Papers.

ENGLISH GRAMMAR AND ANALYSIS

(Three hours allowed.)

1. Give the meaning and derivation of the following words, viz.: Apprehend, adhere, abstraction, sincere, attention and depend, putting each word into a short sentence.

2. Give the literal and mataphorical meaning of these words, viz.: Calamity, hypocrite, talent, occupant, capricious, pagan, tariff and electricity, putting each word into a sentence.

3. Give *three* words used in English derived from Gaelic, French, Dutch, Spanish, Italian and Eastern tongues.

4. Form *abstract nouns* from slow, free, keen, fellow, man, wealth, white, poor, fellow.

5. Form *verbs* from pure, hard, white, equal, quick, human.

6. Give *adjectives* of Latin derivation corresponing in meaning to the following nouns, viz.: cat, dog, eye, band, sun, moon, star, son, father, mother and whale.

7. What is Syntax?

8. Give 4 or 5 of the leading principles of Syntax, taking care to illustrate your statements by examples.

9. Give *three* simple "Sentences" and *three* compound ones.

10. Analyze these sentences, "Alexander the Great, when he had conquered the world, is said to have wept, because there were not other worlds to conquer," and "The two brothers did not wish to live at Alba, but loved rather the hill on the banks of the Tiber where they had been brought up. So they said that they would build a city there, and they enquired of the gods by augury, to know which of them should give his name to the city."

11. Correct the following and assign your reasons for the corrections, viz.: (1) Between you and I the plan is absurd. (2) The whole army were defeated and flew. (3) He and me goes to market every day. (4) I have no idea who he means to put in my place. (5) Have either of your three friends arrived? (6) She always appears very amiably.

12. Substitute the regular *possessive* case for "of Moses, &c." in the following sentences, viz.: (1) The five books of Moses. (2) The horse of the gentleman. (3) The sails of the ship. (4) The fine dress of the lady.

13. Write a short Essay on Human Life as compared with the four seasons of the year.

14. Explain the following "figures of speech" and give illustrations of their use, viz.: Allegory Apologue, Apostrophe, Climax, Hyperbole, Irony, Litotes, Personification and Proverb.

15. Give an account of the days of the week, Sunday, Monday, &c., and of the months of the year, January, February, &c.

16. State where capital letters are employed according to English usage.

17. Give *nouns* corresponding to the following *verbs*, viz.: bless, feed, bind, knit, sit, sing, strike, stick, dig, drive, smite, prove, live, choose, weave and thieve.

HISTORY.

(Three hours allowed.)

I. Greek and Roman History.

1. State what you know of the Argonautic Expedition.

2. Who was Draco and for what celebrated?

3. What was the system of Ostracism among the Greeks.

4. Give the particulars of the Battle of Marathon.

5. Give the particulars of the Battle of Salamis.

6. Give a sketch of the life of Epaminondas.

7. State the nature and object of the Achaean League.

8. Give a sketch of the life of Romulus.

9. Give an account of the war with Pyrrhus.

10. Give an account of the second Pumic war.

11. When did Greece come under the power of the Romans? Give details.

II. English History from 1066.

1. Give an account of Dooms-day book.

2. Describe the circumstances of the death of William Rufus.

3. Give a sketch of the life and death of Prince William, son of Henry I.

4. Describe the Battle of the Standard.

5. State what you know of Thomas A. Becket.

6. Trace the career of the *three* "Edwards."

7. Give full particulars of the Battle of the Boyne.

8. Give full particulars of the Massacre of Glencoe.

9. Give full particulars of the death of William.

10. Give a sketch of the life of Marlborough.

11. Give a sketch of the life of Wellington.

12. Give a sketch of the life of Nelson.

III. Canadian History.

1. State what you know about the foundation and the early history of Quebec.

2. State what you know about the foundation and the early history of Montreal.

3. Give full particulars about the capture of Quebec by the English.

4. When was Canada formally ceded to England?

5. What wars has Canada been engaged in?

6. Give the particulars of the Rebellion of 1837.

7. Describe the great lines of Railways built in Canada.

8. The principal Canals in Canada?

9. What is meant by the "Reciprocity treaty," and what have been its effects.

ARITHMETIC.

(Three hours allowed.)

I. Which is cheapest, an article that costs 15s. and will last 9 months, or one which costs 12s. and will last 7 months? How much will be saved in 3 yrs. 33 wks. (1 year = 52 wks.), not calculating interest, by constantly using the cheaper one?

II. (1) Find the value of $\frac{\frac{1}{3} \text{ of } \frac{1}{2} \text{ of } \frac{3}{2} \text{ of } 5}{9\frac{1}{3} - 1\frac{2}{3}}$;

(2) Of $\frac{\frac{2}{3} - \frac{1}{4}}{1 \div (\frac{3}{10} - \frac{1}{2} \times \frac{1}{5})}$ of 2 shillings.

(3) Express $\frac{2^7}{7 \times 10^7} + \frac{2^3}{3 \times 10^3}$ in decimals.

III. A pays B a debt a year before it is due, mercantile discount being allowed. If B had waited for payment till the end of the year, he would then, money being supposed to produce 5 per cent. interest, have been £5 richer than by the actual arrangement. Determine the amount of A's debt.

IV. A and B can perform a piece of work in 10 days, A and C in 12 days, and B and C in 16 days. In what time would they do it separately?

V. A person has 4 houses, the united values of which amount to £1,840. The value of the first house is two-thirds that of the second, that of the second is three-fourths of the third, and the value of the third is five-sixths of the fourth house; find the value of each.

VI. At what rate per cent. simple interest will 3½d. produce 3½s. interest in 33⅓ years?

VII. Extract the cube root of 731189187729.

VIII. A room 27.7 ft. long, 19.55 ft. wide and 12.4 ft. high, is hung with paper 2.7 ft. wide; find the cost of the paper at 1s. 3d. a yard.

IX. Add $\frac{3}{4\frac{1}{2}}$ of 4s. 7d., 2.35 of 1s. and .2375 of £1; and reduce the result to the decimal of half a guinea.

X. A debt is to be discharged at the expiration of 4½ months, ¼ is paid immediately, and ¼ at the expiration of 3 months; when ought the remainder to be paid?

Transactions of Societies.

HAMILTON MECHANICS' INSTITUTE EXHIBITION.

The April number of the Journal contained a notice of a very interesting Exhibition then being held in the Toronto Mechanics' Institute, of specimens of Art, Manufacture, Natural History, Curiosities, &c., &c.; and a suggestion that other Mechanics' Institutes should organize similar Exhibitions, as a means of educating and improving the public taste.

During the past month we visited the Hamilton Mechanics' Institute, to see an Exhibition of a character similar to the one above mentioned, which was opened with great success on the Birth-day of our most Gracious Queen, and was continued until the 8th of June; having remained open for 14 days, and been visited by a very large number of delighted visitors.

The Exhibition of Oil and Water Colour Paintings, Bronzes, Statuettes, and Natural History, was very fine; and the collection of Ancient books, Coins, and Curiosities, with a few specimens of Ladies' work and Manufactures, was also very interesting. The whole collection reflected great credit on the Ladies and Gentlemen of Hamilton, who kindly lent their valuable specimens for the occasion.

We notice that Dr. May, of the Educational Department, Toronto, attended on two evenings, and very successfully exhibited the Electric Light, and various Scientific experiments.

The net profit to the Institute, for the 14 days, amounted to $217 00; the net profit to Toronto Mechanics' Institute, for the 11 days of its Exhibition, was $195 50. We notice that the new Board of Directors of the latter Institute have already determined to hold another Exhibition, probably in March next, of a character similar to the last, and which will, no doubt, be even more successfull, as the public then was ignorant of its nature, and only began to appreciate it as its merits deserved, when it drew near its close.

Exhibitions of this character, so far as Canada is concerned, were originally commenced some 16 years ago, by the Toronto Mechanics' Institute, which held them with considerable success, for four years in succession. Owing to various causes they were then discontinued, and their re-organization was left in abeyance until last year.

We trust that these Exhibitions, so interesting and instructive in their character, may become general throughout the various Mechanics' Institutes of the Province; and that the profits realised by them may, in some measure, make up for the loss of the Legislative aid formerly received, and thus be one means of infusing new life and vigour into these useful Institutions.

WHITBY MECHANICS' INSTITUTE.

The annual meeting of this Institute was held on Wednesday evening, 31st ult; the retiring President, R. J. Wilson, Esq., occupied the chair.

The Secretary, Mr. Thwaite, read the annual report from which we give the following extracts. The number of members on the books of the association is 125. The receipts from all sources $613 33, expenditure $551 59, balance in hand $61 77, available assets $93 10, liabilities $134 29; excess of liabilities over available assets, $41 17.

The number of books, in the Library, according to last annual report was 1106, additions during the year 200 vols. total 1306. 160 members borrowed books from the Library during the year, and the number of volumes issued was 2260, shewing an average of about fourteen volumes to each reader.

The report was unanimously adopted, when the following gentlemen were elected office-bearers for the ensuing year. President—J. H. Perry, Esq., 1st Vice President G. Y. Smith, L.L.B., 2nd do. G. Cormack, recording sec., M, Thwaite, corresponding secretary, T. Kirkland, Treasurer, James Bain, Librarian H. Fraser.

COMMITTEE.—Messrs. J. Ferguson, G. Blake, R. J. Wilson, J. H. Greenwood, J. Shier, B. J. Hickie, M. Harper, M. H. Cochrane, M. O'Donovan, and J. Howell.

Resolutions of thanks were unanimously passed to the President and Secretary, for their valuable services rendered to the Institute during the year. The members then engaged in a conversational discussion about classes, re-unions, lectures, &c., after which the meeting adjourned.

Selected Articles.

CANADA

(Continued from page 162.)

ARTIFICIAL MANURES.

In addition to the manures which are the produce of the farm, modern agriculture avails itself of various other materials which are capable of restoring to the soil the elements removed by tillage, or in other ways of promoting the growth of vegetation. Of the more common of these materials, lime and gypsum, Canada contains an abundant supply. The further notice of localities of lime, which is found almost everywhere through the province, is reserved for a subsequent page, under the head of Building Materials; but mention may here be made of the deposits of calcareous marl, which abound in a great many lakes and marshy grounds throughout Canada, and being pure carbonate of lime, constitute a valuable manure for soils lacking this element.

Gypsum

Gypsum is found in great abundance for a distance of about thirty-five miles along the Grand River in western Canada, and large beds of it are opened at Cayuga, York, Seneca, Brantford, and Paris. About 14,000 tons of gypsum are annually raised from these quarries, and are for the most part consumed in that part of the province, as a dressing for the soil. It is chiefly ground at mills in the neighbourhood, and sold in that state at from three dollars and a half to four dollars the ton, (fourteen to sixteen shillings sterling). Some of this gypsum is, however, pure and white, and being fitted for use as stucco, commands a higher price. These quarries are situated in the immediate vicinity of railways, which afford facilities for transportation. The gypsum consumed in Lower-Canada is chiefly brought from the Magdalene Islands in the gulf of St. Lawrence. These contain abundant deposits of this mineral, which is brought by water to Quebec and Montreal. The consumption of gypsum for agricultural purposes in Lower-Canada is however less than in the west, and might be increased with advantage.

Phosphate of Lime.

Among the most important discoveries of modern scientific agriculture is that of the value of phosphates as a manure. The beneficial effects of ground bones, and of Peruvian guano, of which last about 300,000 tons are annually brought to Great Britain, are in a great measure due to the phosphates which these manures yield to the soil; and within a few years the use of soluble phosphate or superphosphate of lime as an application to the soil, has been so much extended, that its manufacture has become a very important industry in Great Britain, France, Germany, and the United States, and has within the last few years been successfully attempted at Montreal. The phosphates employed for this purpose are bones, certain kinds of guano, and coprolites, the latter a fossil form of phosphate of lime abundant in some parts of England and France. But the supplies of these materials being limited, and the sources in many cases remote, attention has been turned to the deposits of crystalline mineral phosphate of lime (called by mineralogists apatite.) This substance is found to some extent in Norway and in Spain, and the investigations of the Geological Survey have shown that it exists in abundance among the Laurentian rocks of Canada, forming veins, which have been met with in several places along the Ottawa, and more abundantly near Perth, upon the line of the Rideau Canal. Here, over an area of many square miles, phosphate of lime has been found in a great number of localities, several of which promise to yield abundant supplies of this mineral. The attention of speculators has been turned to these deposits, which are in a locality favorable for working, and for exportation, and during the last year a New York company has expended a large sum of money in opening several veins of the phosphate, with a view to extended mining operations. This mineral phosphate is richer than the coprolites so much used in England, and contains from thirty-five to forty per cent of phosphoric acid. The working of these deposits is however undertaken solely with with a view to exportation. In order to convert this mineral into superhosphate there is required a large quantity of sulphuric acid, a material, which is not manufactured in this country, and can only be imported at a very considerable expense. As yet, the value of superphosphate as a manure is but little known in this country. Small quantities of it are however now manufactured at Montreal from bones, and the farmers of the country are beginning to learn its importance. It is to be hoped that more enlightened notions of agriculture will soon so much increase the demand for this article as to warrant the establishment of a sulphuric-acid manufactory, and the conversion into superphosphate for domestic use of a large portion of the mineral phosphates to be obtained in the province. Its employment will be one of the most efficient means of restoring the apparently exhausted wheat lands of Lower Canada.

Fish Manure.

A most important and hitherto neglected source of valuable manure is to be found in the great fisheries of the Gulf of St. Lawrence. The use of fish for a manure is known in many parts of the world, and there are small and inferior kinds of fish which on the coast of the United States are taken in great quantities expressly for the purpose, and either applied directly to the fields, or converted into a concentrated manure nearly equal in value to Peruvian guano. For this purpose they are cooked by steam, pressed to remove the water, and in the case of some kinds of fish, a large quantity of valuable oil, and finally dried and ground to powder.

According to Payen, an eminent French authority, the total yearly produce of the cod fisheries on the North American coast is not less than 1,500,000 tons of fresh fish. Of this, the head and entrails, equal to one half the entire weight, are left to decay, or are thrown into the sea; but if dried would yield more than 150,000 tons of a most valuable manure. The French fishermen have for several years had an establishment for this manufacture at Kerpon, on the coast of Newfoundland, and export the product to France. The quantity of manure of this kind which might be manufactured in Canada and the Maritime Provinces from the refuse of the fisheries, and from inferior kinds of fish which are now neglected, is very great, and this material might become a precious resource both for exportation and for the enriching of our own soils.

Peat.

The Eastern division of the champaign region of Canada abounds in peat bogs, which are generally distributed, and cover an area approximately estimated at from 120 to 150 square miles. In addition to this the island of Anticosti contains a still greater area. In many of these bogs on the main-land the peat attains a depth of ten to twenty feet, and even more, and, especially in their deeper parts, is often so compact as to sink in water when dried; while it is at the same time very pure, yielding from four to six per cent. of ash. No systematic attempts have hitherto been made to turn this material to use; but within the last few months proper arrangements have been made by an English capitalist to compress, with the aid of proper machinery, the peat of an extensive bog in Bulstrode, on the line of the Arthabaska Railway. The success of this experiment will be a matter of very great importance for Canada. The wanton destruction of the forest in the older settled regions has made fire-wood scarce in a country whose climate renders an abundant supply of fuel indispensable; and which contains no coal-mines within its limits.

One of the chief difficulties in the extensive working of peat, arises from the obstinacy with which it retains a great amount of water. A large proportion of this must be removed by spontaneous drying, a process to which the summer climate of Canada is peculiarly favourable. According to Dr. B. H. Paul's late inquiries, it appears, that the heat-producing power of good peat is about one half that of the weight of coal. It is claimed that by proper treatment peat can be brought to the same density as coal itself; and Dr. Paul concludes that where such peat can be furnished at four shillings sterling the ton, it may advantageously replace coal at ten shillings, as a fuel for generating steam, burning bricks, etc. The price of coal in our markets is more than twice this, and it remains to be seen whether properly dried and compressed peat can be produced at two fifths the market price of coal; in which case it may replace it with advantage on our inland steamers and railways, as well as for household use. It is said to have lately been employed with success as a fuel for locomotives on the New York Central Railway, and it is well known that peat is now largely employed for smelting iron in some parts of Germany. Viewed in the light of the foregoing considerations it can scarcely be doubted that the extensive deposits of peat which Canada contains are destined soon to become very important resources for the province.

BUILDING MATERIALS.

Among the materials of first importance to a country are those required for the purposes of building. Of these, besides the wood of the forests, may be mentioned clay for bricks, lime for mortar and cements, granites, sandstones, limestones, marbles, and roofing-slates. The principal sources of these materials in Canada may be briefly noticed.

Brick Clay.

Brick clay is met with abundantly in almost every part of the great champaign region of Canada, where there are few towns of any size in the vicinity of which bricks are not manufactured. That they are not more generally used for building is due to the fact that quarries of excellent and easily wrought stone are common throughout the province. Through the Western division of the Champaign, and in the westernmost parts of the eastern division, as near Brockville, there is found a clay which yields white, yellowish or cream-colored bricks, which are much esteemed for buiding, and are carried to Montreal and Quebec. This clay is in many parts overlaid by another, which gives red bricks. From eight to ten million are yearly made at Toronto, of which perhaps one half are white bricks. These are sold at the kilns at from $5.50 to $6.00 the thousand, (twenty-two to twenty-four shillings sterling,) while the red bricks are worth from $3.00 to $4.00. At Montreal there are several brick makers, of which the two principal ones manufacture together about 12,000,000 of red bricks, the ordinary price of which is about $5.00 the thousand.

Many of these clays are fit for coarse pottery and for tiles for agricultural draining, both of which are manufactured at numerous places throughout the province; while at Quebec glazed earthenware pipes are extensively made for street and house drains.

Lime.

Limestone fitted for burning is found in great abundance in most parts of the champaign region, as will be seen when we come to speak of building stones. The use of lime as a fertalizer for many soils is well known, and for this purpose the greater part of the limes in the province, on account of their freedom from magnesia, are well fitted. About 270,000 bushels of lime are annually burned at Montreal, where its price is about seventeen cents (eight pence half-penny sterling the bushel. Limestone is less abundantly distributed in the mountainous districts of Canada, where however geological research has shown its presence in very many localities, especially in the Laurentian country, where bands of limestone have been already mentioned as marking the course of numerous fertile valleys. Limestones are also found in many parts of the Eastern Townships.

The property of forming a mortar which will harden under water, which belongs to hydraulic cements and water-limes, is possessed by the lime yielded by many limestones in the country, as at Quebec, at Hull on the Ottawa, at Thorold near Niagara, and at various other places in the western peninsula. Materials from these sources have been used in the construction of the extensive hydraulic works of the province.

Building Stones.

The abundance of good building stones in Canada is so great that it is easier to say where they are not found than to indicate their various localities. Quebec, Montreal, Ottawa and Kingston are built of grey limestone, which is quarried in their immediate vicinity, and abounds in a great many intermediate localities, from which materials have been obtained for the canals and other public works. The stone required for the great Victoria Bridge at Montreal was in a large part procured from Pointe Claire, a few miles above the city. Limestones and dolomites of superior qualities for building purposes are met with in a great many places in the region to the west of Lake Ontario; which also yields in numerous localities a superior sandstone, of which University College, Toronto, and many other of the public buildings of that city and of Hamilton are constructed. Good sandstones for building purposes are also met with among other places at several points on the Ottawa, at Sillery near Quebec, and in the more eastern parts of the province.

In the Eastern Townships, to the east of the Notre-Dame range, there are great quantities of granite of a superior quality for building purposes, and in many parts of the Laurentian region, granite, syenite, and syenitic-gneiss rocks abound, both red and grey in colour. Some of these materials are equal to the granites of Cornwall and of Aberdeen, and would yield materials for building and for decoration of great beauty and durability; but as they are both more costly to work than the abundant limestones and sandstones, and generally more remote from the great centres of consumption, they are as yet scarcely made use of.

Marbles.

The rocks of Canada afford a great variety of marbles. Some of the limestones of the Laurentian region afford a good white marble for building purposes and for tombstones, as at the Calumet, Portage du Fort, and Fitzroy Harbour; from which last place marble has been obtained for the new Parliament Buildings at Ottawa. Similar white marbles are also found in Beverley, Elzevir, and Marmora. These marbles are seldom very fine grained, but from the township of Barrie, marbles of a very fine texture, both white, and colored and variegated have been obtained, though from the remoteness of the locality they have not yet been wrought. A bluish-grey veined marble, which like the preceding is from the Laurentian region, is quarried near Arnprior on the Ottawa, and another at Grenville of mingled green white, containing serpentine, and resembling the Connemara marble of Ireland. Similar marbles abound in many other parts of the Laurentian country, but little has as yet been done to bring these and the other marbles of the country into use.

The hills of the Eastern Townships afford many marbles of considerable beauty, as at St. Joseph and at Dudswell, the former red veined with white. At the latter place are beds of a cream colour and of grey, veined and mottled with yellow, and sometimes with black. The serpentines of the Eastern Townships are also many of them of considerable beauty, being generally dark green, often veined with lighter green and white, and resembling in some cases the famous *verd antique,* or some of the serpentines of Corsica and Cornwall. None of these materials, which abound in Melbourne, Oxford, St. Joseph, and many other parts of this region, have as yet been cut, except for the purpose of exhibition; although the same serpentines are extensively quarried in the neighbouring state of Vermont, and are highly esteemed.

Many of the secondary limestones of the champaign country of Eastern Canada are susceptible of a good polish, and present pleasing varieties of color. Good marbles, red, black, and various shades of brown and grey, often agreeably variegated, may be obtained from them in a great many places in the vicinity of Montreal, but are as yet scarcely known, although well suited for internal decoration.

Stones well fitted for flagging and paving are found in places too numerous to mention, throughout the province, but brick, and from its cheapness wood, is still to a great extent used for pavements in our towns. Paving-stones are however brought from the state of New York and even from Scotland, while materials probably in no way inferior are to be met with in many parts of the country.

Roofing-Slates.

Slates for the roofing of houses have until recently been very little used in Canada, but extensive quarries in no way inferior to the best Welsh slates have within the last few years been opened in the Eastern Townships, on the line of the Grand Trunk Railway. Plates of great size and of excellent quality are here readily obtained. Similar slates are found in several other parts of the same region, and good roofing-slates have also been obtained on the north shore of lake Superior.

Iron Ores.

The ores of iron are found in very large quantities in the Laurentian rocks of Canada at several localities on the Ottawa, along the Rideau Canal, and in the vicinity of Marmora. These deposits are of the magnetic species, and less frequently, of red hematite, both of which are very rich ores, containing about 70 per cent. of metal. They are similar to those which yield the fine iron of Sweden, and to those which are mined on the shores of Lake Champlain in New York. The absence of mineral coal in Canada would render it necessary to use wood-charcoal for the smelting, of these ores, unless as before suggested, peat be employed for the purpose. The price of labor in most parts of the country so augments the cost of charcoal that the iron smelter here finds it difficult to compete with foreign iron, and to this cause is to be attributed the fact that the ores of Canada are not more extensively worked. The state of Michigan possesses on the southern shore of Lake Superior great deposits of red hematite ore, not unlike those of Canada, and within the last few years has exported large quantities of this ore to the vicinity of the coal mines of western Pennsylvania, where it is smelted. The value of the iron ore thus shipped is said to be at present about $2,000,000 annually, and the amount is increasing. A similar ore has lately been found in Canada, on the north shore of Lake Superior, and is about being mined by an American company for exportation to the United States. It has been attempted to send the rich ores from the Laurentian region of Canada to the American market, and it is probable that the plan may be successful, especially as some of these deposits are very advantageously placed for transportation by water.

Extensive beds of good iron ore occur in the Eastern Townships. They are iron-slates, consisting in a large part of red hematite, and although less rich than the ores already mentioned, might under favorable conditions be smelted with advantage, as has already been the case to a limited extent, the ore having been taken to Vermont.

At various localities in the champaign region of Canada considerable quantities of bog-iron ore are found. Near to Three Rivers this ore was smelted for more than a century, and although the ancient furnaces are now abandoned, others have been established near by at Batiscan, known as the Radnor forges. The fuel here used is charcoal, and the metal produced is highly esteemed not only for castings but for the manufacture of wrought iron.

Copper.

Veins of copper ore occur in various places in the Laurentian region, and both of them are now being opened, with what success remains to be seen. On the northeastern shore of Lake Huron, in the Huronian rocks extensive veins of rich copper ores have been mined for several years, and in some instances with great profit, as at the Wellington Mine. The ores of copper are widely disseminated in the Eastern Townships, for the most part in the form of irregular beds and interstratified masses. The Acton mine was one of these, which in three years yielded ores equal to about 1000 tons of copper, but is now exhausted. Numerous other attempts have been made to work copper ores in this region, and several millions of dollars have already been invested, chiefly by New York and Boston capitalists, in the purchase of mining lands in this region; but the workings hitherto have not generally proved remunerative, although from the wide diffusion of the metal in the rocks of the district, and from the great richness of the Acton deposite, there is reason to expect that some of these mines may become sources of profit. The most extensive mining operations as yet undertaken in the Eastern Townships, are at Harvey's Hill in Leeds. Several localities in the vicinity of Sherbrooke now give promise of profitable mining.

The mines of native copper on the south side of Lake Superior are well known, and from these the state of Michigan now exports, it is said, about $7,000,000 of copper annually, while the produce is increasing. The north or Canadian side exhibit similar rocks, containing in many places deposits of native copper like those of the south side. But although these have been known for the last twenty years, ever since indeed the first opening of the mines on the southern shore, almost nothing has been done to develope them. From the identity of the formations, and from the abundance with which the metal appears to be distributed in this part of the Canadian territory, it can scarcely be doubted that a skillful outlay of capital will yet develope on this northern shore a mining region second only to that of northern Michigan.

Lead Ore.

Lead ore occurs in many places in the Laurentian region in the form of veins, which also appear in the eastern division of the champaign region, south of the Ottawa. Some of these veins may perhaps be wrought with advantage. Lead ore has also been met with in several localities on the shore of Gaspé, where mining operations have lately been undertaken. Small quantities of the ore have also been found in the Eastern Townships, and on Lake Superior; in both of these regions the lead is often rich in silver.

Gold.

This precious metal has been shown to exist over a large extent of the Eastern Townships, from near the line of Vermont, in which state gold has been met with in a great many places, as far northeastward as Quebec, and it may not improbably be found farther eastward to Gaspé, along the mountainous belt which stretches to the extremity of the province. It is from the breaking down of the rocks of this Notre-Dame range that have been derived the sands, clays, and gravel which make the soil of this belt of hills, and of the region to the east and south of them. Gold has been found in several instances in these rocks, but the attempts hitherto made to work it, have been by washing the superficial sand and gravel. These trials have in some parts been successful, and the region is now attracting skilled labour and capital, which may probably meet with profitable returns.

Among the other minerals of Canada which are capable of being turned to use, we may mention some few of the more important.

Iron Pyrites

Iron Pyrites is found abundantly both in the Laurentian region and in the Eastern Townships, and is a material of value for the manufacture of copperas, and as a source of sulphur for the fabrication of sulphuric acid, or oil of vitriol. This substance is one of great importance to the manufacturing industry of a country, for it forms the starting point in the ordinary processes for the production of chlorine, bleaching powder, and soda-ash. Of these the latter is the indispensable material for the manufacture of soap and of glass. Sulphuric acid is moreover largely consumed for making super-phosphate of lime, and for the refining of petroleum, two processes having a special interest for the province of Canada, in which the manufacture of sulphuric acid has not yet been attempted.

Chromium.

Chromium in the form of chromic iron ore is another substance which is found in considerable quantities in several parts of the Eastern Townships, and is valuable as the only source of chromate of potash, which has now an extensive use in the arts for the manufacture of several pigments, and in various processes of dyeing and calico-printing.

Titanium.

Titanium, which has within a few years attracted the attention of iron manufacturers for its supposed beneficial influence upon iron, and has moreover been proposed for several other uses in the arts, is found in Canada in great and apparently inexhaustible quantities, as ilmenite or titanic iron ore, both in the Laurentian region and in the Eastern Townships.

Among other materials may be mentioned ores of nickel and cobalt, molybdenum, and carbonate of magnesia, all of which find their applications in a country where chemical manufactures are pursued.

Ochres.

Ochres for paints, of great purity, and of various shades of colour are abundant in several parts of Canada, and are extensively wrought for the New York market. In like manner sulphate of barytes, which is largely used in the preparation of pigments, is found in considerable quantities in several parts of the province.

Quartz.

Quartz of the purity required for glass-making is abundant in the form of white sandstone in several parts of the province, and is employed in a large glass-factory now in successful operation near Vaudreuil, a few miles west of Montreal.

The various refractory materials required for the construction of furnaces, and for smelting metals are not wanting in Canada. In many parts of the Laurentian region PLUMBAGO or black lead is found of a superior quality for the manufacture of crucibles.

Soapstone.

Soapstone which is used not only as a lining for furnaces, but in the United States for the construction of stoves for domestic purposes, abounds in the Eastern Townships; while sandstone for the hearths of furnaces, fire-clay, and moulding-sand are found in many parts of the province.

Mica.

Mica, which now finds so many applications in the arts, exists in the Laurentian region of Canada in abundance, and of an excellent quality. Thin sheets of the mineral of very large sizes are obtained, and it is already an article of export.

As materials for millstones, varieties of granite, and of hard quartzite rocks are made use of in various parts of the province; and in Grenville on the Ottawa a variety of silex precisely resembling the French buhrstone is found. Grindstones are made in many parts of western Canada from a sandstone well fitted for the purpose, while whetstones and honestones, some of them of superior quality, are found in a great many parts of the country.

Superior stones for the purpose of lithography have been found in several localities in western Canada; but although trials have shown them to be of an excellent quality, they have not yet been brought into use.

Among materials for ornamental purposes may be mentioned agates, jaspers, labrador feldspar, and porphyries. In Grenville and in Chatham are found in great abundance porphyries of fine texture, susceptible of a high polish, and of various colors, rivalling in beauty the porphyries of the old world.

Petroleum.

Springs of petroleum or mineral oil occur in several localities in the southwestern part of Canada; and from numerous wells sunk in Enniskillen, near Lake St. Clair, several millions of gallons were obtained in 1861-2. Since that time however the supply of oil from the wells has greatly diminished. In other localities in this region, as at Bothwell, the existence of natural springs yielding a little petroleum has led to the sinking of wells, which are yielding moderate supplies of oil. The part of the country here underlaid by the oil-bearing rock is very large, and it is not improbable that from some portions of it considerable quantities of petroleum may yet be obtained.

At the other extremity of the province, in Gaspé, natural springs yielding small amounts of petroleum are found over a considerable area, and wells are being sunk in the hopes of obtaining it in available quantities. The oil in this region occurs in Upper Silurian rocks, while in southwestern Canada it belongs to the Lower Devonian limestones. These are supposed to be the source of the wonderfully productive wells of western Pennsylvania and the adjacent regions; the estimated value of whose produce of petroleum for the current year is stated at not less than $75,000,000. Although the geological conditions have there been more favorable to the preservation and accumulation of the oil than in Canada, it is probable from the results lately obtained in Bothwell, that wells in this region may be made to yield satisfactory returns.

The narrow limits assigned to the writer of this essay, which he has prepared at the request of the Minister of Agriculture, have permitted nothing more than a notice of some of the more important mineral resources of the province; and the reader who may be desirous of farther information upon the subjects, and also of more detailed chemical descriptions and analyees of the soils of the country, is referred to the work already indicated as the source of the information here given, viz the Geology of Canada.

Useful Receipts.

India-rubber Varnish.

Four ounces india-rubber in fine shavings are dissolved in a covered jar by means of a sand bath, in two pounds of crude benzole, and then mixed with four pounds of hot linseed oil varnish, heated, and filter.

Apple Wine.

Williams Pratt, of East Hartford, has been experimenting in making and preserving cider, and has an article which he calls "refined" cider. He removes all impurities by refining, which leaves the cider nearly as colorless as water. It is then colored a light olive color by putting in a little burnt sugar and chopped raisins, and the cider comes out perfect in flavor and color, and will keep for years. It is really apple wine.

Shoe Blacking.

Polish without friction.—Gum-arabic, 1 ounce; lump sugar, ½ ounce; ivory black, ½ ounce; water enough to make it easily applied with a sponge. Dissolve the sugar and gum, and grind the black on a slab with it. No friction required.

Paste Blacking.—Ivory black, 1 pound; molasses, 12 ounces; vitriol, 1 ounce; sweet oil, 2 ounces. Mix the black and molasses well; add the oil, and by degrees the acid; as much water afterward as may be thought necessary to give the proper consistency.

Papering Walls.

White-washed walls which are to be papered should be well brushed over with strong vinegar previously, or the paste will not adhere.

To Crystallise Glass Windows.

Make a hot saturated solution of Epsom salts, or, still better, of sal ammoniac. Wet the glass window with this solution, laid on equally with a paint brush. The moisture will almost instantly be evaporated, and the salt be deposited in a very beautiful variegated form. For rendering windows semi-opaque, this deposition is said to be preferable to paint.

Cement for Mending Glass.

A transparent cement for glass is made by dissolving one part of india-rubber in chloroform, and adding sixteen parts by measure of gum-mastic in powder. Dissolve for two days, and frequently shake the vessel in which these substances are contained.

Ivory Cement.

A strong solution of isinglass dissolved in gin, is good for cementing pieces of ivory.

Sydney Smith's Receipt for a Salad Dressing.

The following may be useful to such of our friends as wish to put up fancy bottles of salad dressing for sale during the summer months. We have given it a long trial at our table, and can recommend it as the best mixture of the kind. It should be sold in capsuled or sealed bottles.

Two large potatoes pass'd thro' kitchen sieve
Smoothness and softness to the salad give.
Of mordent mustard add a single spoon;
Distrust the condiment that bites too soon;
But deem it not, thou man of herbs, a fault
To add a double quantity of salt.
Four times the spoon with oil of Lucca crown,
And twice with vinegar procured from town.
True flavour needs it, and the poet begs
The pounded yellow of two well-boiled eggs.
Let onion atoms lurk within the bowl,
And, scarce suspected, animate the whole.
And lastly, in the flavoured compound toss
A magic spoonful of anchovy sauce.
"Oh, great and glorious! oh, herbaceous treat!"
Twould tempt the dying anchorite to eat;
Back to the world he'd turn his weary soul,
And plunge his finger in the salad bowl. (*Grocer.*)

Liquid Glue.

The use of this substance has become very extensive in France, and it may be useful to give the process by which it is obtained. A kilogramme (2¼ lb. avoirdupois) of good glue of cologne, or givet, is dissolved in a litre of water in an earthen pot plunged in hot water, the water lost by evaporation being replaced. When the glue is completely dissolved, one-fifth of a kilogramme of nitric acid at 30° centigrade is added: the acid throws the solution into a violent state of effervescence and a quantity of reddish coloured gas escapes. When the mixture has become quiescent it should be well stirred, set aside to cool, and placed in well stopped vessels for future use.

Elastic Glue.

Take a quantity of good carpenter's glue, pour cold water over it and let it stand till it has formed into jelly. Then put it in a warm water-bath untill it become dissolved. Add as much glycerine as there was glue, then mix and stir up well, and continue to beat it until the water has become evaporated. The cooled substance, according to Salleman, will be an elastic glue, suitable for a variety of purposes, such as stamping, and also for printers.—*Gerber Zeitung.*

A New Green Color.

A new color called "green cinnabar" is stated by a foreign contemporary to be prepared in the following manner:—Prussian blue is dissolved in oxalic acid, chromate of potash is added to this solution, which is then precipitated with acetate of lead. The precipitate, well washed, dried, and levigated, gives a beautiful green powder. By varying the proportions of the three solutions, various shades of green may be procured. Chloride of barium or nitrate of bismuth may be used in place of sugar of lead.—*Mechanics' Magazine.*

A New Rubber Cement.

MESSRS. EDITORS:—I have purchased rubber cement of different makers but have found none so inexpensive or that dries so rapidly as a kind made with benzine in the following manner:—Cut virgin or native rubber with a wet knife into the thinnest possible slices, and with shears divide these into threads as fine as fine yarn; the finer it is divided the better the cement and quicker made. Put a small quantity of the shreds (say one-tenth or less of the capacity of the bottle), into a wide-mouthed bottle, and fill it three-quarters full with benzine of good quality, perfectly free from oil—such as may be procured at any paint shop for about 60 cents per gallon. The rubber will swell up almost immediately, and in a few days, especially if often shaken, assume the consistence of honey, with a thick sediment at the bottom, which does no harm. Of course it must be kept well corked except at the time of using. If it incline to remain in undissolved masses, more benzine must be added; but if too thin and watery it needs more rubber. A piece of solid rubber of the bulk of a walnut will make a pint, more or less, of the cement of proper consistency.

This cement dries in a few minutes, and by using three coats in the usual manner, will unite leather straps, patches, rubber soles, backs of books, etc., with exceeding firmness. It succeeds perfectly if benzine free from oil is used in making it; while chloroform is twenty times more expensive, and cannot result in a better product.—*Scientific American.*

Machinery and Manufactures.

ON CERTAIN METHODS OF TREATING CAST IRON.*

Malleable Cast Iron.

The next point to be considered is the treatment for making castings malleable. I should have said nothing of this were it not that, although exceedingly simple, it is but very little understood, for it is a very common notion that many and curious "chemicals" are required, and that there is much mystery in the process. Making iron malleable was, indeed, among the lost arts, and old records show that it was lost and rediscovered more than once. The French philosopher Reaumur, who wrote upon it 140 years ago, observed that it was then practiced as a great mystery in Paris. At last chemistry came to the aid of the metal worker, and he learned that what he had so long called sulphur in the iron—and sulphur was once a name applied to many substances—was really carbon, the same as charcoal or diamond. And chemistry showed how carbon would always forsake iron for oxygen, and that cast iron, treated with oxygen, was made malleable, as it always is, whether in the old refinery fire, in puddling, in pig boiling with forge scales and refinery cinder, in the Bessemer process, and in still other modes of treatment. In 1804, Samuel Lucas, of Sheffield, turned his knowledge practically to account. He took out his patent, too, and described his improvement very clearly; and, to put it in the fewest words, it was nothing more than the present process of making castings malleable by roasting them, at a high heat, from 72 to 120 hours in powdered hematite iron ore, or in any metallic oxide. The oxygen of the ore unites with the carbon in the iron casting, which, being thus left without carbon, becomes malleable—malleable, indeed, to a remarkable degree. It is commonly said that castings intended to be malleableized should be from very hard, brittle iron. It is not exactly because a casting is brittle that it is of the best sort for the malleable iron treatment, but brittle castings contain less carbon than those from gray iron, and so the malleable process does not have to be so long continued to get rid of it. To those who are not accustomed to consider all forms of iron and steel as combinations merely of iron and carbon in different proportions, there is something a little paradoxical in the fact that a gray iron containing much carbon is tough; a white iron, containing less carbon, is brittle; while wrought iron, containing but little carbon, is very tough. Even to a chemist these facts are not easy to be explained; nor shall I examine them further here, it being sufficient merely to have shown why a white and brittle cast-iron, such as some of the Ulverstone iron of which clock bells are made, is the best for the malleable iron process, because it contains less carbon than a gray iron. The castings must be packed perfectly air-tight in layers of powdered ore, and shut up in cast-iron boxes, of which the joints should be luted. The natural ore used for purifying gas at the various stations of the Chartered Gas Works would, no doubt, answer very well for malleable castings, although it cannot be said whether Mr. Hill's oxide would do as well. The goods should be heated very gradually, twenty-four hours being occupied in getting up, and twenty-four hours more in letting down the heat, beside the two or three days at full heat. The heat should be very even over all parts of the goods, and while the full heat is on it should be kept constant by careful firing and attention to the draft. The iron ore may possibly fuze upon the surface of the casting, thus covering it with lumps or warts; but this is the result of too high a heat, or of access of air. Oxide of zinc, which is abundant in some parts of America—as near New York—is preferable to iron ore, but those who cannot obtain the former can get on very well with the latter. The agricultural implement makers have turned the properties of malleable cast iron to good account for the tines of their cultivators. At the large works of my friends, Messrs. Howards, of Bedford, unusually large pieces are made malleable by roasting in hematite ore. McHaffie's malleable castings—and for which it is generally supposed that there is a patent, although I believe there is none—are no doubt made in much the manner described, as also, no

* From a paper read before the Society of Engineers, England, by Mr. Zerah Colburn.

doubt, are Crowley's of Sheffield, although different makers add various chemical substances, which may act in the same manner as the iron ore, and thus, to a certain extent, replace it, although it is doubtful if they greatly promote its real action.

Wherever a shape can be easily made in wrought iron this is probably cheaper than a malleable casting, and it is doubtful, therefore, whether the latter will ever be extensively used. It may be added that the tensile strength of malleable castings varies according to their size, and the depth to which the decarburization extends. If they were freed of their carbon all the way through, they would be converted into wrought iron, or say, "homogeneous metal," as the softest kind of steel has been called. So much of the casting, however, as is not decarbonized by the malleable iron treatment remains cast iron, and has only the strength of cast iron. The effect of the process is generally visible for only a small depth below the surface, but small malleable iron castings have borne a tensile strain of 50,000 pounds per square inch.

Semi-Bessemerizing Iron.

As all the processes whereby cast-iron is strengthened are processes whereby its proportion of contained carbon and silicium is diminished, some quicker and much cheaper mode of effecting this object is required than that by re-melting or by partial puddling. This quicker and cheaper mode would be had by a partial application of Mr. Bessemer's treatment, that is, by blowing air through the iron for perhaps three or four or five minutes, instead of twenty. But, it will be asked, if you are to have the Bessemer apparatus at all, why not convert the iron at once into steel? There are several reasons why we should not. To make steel a much higher quality of iron, and generally the addition of spiegeleisen, is necessary. As steel the metal cannot be run into goods, but only into an ingot, which requires very heavy hammers to forge it, as well as machine tools of unusual strength to finish it after forging; the wear of the converter and other plant would be much greater for steel than for cast-iron. I have, on former occasions, recommended this partial application of the Bessemer process, and I believe that, when more attention comes to be given to strength in castings, this treatment will be adopted. The apparatus for carrying it out would be exceedingly simple, and would be worked with but little trouble, a blast being derived from the rotary blower already described.

STEAM BOILER ASSURANCE COMPANY.

(From the London "Engineer.")

Mr. Longbridge, the Chief Engineer to the Manchester Steam Boiler Assurance Company, has just laid his report for the year 1864 before the directors. The following extracts will be found interesting and instructive:—

The total number of inspections made by the officers of the company in the course of the year was 23,849, of which 766 were internal, and 2,321 thorough examinations. Although the latter considerably exceed those of any former year, they yet fall short of what is desirable, on account of the comparatively few opportunities afforded; the owners of boilers being, in general, unwilling to allow any stoppage of their machinery for this purpose. The opportunities for thorough examination are, therefore, mostly limited to annual holidays, and the occasional stoppage of works from accidental causes.

The principal defects reported were as follows: Fracture of plates and angle iron, 484; corrosion of do., 861; safety valves out of order or overloaded, 507; pressure gauges out of order, 297; water gauges, do., 364.

Fractures.

The dangerous defects under this head which frequently occur on the under sides of boilers, near the middle, have been before described; but there are one or two points in reference thereto on which it may be well to say a few words. I have explained that, in the case of boilers with internal furnaces, such fractures are attributable to unequal expansion, and may generally be prevented by so arranging the external flues that products of combustion, after leaving the internal flues, pass first along the under side of the boiler toward the front, and thence return by the sides to the main flue and chimney; also, that the insertion of vertical or diagonal water tubes in the internal flues, by facilitating circulation of the water, are conducive to the same end. That explosion does not more frequently take place when such fractures occur is evidently owing to the internal flues acting as stays or tie rods, and thus relieving the plates of the shell of a portion of the longitudinal strain. With plain cylindrical boilers, however, having no longitudinal stays, the risk of explosion under such circumstances is much greater, and it not unfrequently happens that boilers of this construction explode at the ordinary working pressure, without any previous symptom of defect. In many instances such fractures result from the objectionable practice of running off the water for cleaning before the adjacent brick work has had time to cool. The consequent overheating of the lower plates causes elongation of the boiler on the under side, which then becomes convex in the longitudinal direction. On the cooling of the brick work contraction and another change of form takes place, and the severe straining to which the plates are subjected, by the alternate expansion and contraction, ultimately produces fracture. When such boilers are suspended by bolts and nuts from cross beams or girders, as is common in the North of England, it has been observed, under the conditions mentioned, that the expansion of the boiler on the under side has raised the ends, lifting the nuts by which they had previously been suspended from one-half an inch to three-fourths of an inch above the girders.

Moreover, when repairing such boilers, too little attention is generally paid to the accurate fitting of the plates, and the importance of retaining the cylindrical form. Where holes do not correspond "drifting" is resorted to, and on completion of the repairs the boiler is often weaker than before, the plates being strained almost to the limit of their strength. This accounts for so many boilers of this constructiou having exploded shortly after having undergone repairs.

Corrosion.

It will be observed that defects under this head are much the most numerous. Many of the boilers inspected have been found in a most dangerous condition, and there can be little doubt that, but for the timely detection of these defects by the officers of the company, the number of explosions must have been considerably increased. The three principal causes of corrosion are these—defective workmanship, dampness of the seating, and acids in the water; the remedies for which are self-evident, and need not, therefore, be repeated.

Safety Valves.

Thirty-one boilers were found working in great danger, owing to the safety valves being entirely inoperative. In many other cases the valves were greatly overloaded, and I must again draw attention to the very prevalent, but most objectionable practice of attaching extra weights to safety-valve levers. For example, I may mention one instance where, in addition to a large weight of 89 pounds attached to the lever of the valve, there were also a piece of 4-inch water pipe, a lump of cast-iron, and a pedestal belonging to the engine, weighing altogether 42 pounds. To another, beside the proper weight, were attached a cast-iron ball, a piece of 4-inch pipe, the flange of another pipe, and a piece of wrought iron.

Explosions.

The number of explosions, and the consequent loss of life in the past year, have been less than in the preceding. In 1864 fifty-one explosions, causing the loss of ninety lives, came under my notice; in 1864 forty-three explosions, with a loss of seventy-four lives.

The following table, though probably not comprising every boiler explosion that occurred, may be accepted as approximately correct:—

	No. of Explosions.	No. of Lives.
Iron works and foundery	9	32
Coal and other mines	9	11
Locomotive	6	4
Agricultural engine	1	1
Steamboat	2	7
Corn mill	2	6
Saw-mill	2	1
Flax mill	1	1
Silk mill	1	1
Bleach works	1	7
Chemical works	1	0
Cement works, flint mill, brickyard	3	0
House	3	3
Boilers for other purposes	2	0
Total	43	74

As in previous years, it will be observed that iron-works and mines still maintain an unenviable pre-eminence for boiler explosions and destruction of life, but in cotton mills not a single explosion has been recorded for the year 1864.

The selfish heart deserves the pain it feels
More gen'rous sorrow while it sinks exalts,
And conscious virtue mitigates the pang.
—*Thompson.*

WOOLLEN MANUFACTURES.

It is impossible to feel indifferent regarding the success of our manufactures, since agriculture alone, according to political economists, forms too narrow a basis upon which to build up a great and wealthy State. By purchasing in a foreign market what may be made in the country to advantage, is plainly a ruinous policy. Our trade has hitherto been of that character. We send abroad for goods which cost about ten per cent. to lay down here, and we pay for our imports by the rude bulky produce of the land which is expensive to move at all, but which expense is very greatly enhanced by a distance of thousands of miles carriage. The cost, it must be remembered, of laying it down in the foreign market comes off the producer. To speak plainly, the difference in price between a bushel of wheat or barrel of flour in this market and the price it rates at in England, is from thirty to fifty per cent.; and the ability of Canada to pay her purchases is lessened to that extent. Under the present circumstances, and pursuing the present policy, the bargain is against us to the extent of at least fifty per cent. in the value of the produce we export.

It would undoubtedly be unwise in this country pretending to manufacture many of the goods that are imported; but on the other hand it is clearly an impoverishing policy to purchase what this country affords every facility to manufacture upon our own soil. As it is with the farmer, the more of the bulky produce he can consume or manufacture into beef, pork, mutton, wool, eggs, butter, &c., the more is he enriching his land; and if he could go even further, and make his leather and cloth, without infringing upon the law of the division of labor, he would thereby contribute even more to increase his own wealth and the value of his farm. Just so it is with a truenationaleconomy, the more that can be made in the country—the more of the bulky raw produce of the ground that can be condensed and manufactured into useful and valuable commodities, such as wo are now importing, the more will we undoubtedly be increasing the wealth of the country, provided we do not infringe upon the law of the division of labour by attempting to make what could be both better and cheaper supplied from elsewhere. And to carry out such an economy, it would not require so much protection as one might at first imagine. The nearer we approach to a free trade policy, the better it would be for the country at large. Every locality has its peculiar advantages in climate, soil, water-power, &c., and the people or nations so situated have but to turn their favourable circumstances to advantage, to the exclusion of similar productions brought from a distance. In fact it is not unreasonable to affirm that freight and insurance alone ought of themselves to afford a sufficient protection to any industrious community manufacturing what their peculiar advantages enable them to do. Were such conditions faithfully observed, neither time nor labour would be thrown away, and something like a harmonious result might be educed.

In illustration of these principles we have only to refer to our woollen manufactures, and particularly to coarse cloths and tweeds. Not many years ago there was not a single set of machinery in the country, and we were of coarse dependent upon the British market for the supply of the commonest cloths. Now, however, it is different; a large number of mills containing from 2 to 6 set of machinery each, are now at work in the manufacfacture of tweeds, blankets, flannels, &c. At a rough calculation we might safely say that fully a million and a half yards of tweeds are annually turned out at a value of over a million dollars. The manufacture of tweeds has been gone into with great spirit, and the result so far is a success. If in colour Canadian goods are slightly inferior to British dyes—and we do not see how such should be the case—the styles and patterns are at least equal, and the fabric decidedly superior, for the same money, to any imported. Canada manufactured tweeds are fast excluding foreign goods from the market, as the wearer begins to learn that he is getting better value for his money. And it must be remembered that this result has been attained not altogether by protection, since our manufacturers are, after all, but nominally protected by the high tarff. Under the Reciprocity Treaty there is free trade in Wool; but in consequence of the high duty upon wool entering the United States from other countries, the American manufacturer is enabled to pay a higher price for that staple in this market than he would otherwise do. The American tariff is 10 cents per lb. and 10 per cent. ad. val., so that the Canadian manufacturer pays at present 43 cents a pound for what, under other circumstances, he would be getting for 30 cents. And although the country, that is the farmer, reaps the benefit, it nevertheless tells to that extent against the manufacturer, and reduces very much the protection which the tariff is supposed to afford. Another disadvantage is the limited extent of the market. In fact we are assured that if we had, out and out, free trade, the Canadian woollen manufacturer, could compete in quality and price with any goods that could be brought into the market of an equal quality of wool. It is true that in regard to the finer fabrics, since the productions of the finer qualities of this staple in this country is limited, England would have the advantage, inasmuch as the freight of imported wool would, in consequence of dirt and refuse, amount to double the freight of the manufactured goods.

It is gratifying to know that this branch is so little dependent upon a protective policy; and there can be little doubt the same energy and and capital employed in other branches of industry would be followed by an equal success.—*Trade Review.*

Oil for Watches.

Mr. David Meek recently read a paper on *oil for watches*, before the Horological Society of Edinburgh, in which he describes the several modes he adopted for testing the effects of various oils upon watches, and, upon different qualities of watch brass. He thus describes the various kinds of vegetable oils experimented with, and says:—

"Having failed to obtain a good vegetable oil my attention was next directed to animal oil. I first tried neat's foot oil. Having put it through the various processes necessary for purifying it, I put a little of it on brass; after lying past for a year, I found it in a far better condition than any vegetable oil I had tried. My next experiment was with fish oils. Of these I have found none to equal sperm oil. I have kept it lying for three years on a piece of brass, and it is as fluid as when first placed there; it has, however, the fault of spreading. As this oil seemed to possess the chief property of a good watch-oil in a much greater degree than any other. I endeavored to prevent it spreading when applied to a watch by mixing it with a small portion of beeswax. The proposed remedy, however was worse than the disease. I then mixed with it a little of the neat's-foot oil, which I found to answer the purpose very well; and for some years I have used this oil upon watches, and find it the best oil I have ever employed. Its color and smell will not recommend it to those who judge by those tests; but, as I before stated, neither of these objections will effect the watch, and possibly both could be removed by some process, with which I am unacquainted, without destroying its good properties. I therefore give the preference to animal oil, for from it I obtain a really excellent watch-oil. I have not arrived at that conclusion from any preconceived notions of its superiority, but from the results arising from my various experiments. My great objection to nut oils, and more especially to hazel oil, is their tendency to cause rust. Nut oils have a good look, a nice smell, and a fine taste; bury them in snow, and they will come out as liquid as when put in; use them on watches, and at the end of twelve months they are either getting thick or very red in color, thus indicating an early stopping of the watch. The methods of preparing watch-oil are numerous and diversified; what the best mode is I am not prepared to say. For filtration, I pass the oil through either blotting-paper or charcoal. To remove the acid, some use lead filings, others carbonate of soda mixed with distilled water. The fatty matter is generally taken out by freezing and again filtering to purify it; some boil it in water, some in alcohol. In endeavoring to procure a good watch-oil, I have given up all hopes of being able to make an oil to please every watchmaker. This is impossible, owing to the grounds on which they base their judgments. Oil may be rendered bad by other causes entirely independent of anything connected with the oil; as, for instance, there are certain kinds of brass which will destroy the quality of good oil. Cedar-wood, if used for any part of a clock-case, will cause every oil applied to the movement to thicken in a few months."

Cement Pipe for Sewers.

Mounted on a table in the room were three pieces of pipe twelve inches in diameter and each peace about four feet in length; they were from the manufactury of Knight & Woodward, No. 10 Reade street, Brooklyn. This firm have made large quantities of this pipe for the sewers of Brooklyn.

Mr. Knight explained the process of manufacture. The materials are one part Rosendale water cement to two parts clean sand. These are thoroughly mixed together dry, then moistened with water into a stiff mortar, and immediately molded into pipe, The core is iron smoothly polished upon the outside, and the exterior mold is of iron polished upon the inner surface. The mortar hardens, or "sets" almost instantly, but it is kept in a damp place a fortnight before it is placed in the ground for use. The pipe is manufactured in sizes ranging from 3 inches to 24 inches in diameter, the prices being from 14 cents to $1·30 per lineal foot. More than 50 miles of the 12-inch pipe have been laid in the sewers of Brooklyn, and many miles of other sizes.

Mr. Woodward read some extracts from the report of an English commission appointed to examine the sewerage system of London, showing the conclusion of the commission that small pipes are less likely to be obstructed than large sewers which are several times more expensive.

Mr. Enos Stevens gave the results of some experiments that he had tried to ascertain the descent required for water to carry along stones and other substances. He found that in a V-shaped trough, after it had become smooth, a descent of 1 foot in 58 was sufficient to wash away all obstructions.

The Pneumatic Loom.

Harrison's new method of throwing the shuttle is illustrated in the *Practical Mechanics' Journal* for April; and some favorable opinions of it by experts are given. The shuttle is shot from an air-gun, across the web, into another air-gun, and back again. The advantage of this process over the old one is, that it starts slowly, and increases its speed, and thus avoids the jerk given to it in the old mode of impulsion. With equal safety to the threads, this shuttle can be thrown 240 times, while the old one is thrown but 180 times, per minute. The general design seems good; but the details of the air-valves seem to need improvement. It can be applied to common looms at little cost; and can be repaired more readily than the old mechanism, it requires no lubrication, and therefore is more cleanly, and does not dirt the fabric.

Iron Slag for Pavements.

Le Moniteur des interets Materiels says that the waste slag from reducing furnaces is found to be an excellent material for paving streets. It is run into molds so as to form large blocks, and allowed to cool slowly. It has been tried in Paris, and several Belgian establishments have commenced the manufacture of it. One great advantage is that it does not become polished by use.

New Metallic Alloys.

Messrs. T. Dunlevie and John Jones of England have patented a metallic alloy, to be employed for the bearings of shafts or frictional surfaces in machinery. First, take 4 ozs. of copper, melting or fusing it in any ordinary crucible.—When fused, add 16 ozs. block tin and 1 oz. of antimony; and when the whole are melted together, pour the compound out into a mould. Then melt in a separate vessel 128 ozs. of spelter together with 96 ozs. of block tin, and when both are fused, add the above ignot of copper, tin, and antimony, and fuse altogether; when properly fused in these proportions, or thereabouts, the alloy is complete. The chief features of this alloy are great durability, and its low temperature when under the heating influence of friction.

For lining bearings, journals, etc., the bearing is to be tinned, in the ordinary method, with block tin and sal-ammoniac. The improved lining alloy is then gradually fused, and the bearing heated, until it will fuse a solid strip of the alloy. A heated shaft, or mandril, is then inclosed in the bearing and mold, and the alloy poured in between the bearing and the shaft, remaining until it hardens; the bearing is then taken from the mould lined with the alloy.

Safety Matches.

Matches are made by dipping the sticks first in sulphur, then in a mixture containing phosphorus, and finally in a solution of gum arabic or similar substance to protect the phosphorus from the action of the atmosphere. The same friction that kindles the phosphorus also removes the thin film of protecting gum.

In the safety match, patented by Bryant & May, of England, phosphorus is omitted from the match, and is applied to the box. Consequently the match is perfectly safe, friction on any surface other than that of the box having no effect to set it on fire. In this manufacture the phosphorus is used in that allotropic condition known as red or amorphous phosphorus. In this state it does not produce that frightful disease of the jaw which has made such havoc among workmen employed in match manufactories.

Patent Gas Machine.

The *American Artisan* contains an engraving and description of a Gas Machine, in which the illuminating effect is produced by charging air with the vapor of a hydro-carbon called gasoline. The apparatus works without heat, only requiring a weight to be wound up. The flow of air, and the elevation of gasoline, are so regulated that the degree of saturation of the air with vapor is constant, and the light is steady; rendering attention unnecessary, except that of keeping up the proper supply of water and gasoline, which will last for months without replenishment, and the working up of the weight. Whether one flame or thirty be in use, the flame is constant in size and quality, depending alone on the size of the weight. Agent, J. W. Bain, 17 Cortlandt Street, New York, from whom illustrated circulars can be had.

Safety Engine.

George B. Brayton is exhibiting a safety engine in Boston, U. S., that he has been twelve years in perfecting. It has no large reservoir of water and steam, the explosive force being confined to minute cells and small tubes; it has a new kind of heating surface; and an engine of 10 horse-power occupies less than 6 feet, square room. It costs but 15c. an hour for fuel, and does away with the extra insurance on buildings containing steam power.

He that is merciful
Unto the bad is cruel to the good.—*Randolph.*

Practical Memoranda.

Horse and Man Power.

A *horse power* is 33000 units of work done in one minute.

Put H, equal to the horse power, and U, the units of work done, in T hours:

$$\therefore 33000\,H = \frac{U}{60\,T}.$$

The following results are taken from MORIN:

A Man laboring eight hours per day will perform the following units of work.

Raising his own body	4250
Drawing, or pushing horizontally	3120
Pushing and drawing alternately in a vertical direction	2380
Turning a handle	2600
Working with his arms and legs, as in rowing	4000

A Man laboring six hours per day.

Raising material with a pulley	1560
Raising material with the hands	1470
Raising material upon the back, and returning empty	1126

A Man laboring ten hours per day.

Raising material with a wheelbarrow on ramps	720
Throwing earth to the height of five feet	470

Useful work of a Man raising water—Duration of labor, eight hours per day.

With a windlass from deep wells	2560
With an upright chain pump	1730
With a Chinese wheel	2167
With an Archimedean screw	1505
Raising water from a well with a pail and rope	1054

Work of Animals.

A horse, in a common pumping engine		17550
A mule,	ditto	11700
An ass,	ditto	3510

Foot-Pounds of Work.

Work is the overcoming of physical resistance, such as the crushing or breaking of bodies, the displacement of fluids, or the raising of weights. The simplest mode of measuring and expressing a given quantity of work is the raising of weights; and the raising of any body weighing one pound one foot in height is called a foot-pound of work. The raising of 1 pound 10 feet high, or the raising of 10 pounds 1 foot high, is 10 foot-pounds of work.

It will be observed that the amount of work is entirely irrespective of the time in which it is accomplished. A foot-pound of work is the raising of 1 pound 1 foot in height, whether one second or one hundred thousand years be occupied in the operation.

Power, on the other hand, is the energy competent to accomplish a given amount of work in a given time. A horse power is the constant force which can perform 33,000 foot-pounds of work in every minute of time.—*Scientific American.*

Measurement of Heights by the Boiling Point.

As might be expected, in consequence of the diminution of atmospheric pressure, it is found that on ascending from the earth's surface the temperature at which water boils becomes gradually lower. In descending a mine the effect is reversed, and the boiling point becomes proportionately elevated. De Saussure observed that on the summit of Mont Blanc, which is 15,650 feet (nearly 3 miles) above the sea level, water boils at 185°·8; and Wisse determined the boiling point upon Mount Pichincha, at an altitude of 15,940 feet, to be 185°·27, while the barometer stood at 17·208 inches. The observation of the point at which water boils at any particular elevation furnishes an easy means of determining its altitude above the sea level; a difference of about 596 feet of ascent producing a variation of 1° F. in the boiling point of water.

Boiling point of water at different pressures.

Boiling Point. Deg. Fah.	Barometer Inches.	Boiling Point. Deg. Fah.	Barometer Inches.
184	16·676	200	23·454
185	17·047	201	23·937
186	17·421	202	24·441
187	17·803	203	25·014
188	18·196	204	25·468
189	18·593	205	25·992
190	18·992	206	26·529
191	19.407	207	27·068
192	19·822	208	27·614
193	20·254	209	28·183
194	20·687	210	28·744
195	21·124	211	29·331
196	21·576	212	29·922
197	22 030	213	30·516
198	22·498	214	31·120
199	22·965	215	31·730

The preceding table shows the temperature at which water boils at the corresponding hights of the barometric column, calculated by Regnault, and confirmed by direct observation. The necessity of attending to the hight of the barometer at the time of making a careful observation upon the boiling point of any liquid will now be obvious. It has been ascertained that a variation of one-tenth of an inch in the barometric column makes a difference of more than a sixth of a degree F. in the boiling point; so that within the range of the barometer in this climate the boiling point of water may vary 5°.—*Prof. Miller.*

Statistical Information.

DEBT AND TRADE OF GREAT BRITAIN.

From Mr. Gladstone's Budget presented to the British Parliament for the present year, we learn that on the 31st March, 1859, after the Crimean war had been paid for, the national debt was £825,934,000. On the 31st of March, 1865, it amounted to £808,288,000, showing a reduction of upwards of £17,000,000, or at the rate of about £3,000,000 per annum. Of this reduction, Mr. Gladstone said in his speech on the budget: "This may sound well, and does sound well; but at the same time, I cannot say that it is a very brilliant result of our labors to find only £3,000,000 a year taken from our debt, considering the enormous amount of that debt, and the difficulties in which we might possibly be involved if we were ever again to be engaged in a struggle for existence; and I cannot say that as legislators, we have yet risen to a sense of the full extent of our obligations with respect to a reduction of the debt."

The imports for 1864 amounted to £274,000,000 exports to £213,000,000; total of £487,000,000 against £445,000,000 in 1863, and an increase of £219,000,000 during the ten years since 1854.

The trade between Britain and France has increased from £26,431,000 in 1859 to £49,197,000 in 1864, or nearly 90 per cent. in five years.

The exports of Britain in 1854 were 116,000,000 pounds sterling, and in 1863, 197,000,000 pounds, showing an increase of 81,000,000, or 70 per cent. Those of France were, in 1854, 78,000,000 pounds, and in 1863, 141,000,000, showing an increase of 63,000,000 or 81 per cent.

Last year Mr. Gladstone estimated the revenue at £67,128,000; but £70,313,000 was the amount received, showing a surplus of £3.185,000. The expenditure he had estimated at £66,890,000, and the appropriation bill granted £67,073,000; but the actual expenditure was only £66,462,000, showing a gain here also of £611,000, or a total surplus of revenue over expenditure of £3,796,000.

The estimates for the current year are thus stated:

EXPENDITURE.

Interest on debt	£26,350,000
Charges on Consolidated fund	1,900,000
Army	14,348,000
Navy	10,392,000
Civil service	7,650,000
Revenue department	4,657,000
Packet service	342,000
	£66,139,000

Or a reduction of about £300,000 on previous year.

REVENUE (based on existing taxes).

Customs	£22,775,000
Excise	19,030,000
Stamps	9,550,000
Taxes	3,350,000
Property tax	7,800,000
Post office	4,250,000
Crown lands	315,000
Miscellaneous	2,650,000
China indemnity	450,000
	£70,170,000

This shows a surplus of £4,031,000 which Mr. Gladstone proposed to give away as follows:

A reduction of the tea duty from 1s. to 6d. per lb	£1,068,000
Reduction of the income tax from 6d. to 4d. per £	1,650,000
Reduction of tax on Fire Insurance	260,000
	£3,778,000

which only leaves a surplus of £253,000, as small a margin as the Chancellor of the Exchequer thought safe to go on with. Nay, we see that instead of making a reduction on tea to date from the 4th inst., as originally proposed, it will only go into force on the 1st of June, which will probably increase this surplus by more than another £100,000. These reductions, when applied to the whole year 1866-67, would amount to £5,420,000.

NATIONAL DEBT OF THE UNITED STATES.

The entire debt of the United States is officially reported, under date of May 31st, at a little over twenty-six hundred and thirty-five millions of dollars, which is near five hundred millions more than was estimated in the last report of the Treasury Department. The exact figures are as follows:—

Interest payable in gold	$1,108,113,842
Interest payable in currency	1,053,476,371
Treasury Notes not bearing int.	472,829,270
Past due, and interest ceased	786,270
Total	$2,635,205,753

The estimated receipts for the year ending June 30, 1866, are three hundred and ninety-six millions, as follows:—

From Customs	$70,000,000
From Internal Duties	300,000,000
From Lands	1,000,000
From Miscellaneous Sources	25,000,000
Total	$396,000,000

The annual interest in coin and currency together is over one hundred and twenty-four millions, which is an inconsiderable fraction less than six per cent on the interest-paying portion. We are now able for the first time to assign a proximate limit to the debt, and to estimate very closely its yearly burden on the country. When all the expenses of war are settled the mass will doubtless be near three thousand millions of dollars. The policy of the Government will be to convert the Treasury Notes into bonds with as little delay as possible. At six per cent, which is the present average rate, our annual interest will be one hundred and eighty millions of dollars.—*Evening Post.*

SUMMARY.

The tonnage of shipping employed in the trade of the British Colonies for the year 1863, was 22,000,000, of which 7,000,000 was British. With the exception of India and Victoria, Canada has a greater import and export trade, revenue and expenditure, than any other country.—The value of Kashmir Shawls exported from India to all parts was in 1851, £171,700; in 1861, £357,093; of the latter to the value of £222,360 were imported into Britain and sold at half-yearly sales, besides large numbers not put up for sale.—From a report just submitted to the Italian Government, it appears that out of 21,777,534 people, 16,999,701 are unable to read or write; in Piedmont, only, is half the people able to read.—Dr. James Johnston says 800,000,000 of men smoke tobacco; 400,000 opium and its compounds; 300,000 hemp and haschisch; 100,000 betel; and 40,000 the American plant coca.—The annual consumption of copper is said to be 13,000 tons, of which about one-half is derived from the Lake Superior mines.—Certain English Railway Mail trains run at the rate of 40 miles an hour, including stoppages, while the American Mail trains, owing to the inferior construction of their roads, only attain about half that speed.—Of one million tons of pig iron annually made in France, three hundred thousand tons is charcoal made.—The "Trade Review" estimates that the total imports for 1865 will not exceed $30,000,000;

against $52,000,000 in 1864, and that the export will scarcely reach $25,000,000, against $38,000,000 last year; this will give, as between imports and exports, some $9,000,000 in our favour as compared with 1864. The Review estimates a total deficiency in the revenue of $5,000,000, and wonders how it is to be made up.

The *London Telegraph* estimates that 252 persons are killed annually in the thoroughfares of London, by accidents, and that on the whole of the British Railways the number is only about 20 persons annually; or 100 to 1 in favour of the Railways—John Wilkinson, of Castlehead and Broseley, known as the great iron-master, is said to have built the first iron ship, which was launched in July, 1787; he issued coinage dated 1790, on the field of the reverse of which is pictured his iron ship.—The Wheeler and Wilson Sewing Machine Co. turns out a machine every three minutes, or twenty in a working hour; there are 900 men employed.—The expense incurred by the War Department on Armstrong guns and projectiles, from May 1863 to end of March, 1864, was about $1,400,000.—In 1854 there were in Great Britain 555 furnaces in blast, which produced 3,069,838 tons of pig iron; in 1864 the number of furnaces was 594, producing 4,179, 305 tons of iron.

Photography.

Photographs in Colours.

An article on scientific discovery in the last number of the 'Revue Contemporaine,' by Dr. H. Montucci, gives a detailed account of the last triumph of photographic art, due to the indefatigable researches of M. Chamboy, who has spent the last few years at Port Louis, Ile de France, M. Chamboy has succeeded in fixing the natural colours of the object photographed. The operation is as instantaneous as in ordinary cases, and, if the report be not exaggerated, the likeness obtained has all the delicate colouring of a pastel drawing and the minute accuracy of miniature-painting. The question arises whether a similar result can be obtained in our foggy climate. Dr. Montucci reminds his readers of the contrast between the marvellous clearness of the air in the southern hemisphere when compared to even that of the finest of summer days in Paris. This has been the grand difficulty which M. Nièpce de St. Victor has so long struggled to overcome in his photographic experiments. and with wonderful success, as M. Nièpce has succeeded in fixing on his proofs, not only reds, greens, yellows, and blues, but blacks and whites, which have been the most difficult to seize. M. Nièpce has had recourse to a very high temperature, which unfortunately has a disastrous effect on all colours produced by light, giving them a tinge of red. When the proof is removed from the dark box in which it has received the impression of the object to be photographed, the whites and blues have a peculiar delicacy of hue, which the process of fixing by heat unfortunately tarnishes. Dr. Montucci does not appear to despair of M. Nièpce's ultimate success.—*Star*, Feb. 6.

Flattery in Photographic Portraits.

A method has been recently suggested for softening the effect of photographic pictures, and removing the too faithful harshness with which they render some faces. M. Mathey suggests the following method:—"The plan is to have a lace curtain stretched on a wooden frame placed between the camera and the sitter: the farther the the curtain is from the model, and, consequently, the nearer it is to the lens, the softer the features appear; the threads of the lace give the *grain* of a chalk drawing or engraving, and the defects of the model are modified and softened down."

Miscellaneous.

Plasticity of Sulphur.

MM. Moutier and Dietzenbacher presented a note to the Academy of Science on a "A Property of Sulphur." The second of these gentlemen showed some time ago that sulphur melted with a small proportion of iodine retained its plastic state. The authors now show that a number of other substances, napthaline, paraffine, camphor, oil, wax, etc.—confer the same property. The mixture with some of these substances is insoluble in sulphide of carbon. Carbon also greatly modifies the properties of sulphur, rendering it completely fluid at 170°.—*Chemical News.*

Moral Algebra.

A most curious expedient was Franklin's moral prudential algebra as he called it. When asked by Dr. Priestly how he made up his mind, when strong and numerous arguments were presented for both of two proposed lines of conduct, he replied—My way is, to divide half a sheet of paper, by a line into two columns, writing over the one *pro*, and over the other *con*; then during three or four day's consideration, I put down under the different heads short hints of the different motives that at different times occur to me, for or against the measure. When I have thus got them all together in one view, I endeavor to estimate their respective weights; and where I find two (one on each side) that seem equal, I strike them both out. If I find a reason *pro* equal to some two reasons *con*, I strike out the three. If I judge some two reasons *con* equal to some three reasons *pro*, I strike out the five; and thus proceeding, I find at length where the balance lies; and if, after a day or two further consideration, nothing new that is of importance occurs on either side, I come to a determination accordingly. He added that he had derived great help from equations of this kind, which at least rendered him less liable to take rash steps.

Greater Than Niagara.

An eastern gentleman having visited the Great Falls on the Snake River—the Southern fork of the Oregon—writes home a description of this marvellous natural curiosity, in which he says: "When we arrived at Rock Creek, one day's travel this side of Salmon Falls Ferry, we left one morning for the Great Falls, and took a straight line for

Snake River. At a distance of four miles we came upon them unawares, as the bluffs are over 3,000 feet high on each side; consequently you could not hear them. There we commenced the descent to the falls on horseback, to within a few hundred yards of the awful precipice. Then fastening our horses, we soon descended to a level with the river above the falls. The sight that then broke upon the view is too sublime to be described by one so little capable of doing it justice as myself. We measured the distance that the whole volume of water falls in one sheet, and found it 203 feet. Then above. I should judge it to be about 25 to 30 feet fall before it reaches the grand fall. The width of the grand fall I should judge to be about 2,500 feet. I have visited Niagara many times, but this far eclipses it. Four miles further above we found another one of less note, where the water divides into two parts and falls a distance of 166 feet. Should you ever again cross the Plains, don't go by the falls without visiting them, as it is well worth one year of one's life. Our measurement may be relied upon as perfectly correct, as we started prepared for it.

Embalming

Falconi, in a paper read to the French Academy, states that after a series of experiments made with different salts, he finds that sulphate of zinc, prepared of different degrees of strength, is the best material. An injection of about a gallon would perfectly well preserve a dead body, as is proved by the preparations belonging to the anatomical cabinet at Genoa. Bodies so prepared preserve all their flexibility for 40 days. It is only after that period that they begin to dry up, still preserving, however, their natural color. Chloride of zinc and sulphate of soda are sometimes used also.

Weights of Railway Carriages and Omnibuses

It is certainly worth considering whether railway engines and carriages need necessarily be such ponderous affairs—at any rate for passenger traffic. The Americans accuse us, with some justice, of being wedded to weight and massiveness in all our manufactures, comparing for instance, our crawling broad-wheeled wains and elephantine horses, with their express wagons and small-boned cattle. There is a curious comparison between a first-class railway carriage and an omnibus—carriage weighs 5 tons, carries 18 people weighing 22 cwt.; omnibus weighs 1 ton, carries 30 people weighing 37 cwt. Consequently the railway carriage weighs five times as much as all the passengers put together, the omnibus only half as much. If omnibuses were proportionately as heavy as railway carriages, they would only carry three people; if, on the other hand, railway cars were as light as omnibuses, each carriage would carry 180 people!—*London Mining Journal.*

The Vegetable and Animal Kingdoms.

The simplest organized plant is composed of cells. Lay a row of egg shells side by side and we have an idea of the simplest form of a vegetable. A single cell is then the simplest form of organization known to us. This cell has the power to double itself and thus another cell is formed. The most complicated vegetable and animal substances are composed of cells.

Akin to this simple form of structure in plants, may be seen a similar one in the lowest form of animal creation. Starting with a single cell, it has the power of doubling and multiplying itself till it forms a shapeless jelly-like mass, composed of cells. It has no stomach, no form of circulation, in fact, it has no distinct organs whatever. It receives its food in one part of itself as well as in another. So it is with its respiration and circulation.

Thus when we examine the lowest forms of vegetable and animal matter, we shall find them composed of simple cells with power to reproduce themselves. From this starting point we gradually ascend to the most complicated structure of vegetable and animal creation. Thus, Nature's laws which are obscure to us when not understood, appear the simplest possible when fully comprehended.—*Maine Farmer.*

Purification of Petroleum.

In treating for disinfecting and removing the impurities from petroleum and products thereof, it has been usual to employ chloride of lime in a dry state and in combination with other matters, but which, however, is very imperfect in its action and far from obtaining the desired results.

According to an invention which has been patented by Mr. B. Azular, of Rotherhithe, the oils are treated with a saturated solution of chloride of lime, and, as it were, washed in the solution. For this purpose the oil is placed in a suitable vat or vessel and the solution poured over it, the solution sinks through the oil, and is drawn up from the bottom, and by a pump or other means is elevated again to the top, and so a circulation of the solution in the oil is kept up and the impurities thus abstracted from the oil, which is rendered clean and quite free from offensive smell, besides enhancing its lighting properties. If the oil is not very bad the same solution may be used again. If the oil is bad the solution will be found to have acquired the taint of the oil and must not be used again.

If the oil is very bad it may be found necessary to repeat the process with a fresh solution, in that case a second vat is provided, the top of which would reach the oil tap of the first vat; the treated oil is then drawn from the first into the second vat and washed in water. After the oil has been separated from the water, the latter is drawn off and a second solution is then thrown on the oil, and the process proceeds as before. Instead of the solution of chloride of lime being applied at the top and drawn up from the bottom of a vessel, the oil may be forced in at the bottom of a vessel, containing the solution of chloride of lime, when it will rise through the solution and may be drawn off at the top, repeating the operation as often as may be necessary according to the quality of the oil operated upon.—*Mechanic's Magazine.*

"A 1."

The expression "A 1," applied popularly to everything of the first quality, is copied from the symbols of the British and Foreign shipping list of the Lloyds. A, designates the character of the hull of the vessel; the figure 1, the efficient state of her anchors, cables and stores; when these are insufficient, in quantity or in quality, the figure 2 is used. The character A is assigned to a new ship for a certain number of years, varying from four to twelve, according to the material and mode of building, but on condition of the vessel being statedly surveyed, to see that the efficiency is maintained. When a vessel had passed the age for the character A, but is still found fit for conveying perishable goods to all parts of the world, it is registered Æasterisk in red. Ships Æ in black form the third class, and consist of such as are still found, on survey, fit to carry perishable goods on shorter voyages. Classes E and I comprise ships sufficient to convey goods not liable to sea damage; the one class for voyages of any length, the other for shorter voyages.—*Scientific American.*

Liberality is the Economy of States.

The following eloquent and truthful passage from Gov. Andrews' message, commends itself to the attention of our own legislators:

"Liberality toward all institutions of science and art which develop the mind and foster civilization is our highest interest and must be our welcome duty. A Commonwealth which spends freely, if wisely, in unfolding its material resources by artificial improvements, by cultivating the intellectual capacities of its people, by encouraging the ingenious to experiment, the aspiring to try their wings, and the studious to divine the mysteries of knowledge, must, of necessity, be prosperous and great. In such things to be mean is to be poor, to be generous is to be rich. That which is only economy when applied to an individual, whose enterprise must be bounded by the opportunities of a single lifetime and a limited fortune, becomes narrow and short-sighted when applied to States having all the combined opportunities and powers of millions of people, of all their possessions, and of unlimited duration of time."

Fourteen Ways by which People get Sick.

1. Eating too fast, and swallowing food imperfectly masticated.
2. Taking too much fluid during meals.
3. Drinking poisonous whiskey and other intoxicating liquors.
4. Keeping late hours at night, and sleeping too late in the morning.
5. Wearing the clothes so tight as to impede circulation.
6. Wearing thin shoes.
7. Neglecting to take sufficient exercise to keep the hands and feet warm.
8. Neglecting to wash the body sufficiently to keep the pores of the skin open.
9. Exchanging the warm clothing worn in a warm room during the day for the light costumes and exposures incident to evening parties.
10. Starving the stomach to gratify a vain and foolish passion for dress.
11. Keeping up a constant excitement by fretting the mind with borrowed troubles.
12. Employing cheap doctors, and swallowing quack nostrums for every imaginary ill.
13. Taking meals at irregular intervals.
14. Reading the trashy and exciting literature of the day, and going crazy on politics.

Working and Thinking.

It is a no less fatal error to despise labor when regulated by intellect, than to value it for its own sake. We are always in these days trying to separate the two: we want one man to be always thinking, and another to be always working, and we call one a gentleman and the other an operative; whereas *the workman ought often to be thinking, and the thinker often to be working; and both should be gentlemen* in the best sense. As it is, we make both ungentle, the one envying, the other despising his brother; and the mass of society is made up of morbid thinkers and miserable workers. Now it is only by labor that thought can be made healthy, and only by thought that labor can be made happy, and the professions should be liberal, and there should be less pride felt in peculiarity of employment, and more in excellence of achievement.—*Ruskin.*

Street Railways.

Mr. Norman Wiard proposes to make the wheels of street rail-cars of wood, with the grain radiating; and to put a steel flange in the middle of the rim, instead of the usual flange. The rail, or tram-plate, is to have a groove in the middle three-fourths of an inch wide, in which the flange-ring will travel; and one flange will be sufficient to keep the car on the track, unless a substance harder than ice gets into the groove.

This plan has advantages as to the rails. First, they will not be an obstruction to common carriages, if they are kept flush with the pavement: the ¾ inch groove will not allow a wheel-tire to fall into it. Second, the weight of the car will bear equally on both sides of the rail, instead of bearing wholly on one side, as on the present rails.

The noise of wooden wheels is less than that of iron, even when they have iron tires, like Mansell's; and when they have no tires the noise will be still further lessened.

The durability of the wheels is at present a matter of opinion. They will be saturated with paraffine, on Mr. Gwynne's plan, or with asphaltum or rosin, so that moisture may not pentrate and distort them; and when worn out of round they may be trimmed in a lathe; and if reduced several inches in diameter they will still work well.

We go with Mr. Wiard so far as he goes; and we go still further. We have ridden over the stone tram-roads in Northern Italy, and carefully observed the trackings; and are convinced beyond the slightest doubt that all vehicles can keep the track without help of flanges. The horses keep the horse-tracks of their own accord; and the wheels necessarily follow; and we never knew the horses to deviate unless reined off by the driver. The ridge-rail and flange-wheel are mere devices to secure a monopoly to the owners of tne rails. They are abominations; they are incomparably inferior in public utility to the Italian tram-roads; and they ought to be prohibited. Plain tram-plates will be much better for the carrying companies who lay them—provided their monopoly is secured by other means; and it is a trifle for them to allow the common traffic to use their rails. But the whole pavement should be iron.—*American Artisan.*

Sewage of English Towns.

The last report of the Sewage of Towns Commission has just appeared. As the result of labors extending over eight years, the commissioners have confidence in the following conclusions:—1. The right way to dispose of town sewage is to apply it continuously to land, and it is only by such application that the pollution of rivers can be avoided. 2. The financial results of a continuous application of sewage to land differ under different local circumstances; first, because in some places irrigation can be effected by gravity, while in other places more or less pumping must be employed; secondly, because heavy soils (which in given localities may alone be available for the purpose) are less fit than light soils for continuous irrigation by sewage. 3. Where local circumstances are favorable, and undue expenditure is avoided, towns may derive profit, more or less considerable, from applying their sewage in agriculture. Under opposite circumstances, there may not be a balance of profit; but even in such cases, a rate in aid, required to cover any loss, need not be of large amount. Finally the commissioners said that, in their judgment, the following two principles are established for legislative application:—First, that wherever rivers are polluted by a discharge of town sewage into them, the towns may be required to desist from causing that public nuisance. Second, that where town populations are injured or endangered in health by a retention of cesspool matter, the towns may be required to provide a system of sewers. And should the law, as it stands, be found insufficient to enable towns to take land for sewage application, it would, in their opinion, be expedient that the legislature should give them powers for that purpose. The report is signed by the Earl of Essex and the other members of the commission, and dated March, 1865.—*London Artisan.*

On Food and Work.

At the Royal Institution, after the Easter vacation, Professor Lyon Playfair delivered a lecture "On the food of Man in relation to his useful work." In his treatment of the subject he considered almost entirely nitrogenous food, or that kind which produces flesh, on which he remarked the power to do work depends; and consisting of the lean part of flesh, of corn, beans and peas; such food as fat and potatoes only tending to keep up the animal heat. The amount of work which a man can do in a day has been estimated to be equal to a force that, if properly applied, would raise the weight of his own body one mile—the standard weight of a man being assumed to be 150 lbs. To enable him to do that amount of work he should eat 4½ ounces of nitrogenous food, in addition to food that produced only heat. A horse could do eight times as much work as a man, but it eats rather more than eight times the nitrogenous food in beans and corn. The lecturer alluded to the dynamical theory of heat, according to which heat and mechanical power may be converted into each other; but he did not explain why that theory does not apply to heat-producing food, such as fat and potatoes, which ought, he supposed, to have its dynamical effect. He mentioned, indeed, that the heat-producing-food might probably contribute towards the work done, but he considered it to be an insignificant portion, if any, and that the useful work of man is produced almost entirely of nitrogenous food.

A Trap to catch Burglars.

A London paper recently published a description of a curious invention designed to catch safe-burglars. The depredator no sooner commences, in perfect ignorance of the secret arrangements, to force open the door, drill the lock, or move the safe, than by so doing he sends a telegraph message to the nearest police-office, exhibiting the number of the safe he is attacking, and this number, registered in the police-books, has opposite to it the address of the house in which the robbery is being effected. The apparatus is the invention of M. Barb, and is a very simple affair. An instrument termed the "communicator" is fitted inside the safe; it consists of a small bolt, which is forced back upon a coil-spring when the door is closed, and which, in opening or moving the door, is instantly set in motion, In connection with this, bolt wires are led through the bottom or the back of the safe and concealed in the wall, or inclosed within gas and water pipes, and, communicating with the street-telegraph wires, are connected with the "alarm" and indicator at the police-station. The effect of tampering with the door or other part of the safe, is to sound the alarm-bell at the police-station, and to exhibit on the face of the instrument the number of the safe. Arrangements are, of course, made to obviate the sending of alarms on ordinary and legitimate occasions of using the safe, by simply putting the apparatus out of gear at the pleasure of the owner. The simple operation of turning a small key is all that is required to render the wires available, after which the owner may leave his premises, perfectly confident that electricity will keep a tireless watch over the property left in its custody. M. Barb has patented his invention, but it cannot be called *barb*-arous to burglars, so far as their immediate corporeal punishment is concerned.

Watering Plants.

While travelling in Ohio last summer, during that exceedingly dry season, I noticed in a friend's garden a contrivance for watering plants, which struck me as being the best that has yet come to my knowledge. It may be old to you and to some of your many readers, yet I will venture to give it.

It was nothing more than the principal of capillary attraction applied to moistening the earth around cucumber vines. A vessel containing water was placed near the plants, from which extended a piece of old cloth to the roots of the plant. Thus water was conveyed from the vessel to the plant slowly, keeping the ground constantly in a good degree of moisture. One vessel answered for several hills. This method I think much superior to pouring on water, which generally flows off and hardens the ground, sometimes injuring the plant more than if it had received no water at all.

I also saw in another garden another method, equally good, in practical operation. A barrel with both heads out was set in the ground halfway, and partly filled with manure. Around the outside of the barrel the cucumbers were planted. All watering was done through the barrel and the manure. The water reaches the roots from beneath, and kept the soil moist and rich. In both methods the plants were more thrifty than those treated in the common way.

Remarks.—We thank our correspondent for keeping his eyes open and giving others the benefit of what he sees. The first mode is new to us; the second is not.—*Rural New Yorker.*

Stiffened Pasteboard.

Stiffened pasteboard, or papier mache, is now being used in France, with success and economy, in the manufacture of sugar moulds, vessels for the chemical laboratory, photographic basins and funnels, and cells for electric piles. It is made smooth and impermeable by application of paint and lacquer; and in the case of sugar moulds, the sugar cannot be injured by rust as is the case with iron moulds in spots where the paint or enamel may by chance break off.

Animal Electricity.

Professor Beckensteiner, of Lyons, in investigating the origin of the electrical power exhibited by the torpedo, gymnotus, etc., was struck by the analogy of the cells of electric fishes, with certain minute vessels, united by nerves and moistened by mucus, which exist in nearly all kinds of animals, and are found developed in man at the period of the greatest strength, but collapsed and dried up in old age. He began a series of experiments, and after three years' investigation has lately published the following results:—When the temperature is below 32°, the wind north and the sky clear, expose a cat to the cold until his fur lies close to the skin and appears greasy; expose your hands to make them equally cold; then take the animal on your knees apply the fingers of your left hand on its breast, and pass your right hand down its back, pressing moderately; at the fifth or sixth pass you will receive a slight electric shock. At first the cat will appear pleased, but as soon as it feels the shock it jumps away, and will not stand a repetition of the experiment during the same day. After the experiment the animal looks tired; some days after it loses its appetite, seeks solitude, drinks water at rare intervals, and dies in a fortnight. The same experiment has succeeded with rabbits—they die the second day. It is unsuccessful with dogs. Once only it was made on a cow; she was tied to an iron ring, the ground was frozen, one hand was placed on the breast and the other passed down the back, when such an electric shock occurred that the professor was thrown to the ground. The cow appeared very much irritated, but it was impossible to know if she suffered from it, since she was killed by a butcher three days afterward. —*Telegraphic Review.*

SUMMARY.

It is estimated that from the breeding grounds of three provinces of France, no less than 400,000 common snails are sent to the Paris markets daily, where they enter into competition with oysters, than which they are said to be infinitely richer in nutritive matter.——100 barrels of crude petroleum will yield from 70 to 80 of refined oil, according to the skill of the refiner, and the perfection of the machinery.—— A stamping plate for stamping addresses is made out of blocks of timber two and a half inches square and half an inch thick, on which are nailed or glued woollen cloth letters; these blocks are secured to each other to form words by means of dowels, and the cloth letters saturated with marking ink, from which impressions are taken.——The promoters of the Bombay (East Indies) International Exhibition, for 1866, have sent $60,000 to defray the expenses of collecting and forwarding specimens of American industry. A committee has been appointed to receive the goods in New York.——A Bessemer Steel Manufactory has been established at Troy, New York, by Messrs. Winslow, Griswald & Holly, who it is said have been eminently successful in the quality of the metal produced. This firm holds the patent right in the United States.——A wharf laborer in England recently met his death by sucking at a cask of pure spirits, 66.8° over-proof, supposing it to have been wine. Another man was severely burnt internally from the same cause.—— It is said, that, if the largest pip in an apple be sown, the fruit will be similar to that of the parent tree without grafting; and that the cabbage seed gathered from the middle flower stem produces plants which will be fit for use a fortnight earlier than those from the seed of the lateral flower stems.——Liebig says 40 lbs. of finely ground bone contains 22 lbs. of pure phosphate, and is the best agent to supply phosphate to the soil.——An inventor in Washington is manufacturing violins, and other musical instruments, of *glue*, instead of wood; the sounds from which are said to be "perfectly astounding." A violin mended with glue is said to be better toned than before being broken, he therefore concluded that glue was more sonorous than wood.——Let your hogs run in the orchard; they will eat up the wormy windfalls, destroy the worms and borers, and stir up the soil and keep it mellow round the roots of the trees.——A steam omnibus is now running between Nantes and Niort, in France, ascending and descending rather steep hills with facility and safety.——The Mersey Steel and Iron Works Co. are about to smelt their iron with gas instead of coal, and thus entirely do away with the smoke nuisance.——Correspondents of the *Maine Farmer* give several instances of horses being poisoned by eating "pine weed" or "marestail" (*equisetum arvenss*); which, it appears, grows profusely amongst clover and timothy, on wet undrained lands.

A very delicate oil, much used in Russian cookery, is expressed from the seeds of the sunflower, and is prepared by enclosing them in bags and steeping them in warm water, after which the oil is expressed. This is actually as sweet as butter.