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The Canadian Engineer

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FOR THE CANADIAN ENGINEER

WATER SUPPLIES.

BY W. M. WATSON.

(Continued from last issue.)

The need of sufficient water pressure is often a danger to the public health. Last September I was staying at a prominent hotel in one of our great cities, and while on the top flat I heard the water closet cistern (a noiseless syphon flushing cistern) syphon the water out of the cistern back into the town supply service. On examination I found that the pressure was so poor that when they drew water at a lower flat the water was sucked out of the closet cistern and drawn out of the taps below. This was very serious for the health of the household, because there would be a passage of the foul gases contained in the closet bowl upward, through the flushing pipe, and into the flushing cistern when syphoned empty, and when the cistern was refilled with water it would be fouled by these gases, and if they happened to draw the water again at the lower rooms before the w.c. was used they would be receiving poisoned fluid. A similar case occurred at the Caius College, Cambridge, where a violent and disastrous outbreak of typhoid fever occurred because one of the water closets that was flushed by a dangerous old fashioned stool tap, out of repair, and not having sufficient hydraulic pressure behind it from the water mains, allowed the contents of the water closet bowl to be sucked back into the service pipe and delivered to the kitchen.

At Mountain Ash, in Glamorganshire, the people were struck with an epidemic of typhoid, and Mr. Spears proved it to be caused by a water main being laid for a long length alongside a very foul old stone sewage drain, and the poisonous gases had been attracted through the walls of the iron-pipe main into the motionless water when there was no one drawing. When the main was removed out of the way of the sewer the outbreak diminished and has since not occurred again. (See health reports of Great Britain for 1887.) In an English manufacturing town I examined about fifty sets of steam boilers which were supplied direct from the town's water mains and found only about twenty per cent. that were supplied with proper valves and other appliance in sufficiently good working condition to prevent the fluid from the steam boilers leaking back from the boilers to the water mains when the steam pressure in the boilers was higher than the water pressure in the mains, and sometimes the ingredients used to prevent the boilers scaling could be tasted in the water drawn at the taps of the houses situated in the immediate neighborhood.

The insuction of polluted water and foul gases into water supply mains of towns, and the illnesses caused therefrom, does not receive the attention it should, for it is of little use securing good water at the intake if it becomes contaminated after entering the town supply pipes.

But the intake end of the service should also be watched, because what sometimes seems a very trivial affair turns out to be serious. In 1892 a number of Russian Jews from the cholera stricken districts of Russia squatted on the quays of the river Elbe and the sewage from them was washed up by the tide to the mouth of the intake pipe that supplied the city of Hamburg with water, and in the space of eighty days 18,000 persons were attacked with cholera and 8,000 died from the complaint. (See Professor A. Koch's report).

During a general heavy rain or thaw of thick snow the face of the earth is washed and its impurities, coupled with the ejecta from men, animals, and birds, together with every description of decayed and putrefactive matter, is discharged into the rivers, making the waters they are carrying away totally unfit for domestic consumption for probably a whole week, and this makes it almost imperative for towns who draw their supply from drainage rivers to have a reservoir accommodation to hold over one week's supply, so that the river supply may be dispensed with during such periods, or else they should be provided with good filters.

There is a purifying advantage in storing water in reservoirs, for water allowed to rest in reservoirs for a few days improves considerably in quality if the reservoir is clean. It seems to go through a process of mild fermentation, and the friendly cleansing microbes feed on the injurious germs that the water may contain. No doubt a similar purifying process goes on in slow moving rivers, probably in a rather less degree, but it cannot be expected that the germs cast off by diseased persons and putrefactive

substances will be extracted by this process when passed into the river as sewage, because sewage waters need thorough shaking and mixing with fresh water before they both can be incorporated and the purifying influence of fresh water have a telling effect on the sewage. This fact has caused the British Government Board of Health to say that they know no river of sufficient length to thoroughly oxidize sewage fluids so as to be safe to use for domestic purposes.

Dr. Frankland assures us that dangerous microbes that cause epidemic diseases are held in suspension by the waters and do not settle down with the dead organic matters termed the heavy solids, to the bottom of the rivers or reservoirs. Dr. Thresh has proved by tests and close investigation that the poisonous germs cast off by diseased persons have been still alive and dangerous after traveling in river water for 108 miles at a speed of one mile an hour, though the germ-carrying sewage had become well clarified and clear. He also bears out Dr. Frankland's statement that the disease breeding germs are held in solution in water after the sewage is cleaned and the sediment is separated. Several noted biologists hold the opinion that when river water is specifically infected with germs ejected from persons or animals suffering from epidemic diseases they cannot afterwards be sufficiently purified to be safe for use for drinking purposes for a long period after contamination, however far they are carried with the stream.

The effect of the sun's rays upon water containing organisms is beneficial. Professor Buchner proved this by placing gelatine plates closely sown with live typhoid bacilla in water, at various depths, for a period of over four hours and exposed to the rays of the sun, when he found that all the plates that had been placed less than five feet deep were sterilized; this proves that the sun can do purifying work to a depth of five feet in clean water. Dr. Thresh and others state that typhoid ejecta loses its virulence within fifteen days, but in that space of time it may travel and convey the disease to persons 400 miles from the place from which it started.

I stated and showed clearly in my first article on water supplies that people may get accustomed to swallow contaminated water with impunity without ever being seriously and violently affected, but the act runs down the bodily system and makes life less enjoyable and shorter than if pure water was always used. This statement was proved in a very remarkable manner at the town of Newark, England. For many years that town took its water supply from the river Trent, and to be sure to have it palatable they filtered it, but the death rate for a rural, healthy district like Newark was high, and it was decided to secure the town's supply from deep wells, and abolish the use of river water. The waterworks system was totally changed in August, 1893, and proved to have a surprising beneficial effect. I herewith give the number of typhoid fever cases of that town for six years, which was supplied by Dr. Wills and published by Dr. Thresh in his reports (page 224). Newark on Trent has a population of 14,500:

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1890	1	4	1	2	3	3	3	1	1	6	20	8	53
1891	25	17	8	5	5	0	12	7	14	12	15	5	125
1892	1	1	0	5	1	3	5	12	12	7	12	10	69
1893	16	16	4	5	4	5	5	8	5	4	4	2	78
1894*	1	0	0	0	0	0	0	2	1	2	3	1	10
1895	1	0	0	0	0	1	0	0	1	1	3	0	7

*The new water supply

This table of figures speaks for itself and proves the advantages derived from a pure water supply. It is not always the best policy to extend intake pipes too far into the rivers, because the river may prove to be of better quality near the shore, and it is not hard to judge by the eye where good palatable water locates. For example I may state that this week I was over a part of the St. Lawrence River in a boat; on leaving the beach I sailed for several hundred feet over a beautiful bay of clear, bright, good water, resting on a clean stony bed, which could be easily seen at a depth of about nine feet, and appeared totally free from vegetable growth until nearing the main body of the river stream where the water turned a yellowish green and could not be seen through nearly so well. As this bay had a clean bed and was shallow for a good distance out, the water it contained would easily get aeration and have the full benefit of the sun's rays, moreover, the water coming from the surface of the main stream would be partly aerated and oxidized before it overflows sideways into the bay. This bay is really a self-cleansing reservoir kept clean at the bottom by slow circulation of the surface water of the river moving towards the beach and returning back to the main body of the river. That part of the river that is really the fringe or edge of the main stream is not of so good water, or so well sterilized as the water in the bay, moreover, it is the part of the river stream that carries the sewage from the towns situated higher up the river banks, for no sooner does sewage leave the mouth of the discharge pipe of the drain, than it makes a bee line straight down the stream and seldom passes to the main current in the centre of the stream.

In summing up the subject we may say that it is absolutely necessary to supply the public with water that is free from excrements and urine, also, any bodies or material that are in a state of decomposition or putrefaction, but I cannot admire such judgment as the citizens of Bradford, England, showed three years since when they compelled the waterworks committee to run to waste over 50,000,000 gallons of good water out of Chellow Dean reservoir because a person had drowned himself in it. The body was removed long before decomposition set in, therefore the immersion was harmless.

LAKE LEVELS.

Referring to our remarks in last issue on the subject of St. Lawrence levels, the Engineering News, New York, says: "Our contemporary is needlessly alarmed." The fact remains, however, that the situation is serious and that the outflow at Chicago by the canal will injure Canadian shipping enormously. The United States interests on the Upper Lakes may be protected by a dam on the Niagara River as recommended some time ago by the commission, and by a new Erie Canal as resolved on by Gov. Roosevelt's commission in the past few days, but these measures will not help the St. Lawrence Canals, they will make their maintenance a matter of purely Canadian interest, and it is necessary that public opinion should be educated on this important question. The Montreal Witness has an editorial under the head "Stolen Waters," recently, which takes a commendable position on this subject. The Engineering News in discussing the question refers to the capacity of the canal as "300,000 cu. ft. per second." This passing through a canal having a section 161 x 22 ft. would move at the rate of a mile a minute and the total flow per annum would equal the area of Lake Erie with a depth of say 35¼ inches. Taking our contemporary's own figures we need not be alarmed about the St. Lawrence levels, as there would be no St. Lawrence under those circumstances.

SOUTH AFRICA, ITS PEOPLE AND TRADE.

CAUSES OF THE BOER WAR.

ARTICLE IV.

(Continued from December Issue.)

The foregoing were a few out of many political grievances. On the top of these the people of Johannesburg in particular had their local or municipal grievances no less trying. The condition of Johannesburg has, like other matters in the Transvaal, been much misunderstood by outsiders. The Boer newspapers and public men have sought to make it appear that Johannesburg is made up of the offscourings of the earth, to whom it would be dangerous to give rights of self-government. In the early days, it is true, a great many adventurers came from all parts, but the town passed through that phase of life as all mining communities do; and for some years past it is no better and no worse than the average city of its size. It is not an alluvial mining diggings where men of every stamp can work their own claims, but a settled industry carried on by rock-crushing, as in the Kootenay, and necessitating expensive machinery and expert hands. Indeed, the mining machinery of the Witwatersrand is the most modern, as well as the most extensive in the world, many of the large companies having their own machine shops and operating large steam and electrical plants, with large staffs of the most skilled workmen. The manual labor is done chiefly by natives, but the mining and commercial business—the former having the cleverest mining engineers and experts in the world, and the latter, including branches of the most reputable firms of England, Germany, the United States, etc.—are carried on by white people, among whom there are practically no Dutch. Where there is so much gold production (the output last year was $75,000,000), there must be a large number of banks and financial corporations, which of necessity must have trustworthy employees, and so it must be said of business firms. Are the owners of these big mining plants, banks and financial houses likely to put their affairs into the hands of ruffians, drunkards, and thieves? If this question cannot be answered by a moment's reflection, the doubtful reader can satisfy himself by examining a copy of a recent Directory of Johannesburg, and read down the names and occupations. The same directory will show how unfounded is the statement that this agitation is purely a capitalistic one. Now imagine such a city of 80,000 * progressive and energetic inhabitants being governed by thirty farmers; and imagine the representative financial and mining body of the city (the chamber of mines) being refused an ordinary charter of incorporation, on the ground that it would be creating "a State within a State." At first, English-speaking men were chosen to the town council, but to cut them off from self-government, even in municipal matters, President Kruger decreed that only Dutch should be spoken in the council, and so the Anglo-Saxon was debarred there. And the Burgomaster (Mayor) is not elected by the voters, but appointed by the Government. The drainage of the city flows along the streets in open gutters, exhaling poisonous vapors, as was the case in the early days of Capetown, and the people are compelled to drink dangerously unwholesome water, with no power to alter the condition of things. Drunken zarps (policemen) swagger about brandishing revolvers, occasionally shooting down poor natives for some trifle, and insulting Uitlanders (who are not allowed to carry arms), whenever an excuse offers. The killing of Edgar by a squad of zarps, who broke into his house and murdered him in cold blood, as he was sitting on his bed talking to his wife, is a notorious example. The murderers were arrested, tried, acquitted, and some of them promoted. Such was the municipal condition of Johannesburg up to the present crisis.

The Boer Government of the Transvaal stands condemned by the liquor traffic. In theory, no liquor is sold to the natives, but in the large mining centres, particularly Johannesburg, the native laborers, who are herded in enclosures like cattle, are supplied with the vilest of intoxicating drinks, in such quantities that scarcely a day passes without one or more murders, brought about through drunken natives engaging in "faction fights." It is estimated that one-third of the total native labor supply is rendered non-effective, week in and week out, through natives being incapacitated by drink, while the damage to goods and machinery, through the same cause, is a serious item. So great did this scandal become that the Boer Church was shamed into strong representations against it last year, but though Kruger is himself an abstainer, he sided with the liquor dealers, and would do nothing, on the ground that if this traffic were stopped, a number of honest men would be put out of employment.

The operation of the liquor law in Johannesburg is thus described by a brother of the Rev. Chas. T. Cocking, of King, Ont., writing lately from the Transvaal: "Take the case of the liquor law, which prohibits sale of liquor to natives. Every Sunday one can see hundreds of natives wandering about the mines and suburbs of the town almost mad with drink. Kafir eating-houses are filled with natives drinking, and from which they stagger with sacks full of liquor to be swilled on the open veldt by fraternal groups. A special liquor detective department exists, and yet for twelve months this has gone on. Result? For two or three days following the debauch, hundreds of natives are unable to do their work, and remain sleeping off their carouse in the mine compounds to the dead loss of the mining companies. Cause? An immensely wealthy liquor syndicate, which, by bribery, etc., prevents the law being effective. The Government is so inconsistent as to absolutely prohibit natives from drinking, but a treaty with Portugal must allow the importation of Kafir liquors and spirits through the port at Delagoa Bay, and from the duty on which they obtain a handsome increase in the revenue."

(To be continued.)

*Besides the white population there were at the beginning of 1899, 90,000 blacks.

WATER PRESSURE.

Editor CANADIAN ENGINEER:

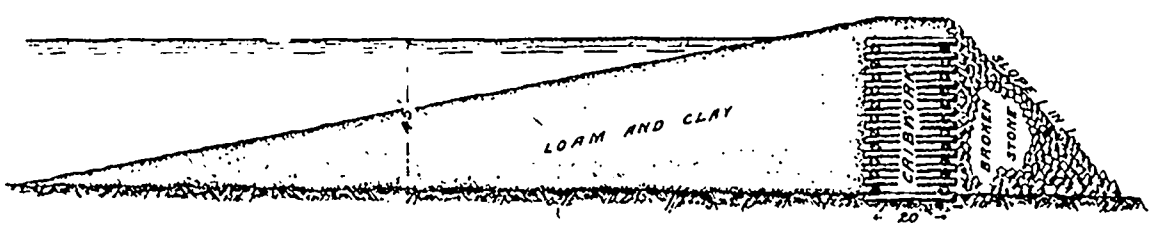
I would be pleased if the city engineer of St. John, N.B., would explain the last eight lines of the first paragraph, page 232, of December issue of *The Canadian Engineer*, where he shows that there was a great increase in the pressure of water because he caused three-quarters of an inch of calcareous matter to be removed from the inside of the water mains. It will be a great discovery if the head of water can be increased by increasing the size of the carrying pipe.

Toronto, January 15th, 1900. CORRESPONDENT.

THE CANALS OF CANADA.*

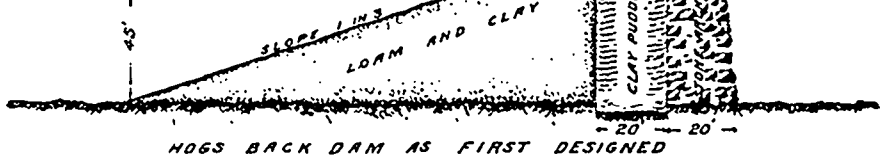
(Continued from last issue).

Again with a regular canal in times of flood the engineer simply closes his guard gates and lets the angry river sweep by, but if he has dammed right across it he must be prepared to cope with and tame its fullest strength. More than one dam, built in the most approved materials of modern engineering, has gone down before such floods, and the best method of building such structures is still a matter of controversy. The boldness of these pioneer engineers can be best judged by their own recital of the disasters that befel their first dam. This was the Hog's Back dam, which is situated close to Ottawa, and at a point where the level of the water had to be raised 45 feet. The river was 170 feet wide, and in 1827 a dam was constructed half way across the river. It was built on the authorized plan: that was, an earth structure which was rendered water-tight by clay puddle and supported on a great dry stone wall built in an arched shape of large stone set on edge. Then the contractor attempted hurriedly to block the other half of the river by a dump of what



HOGS BACK DAM AS COMPLETED

the Royal Engineers called rubbish, but no provision was made for the water, and rising, it swept over the rubbish and carried it all away. A rough timber dam was then thrown across the opening in order to protect the finished part of the arch, but the spring floods overtopped this, swept it also out and cut a new channel around one end of it. The gap was again closed in the simple method followed by our lumbermen in building their driving dams, and under this protection the great arch was at length completed, and by March, 1830, the dam seemed safe. But the river rising in spring flood worked through the ill packed clay and puddle, and on April 3 the stone work fell with a great crash, and the river swept on its course once more. The Royal Engineers write that they saw that day an extraordinary exhibition of the power of Canadian frost, for while the turbulent stream swept through, the top of the dam remained standing, an earth arch of over 50 feet span. The dam was finally completed by building the lumbermen's cribs right across, backing



HOGS BACK DAM AS FIRST DESIGNED

them with broken stone, and dumping earth and clay in front, and providing ample by-passes for the flooded river. The lessons its construction taught have been well learnt, and no man would to-day build an earthen dam that the river could overtop, nor attempt any construction without providing ample by-passes while his works were in progress. The still recent failure of the dam on the South Fork of the Conemaugh river was caused by the blocking up of its waste weirs or by-passes, and the destruction of Johnstown and of the railroads in the Conemaugh valley was a terrible demonstration of the power of a flooded river that has broken its dams. The Rideau Canal is a succession of pools formed by dams like that at the Hog's Back, lift locks being built near the end of the dams. These were of rubble masonry laid in lime mortar and faced with cut stone. Considerable difficulty was experienced with the masonry owing to the poor quality of puddle used around the walls, and the total unsuitability of lime mortar for such work. This was finally overcome by making a special cement at Hull, for our modern hydraulic cements were then unknown, and grouting the finished walls with it through long tin tubes let down in holes drilled in the masonry. The vertical lift of these locks varied considerably, but it was necessary at some places to place several locks together to overcome the rise at those points. Thus at Ottawa a rise of 81 feet is overcome by eight locks in a flight.

The delay and inconvenience to traffic of such an arrangement has been found to be very considerable, and in the canals now building it is carefully avoided. The Trent Navigation is a system of canalized rivers connecting natural lakes, very similar to the Rideau, but on that work the engineers are building hydraulic lift locks where a great rise is to be overcome at one point. These are a distinctly modern device, and pending the completion of the Trent lock, the most notable of them in service is that at La Louviere on the Belgian State canals. The upper and lower reaches of the canal are closed by vertically sliding doors, and the lock is simply two great steel troughs, carried on girder work very similar to that of a railway bridge. The troughs are closed at the ends by doors like those on the ends of the canal, and each trough runs up and down between braced steel guide towers. Under the centre of each trough is an enormous ram, and the cylinders in which the rams work are connected together so that one lock in descending forces the other to rise, and in practice the lock is actually operated by allowing the water in the upper trough to become a little deeper than that in the lower, the weight of this extra water supplying all the power required for the lift. The trough becomes part of the upper or of the lower reach according to its position, the gates being run up far enough to clear the barges. The rise at La Louviere is 50½ feet, and the lock will lift barges carrying 400 tons. The Trent lock will have 15 feet more rise and will handle much heavier boats. The time of passage through one of these locks will not differ materially from that required for a gate lock, but it has a much greater lift, the maximum on the Canadian gate locks being that recently adopted for the Soulanges canal, 23½ feet; it has also the advantages of giving a passage up and a passage down at the same time, and of requiring very little water to operate it; a feature which recommends it strongly to the Erie canal engineers, that work being badly handicapped by lack of water. It is not at present considered suitable for the great locks of the St. Lawrence system.

That the Royal Engineers were wise in their decision to raise the levels of their rivers rather than attempt to excavate canals, seems to be proved by the history of the first Welland canal, which was built at the same date. It was proposed that there should be no locking up from Lake Erie, and the "deep cut" near Allanburgh was undertaken with that end in view. An excavation varying from 30 to 55 feet was required for about a mile and three quarters through a heavy clay, underlaid with treacherous unstable material resembling quicksand. When this was about two-thirds completed tremendous slides occurred blocking the canal and rendering necessary the raising of the summit level, and the building of a 21 mile feeder to obtain water to operate that level. Those slides remained an obstacle

*From a popular lecture by J. G. G. Kerry, B.Sc., before the Applied Science students of McGill University.

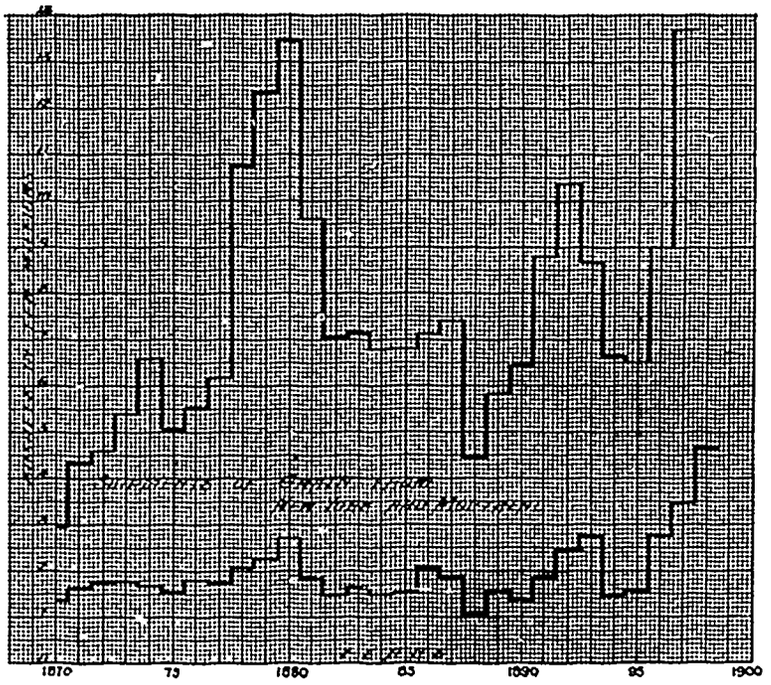
to our commerce until after 1870, for in spite of all improvements and enlargements it was not until that date that the cut was excavated to such a depth that the Erie level could be carried through.

The Soulanges canal may be taken as the most advanced type of canals proper. It is a built canal for its entire length of 14 miles, and has a waterway 100 feet wide at the bottom, with side slopes of 2 to 1. The banks of the canal near the water line are protected from the wash of the swell of passing vessels by a layer of broken stone. The excavation of the material for the waterway involved enormous quantities, but the perfection of modern contracting plant rendered it easy to handle the material at rates that would never have been thought of in the construction days of the Rideau; and, although its route did pass through material well nigh as unstable as that on the Welland, the great slips that have occurred have been readily taken out by the contractors. The Soulanges canal has no lack of water to fear, for its summit level is that of Lake St. Francis, and like all the St Lawrence canals it has the great river to draw from. But though the flow of the St. Lawrence may be ample its depth is not always so, as the shippers of Montreal well know from recent experiences in the ship channel, and in this particular the engineers of the Soulanges have made more ample provision for unprecedented low water than has been made at Lachine and Cornwall, for on those canals of nominal fourteen feet draught, the water has sometimes been less than thirteen feet deep. There is also grave reason to fear that the opening of the Chicago Sanitary Canal will divert so great a flow from the St. Lawrence that in low water seasons the river level will sink lower than ever before, and that the efficiency of our most important canals will be seriously impaired by this local American work, for unfortunately, the time of low water is coincident with the time of heaviest trade, and then every inch of draught means much to our forwarders. As in the Rideau, the heavy fall of the Soulanges comes at one point, but here in order to avoid a flight of locks short stretches of canal with large equalizing basins are built in between the separate lifts. The locks themselves are built of concrete, and faced with cut stone. Their magnitude can only be realized when standing in them, for the size of a wall 22 feet thick, and 41½ feet high, is not easily grasped from the figures alone.

There are several details that are worthy of note in these locks. The breast walls at the upper end are reintroduced, as it is found that the most fruitful cause of accident in canals is the collision of an upcoming boat with the upper gate, and breast walls will prevent this. The gate valves for letting the water in and out of the locks, and that we are all so familiar with, have been abandoned, and the water flows through great culverts in the heart of the wall. The flow through these culverts is regulated by vertically moving valves called Stony sluices, a device adopted from the Manchester Ship Canal. The familiar winches for operating the gates will also be missing for these, themselves nothing but a pile of great beams of British Columbia fir solidly bolted together, will be moved by heavy struts attached a little above the centre of the gate and working in recesses in the walls. The power for all this movement, and for the lighting of the canal from end to end at night will be electricity, and will be obtained from a special power-house, built in the bank of the canal, and utilizing its surplus flow.

Special channels or by-passes are built around each of the locks by means of which water for the reaches below can be supplied without flowing through the locks themselves. These by-passes are spanned by stone bridges at each end, and the discharge through them is controlled by a set of automatic Stony sluices built directly across the by-pass at the centre. Long walls of cribwork run out into Lake St. Louis and Lake St. Francis at either end of the canal, but there is a novelty in their design also. For the cribwork is only carried up to within a foot of low water, and above that these quay and anchorage walls are all concrete.

The line of the canal is intersected in several places by roads and streams, and provision has had to be made for their crossings. The roads are carried on swing bridges as is customary, but these are specially designed so that there is no masonry to interfere with the clear waterway of the canal, and an extra channel is excavated around the swing pier of the bridge. The opened draw is completely on one side of the canal proper. The piers are of concrete and the scaffolding in the slide is typical of that used for all the structures. It is not an easy matter to cross a large stream with a canal, for the level of the canal is usually about that of the stream, and although the latter's low water flow might be a desirable addition to the resources of the canal, its flood tide would be far too strong to be accommodated in so artificial a channel. The main stream that crossed the Soulanges location had a flood discharge greater than that of the Rideau at the time of the Hog's Back disaster, but it and all other streams have been quietly passed under the canal by means of lines of cast iron pipes, set in concrete. The Delisle River required 4—10 ft. pipes to give it free passage. The St. Lawrence canals are all built to the same general dimensions, but the details of the Soulanges are more complete than those of the earlier finished canals. The locks are much larger than those of the Ottawa and Chambly canals, but are after all only modern developments of the original type which they well illustrate.



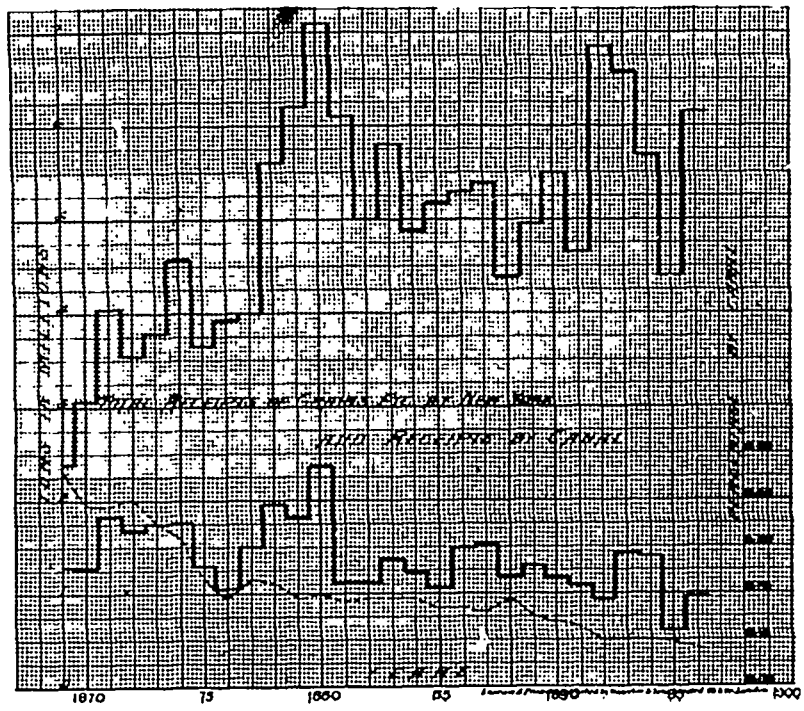
Turning now to consider the canals from the point of view of the commercial public, it must be admitted at the outset that they have failed to fulfil the expectations of their designers. In the case of the smaller canals the reason for this is not far to seek. In England and in the United States no stocks have

suffered such a tremendous decline as those of the canal companies, which at the beginning of this century were considered the most desirable of investments; and the same competitor that has ruined, and so often absorbed those canal companies, has taken away from our canals most of the freight that they were designed to handle. Half a century ago, just on the completion of our St. Lawrence system, T C. Keefer, C.E, was quietly prophesying that in a few years the railroad would leave nothing for the river but "emigrants, pork, flour and lumber," and the event has proved him to have been more than right. In Europe, the canal remains a great and valued part of the transportation systems, but the conditions that make barge canals profitable there are not found here The American transportation problem has been a peculiar one, and it has worked out its own solution largely in special long-haul low rate freight railroads, which have been developed to meet the needs of a restless and energetic people, of great commercial activity and impatient of all restraint, struggling against the disadvantages of a northern climate and of a sparse population scattered over widely extended areas. The smaller canals, both in Canada and the United States, have not been able to hold their own against such competitors.

The traffic on the St Lawrence system is worthy of a more detailed study, for it was built for the one purpose of winning for the river the export trade of the west, and it has not done

last thirty years it has resulted in a steady diminution in the canal traffic, although the tolls have been steadily reduced, and finally abolished in 1882.

It was in the hope of capturing this Erie Canal traffic that the St. Lawrence canals were built, and the great expenditures made by the Canadas in the early days do not appear so extravagant, when we remember how great was the toll collected by the rival route at that time. Col. Philpotts in his report, previously referred to, pointed out how marked would be the superiority of the St. Lawrence route if its canals were made large enough to permit the passage of the lake vessels to Quebec without breaking bulk, and how great a share of the traffic such an improvement would divert, but he does not seem to have fully considered the influence of the vested interests and established trade routes of New York. The clearest proof of the impossibility of natural advantages alone changing the channels of trade is in the fact that although the Welland was long the smallest of our canals, about half of the traffic passing through it was diverted from the St. Lawrence route and sent to New York through the Erie canal via Oswego by American forwarders. This fact is but another tribute to the superior energy and resource of our New York competitors. Col. Philpotts' idea was that the lake carriers should be brought through to Quebec with full cargoes, but this was rendered impossible by the small size selected for the Welland locks on its enlargement in 1848, and the possibility of car-



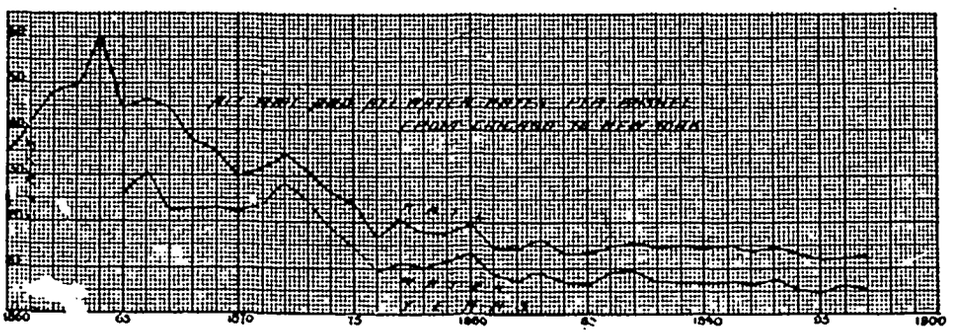
so. The principal reasons of this failure are the commercial inactivity of the Province of Quebec, the disproportion between the canal locks and the vessels carrying the lake trade, and the great changes in the positions of the world's manufacturing centres since the system was first projected. That we have been completely outdistanced by New York in the struggle for the western trade must, in large measure, be attributed to the superior commercial genius of its people Early in the century the New York statesmen saw that the Great West, then just opening up, must become commercially tributary to the St. Lawrence, unless they could provide a competing water route, and with the steady purpose of securing that trade they completed in 1825 the Erie Canal. Perhaps no transportation work has ever been so completely successful both politically and commercially It fully achieved its purpose and from the hour of its completion New York became the commercial capital of North America For many years it was crowded beyond its utmost capacity, its locks worked continuously night and day, and the revenue from its tolls was so great that when the railroads parallel to it were first opened they were forbidden to carry freight lest they should diminish the income of the State But with the removal of this embargo, and the development of railroading consequent upon the introduction of the Bessemer steel process, the competition grew more and more keen between the two systems, and for the

rying out his idea has never yet arrived owing to the fact that the dimensions of the lake carriers have always increased more rapidly than those of the locks of our enlarging canals. With a strange lack of foresight, in which, however, they were amply justified by the statements of the most prominent forwarders of the day, the Canal Commissioners of 1871 determined the dimensions of our now nearly finished system, and after pointing out that when Col. Philpotts' recommended locks of 750 tons capacity there were then boats of 800 tons on the lakes, and that there were boats of 1,600 tons at work in their own day, and that no man could prophesy what the increase of a few years would be, they calmly recommended locks that would not pass the largest vessels of their own day, so that when the enlargement of the Welland was completed in 1887 it was more out of date than it was in 1871 Vessels at present carry about 1,800 tons through the Welland, and will be able to descend to Montreal upon the completion of the Soulanges, but the great grain carriers of the lakes now run over 6,000 tons. T. C. Keefer, writing in 1893 recommends that the locks of the canals be lengthened, as the first step in their further improvement, pointing out that although in modern steamers the proportion of breadth to length varies from 1 to 8 to 1 to 10, our commissioners adopted those of Noah's ark and made the locks 1 to 6. The most economical size and draught of steamers is a matter of controversy, and for

ocean steamers the largest are now greatly preferred, but Mr. McDougall, the designer of the whaleback lake fleet, for which the highest efficiency in service is claimed, has stated recently that of all their boats, they believe that those suited to the Canadian canals will make as good a showing as any of the larger vessels. The promoters of the Trent Navigation are of the same opinion, and claim that the present craze for large lake ships is without satisfactory foundation, and say that they will be able to compete on even terms for the grain trade over their land locked barge route from the Georgian Bay to Montreal; but the truth of this claim remains to be tested. The failure of the Erie Canal in its struggle against the railroads, they ascribe to a communistic law which forbids any company with a capital of more than $50,000 to operate on that route. As the great transportation companies now reach after their traffic for thousands of miles, it can easily be realized how hopeless it is for a small barge owner to secure the carrying of that traffic for but a portion of the way.

The completion of the Erie Canal by centering the export trade at New York made it also the importing centre of the continent, and the forwarder by the Erie route was nearly sure to secure a return cargo for his boats, and the influence of the great importing firms thus tended to draw the export traffic from the St. Lawrence, and it would only have been by the growth of a mercantile community in Montreal equal in wealth and enterprise to that of New York that that advantage could have been offset; and any attempt at American importation via the St. Lawrence was rendered impossible by the attitude of the United States custom officials. The disproportion of trade in the St. Lawrence, and also in the export and import trade of Montreal itself has always been very great. This centre Montreal is unfortunately greatly handicapped by her distance from a winter port, and it is much to be desired that the late suggestions of T. C. Keefer with regard to keeping the St. Lawrence open in winter should be given a thorough trial. This has frequently been pronounced altogether impracticable, but until it has been thoroughly tried with modern ice-breaking steamers no man is really in a position to make this assertion. If the river could be kept open even to Quebec the advantage to Montreal, and to all routes leading to Montreal would be very great. The canals themselves will, of course, never be kept open for more than eight months as an absolute maximum. It is well to state here, however, that although competitively our St. Lawrence canals have not succeeded, they have always been of great absolute importance to this city for almost all the grain for export, and a large proportion of the lumber, has been brought by barges, and it is its great export rather than its import trade that maintains the harbor of Montreal. The canals were for many years the practical link that held the Canadas together. The facilities that they furnished contributed greatly to the building up of Ontario, and they have been indispensable to purely Canadian trade, and have only failed in the effort to turn the trade of New York to Montreal.

There are three canal schemes now attracting the attention of the Canadian public. The first is the old Trent Navigation, commenced in 1837 and discontinued in 1841, and again taken up about 1882 by the Dominion Government. Several references have been made to it in this lecture, and active efforts are being made to secure the necessary appropriations for its completion. It will open up a local trade route of great length, and its promoters expect by a well organized barge service to secure a large proportion of the through eastward traffic.



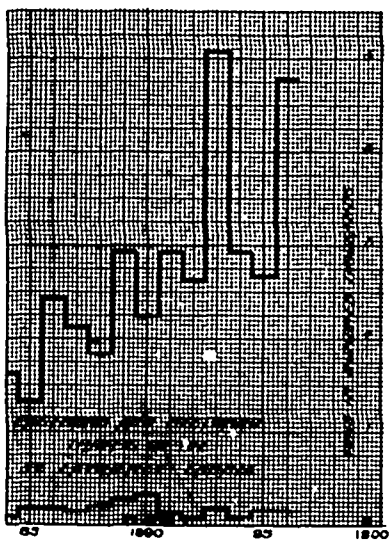
impossibility of securing return cargoes has been keenly felt by our forwarders, and the early canal builders hoped that the low freight rates that could be made by the St. Lawrence would induce heavy shipments of coal, iron and salt up the river, but the growth of the manufacturing interests on the lakes, where these raw materials are now mined in greatest abundance and at the lowest figures in the world, have destroyed this hope of westward traffic.

For the future our forwarders can only hope to compete for the grain export trade, of which we handle at present but a tithe, although our shipments for 1898 were unprecedented. This increase must, however, be largely ascribed to the activity of the Canada Atlantic Railway which, unlike the Canadian Pacific and the Grand Trunk, catered vigorously for the grain trade, and at prices practically equal to those offered by canal. It will therefore be a matter of great interest to observe in the future the contest between our 14-ft navigation, and this energetic railroad, which is so situated that the grain traffic is almost an essential to it. Certainly the cost of grain transportation has now become much less than the fluctuations of the market price of that commodity. We have also something to hope from the development of heavy manufacturing interests, now taking place in the Province of Quebec; for an active commercial population here would contribute more to the prosperity of our canals than any other probable event. It is also possible that, if the present hostility to our interests evinced by our American neighbors continues, we may be forced to build against them a tariff wall, as high as that which they have so persistently erected against us, and that will mean that much of the coal and iron that is now imported from the States will have to be brought from England and the lower provinces, and will move westward over the cheapest route, that is by the canals. As an importing

The western shippers have long been anxious for a deep waterway canal to the sea, and this has been reported as feasible by an International Commission. The commissioners advised the examinations of the three following routes, by the St. Lawrence River to Montreal, by the St. Lawrence River, Lake Champlain and the Hudson River to New York, and by Lake Ontario, Lake Oneida and the Hudson River to New York. The St. Lawrence route would prove very much the cheapest, but this enterprise is never likely to be undertaken as an international work, because the great bulk of the traffic of the Western States is now with New York and Boston and their surrounding cities, and not with Europe. The Lake Oneida route will therefore best serve their trade, and as this is a purely American route, that would not in any way tend to the building up of Canadian shipping, and to the increase of an independent Canadian commerce, Canada has no interests in it; while the St. Lawrence route by not leading directly to the Eastern States would not be a benefit to the larger portion of the American trade and would not be considered by the United States.

The proposition that was made to the Dominion Government during the last session of Parliament for the building of a 14 foot canal via the old route of Champlain and the fur traders from the Ottawa River to the Georgian Bay, renders possible the construction of this work at an early date, but it is doubtful if the offer will be accepted by the Government. Considered as a canal it could not under present conditions be made a paying investment as our Government canals are at present operated at a heavy annual loss to the country, but the enormous water power that would be made available by the construction of the proposed system of locks and dams on the Ottawa and on the French Rivers is a commercial prize well worthy of attention. This is estimated at a million h.p., after making all allowances

for losses in development, an amount that can only be realized by remembering that it is more than twelve times the horse-power of all the engines in Montreal. The Montreal Board of Trade has opposed this proposition on the ground that a route of such importance should not be alienated to a private company; but in view of the history of Canadian transportation affairs it is doubtful whether this ground is sound, even though the scheme itself may not call for commendation. It is certain that our heavily subsidized railroad corporations have shown an energy and enterprise in developing our trade, and in operating their systems to the satisfaction of our shippers, and of the travelling public that we would never expect from a Government work, and have carried on their extensions with a financial success that the Intercolonial has never had. In Mr. Keefer's essay of 1850, that has been already quoted, he remarks bitterly that the subject of canal development is subordinated to the wrangling of rival lawyers; and from the present result of Governmental control in Montreal harbor, and the recent refusal of the Canal Department to make their repairs so as to get the canals ready to be opened at the date the forwarders requested, it would appear as if our politicians had not greatly advanced in states-



manship since 1850, and that for the present, the interests of the country are better served by highly privileged and subsidized companies, whose very existence depends upon their developing our natural resources, than by Government action under the control of party politicians, who cannot afford to exercise any foresight, but must fight day by day to maintain their hold on the narrow majorities on which their tenure of office depends.

MANUAL TRAINING IN PUBLIC SCHOOLS.

The system of manual training about to be introduced experimentally into the public schools of Canada by the Dominion Government, through the generous endowment given by Sir Wm. McDonald, is almost the same as that in use in some of the English schools, and is described by Jas. W. Robertson in a pamphlet recently issued.

The system of education is called English Sloyd. Sloyd is a Swedish word for "dexterity." Educational Sloyd is an entirely different thing from carpentry. The manual training room is not a workshop where operations are carried on with a view to the commercial value of the articles turned out. A workshop is a money-making institution, whereas a room for manual training —for Sloyd work—in connection with a school, is for the training and developing of the children, without regard to the intrinsic value of the work turned out, or to the length of time required to make any particular object. Sloyd work is really a series of exercises so arranged as to have educational results.

A floor area of about six hundred square feet is enough to accommodate about thirty pupils and one bench for each. A room 24 x 30 feet would be amply large; and would provide also for the instructor's bench, and for a group of pupils to watch what he was doing. Ten classes of thirty pupils each, or three hundred in all, could be passed through such a room in the week. The benches are of convenient height and size, and each one is fitted with a rack for the holding of tools and also with tools. Some of them are also fitted with a simple device for the holding of the drawings, so that the work with the tools may proceed with the drawing in full view all the time. General class instruction with the aid of a blackboard is given by some teachers in a fifteen minutes' talk, before the particular work of the half-day begins; and instruction is given also to each of the pupils individually as the work at the benches proceeds.

In some schools the first object to be made is a plant label. This involves (1) cutting to an exact length, (2) cutting the ends square by the use of a fine saw, (3) reducing to the proper thickness and width, and (4) making a taper with the same angles as those of the model. In other schools a small pointer is the first model, and in others some object equally easily made. The first article is easily made; the second introduces some slightly different use of a tool or the use of some different tool, and so they proceed, arousing, training and gratifying the child as he makes all of each one himself. It is to be remembered that the pupil makes each article wholly himself. At first he makes directly from the models. Later on he makes drawings from drawings of the models. Further on he makes his own drawings directly from the models. Then finally he is trained to make the articles from his drawings of the models. The course may be arranged on a plan of from thirty to sixty or more articles to be made by the pupil during the three years.

The lectures of Otto Salomon, the renowned director of the Seminarium for teachers at Naas, Sweden, furnished valuable suggestions on the choice of models and on the arrangement of the series of models. An authorized edition of those lectures is published under the name of "The Theory of Educational Sloyd." From it the general principles relating to the series of models are given: (1) All objects of luxury—knick-knacks—should be excluded. From an educational point of view, we must first teach what is necessary; secondly, what is useful; thirdly, if time permits, what is agreeable. These terms are, however, relative.

What is necessary to one person may be useful to another, and what may be useful to one, agreeable to another. What is a luxury in one age or country, is not necessarily so at another time or place. What is a luxury to a poor man may be a necessity to a rich. In regard to nature the terms are more absolute. What is necessary to one is necessary to all. It is necessary to eat food; it is useful to eat food sufficient, and of good quality; it is agreeable to have it well cooked and prepared.

(2) All models should be serviceable in the house. If this is to be the case, the models will vary to some extent in different schools. Not only will the models be different in different countries, but in different districts of the same country; e.g., in country schools it would not be wise to teach the manufacture of objects only useful in towns. It would be preferable to substitute models which may be used in agriculture; but in substituting other models, care must be taken not to disarrange a carefully graduated series of exercises. So, too, if the school be near a lake, objects concerning boats and fishing should receive attention. The general principle by which we should be guided is: That the series of models made in the school should give the best expression to objects needed at home or in the district.

(3) They should be capable of being finished by the children without help. Hence models should not be a part merely of something, but the whole. For this reason it has been found necessary to exclude many things which would otherwise have made useful models.

(4) The models should be of wood, and only wood should be worked in, as a rule. To this rule there are one or two exceptions, as the cloak suspender, the clothes rack, and bucket: and these have been inserted because teachers in the country districts of Sweden cannot buy them, but there is no reason why they should be retained in an English series. When it is said that the models must be made of wood, it is not implied that there is any objection to the purchase of iron fittings.

(5) The objects should not be polished or stained. In the first place, because children cannot polish well. Models are frequently spoiled by it. Many juniors cannot polish well, i.e., French polish. In the second place, it is important that children should not be taught to think too much of the surface. It is not so important that a thing look well, as that it be done well. Polishing and wood-carving exert a morally bad influence, if done to cover up bad or indifferent work. It is a degradation of

the polisher's and carver's arts to use them for such a purpose.

(6) The objects made should be such as to require as little wood as possible. Some models require much wood, but if the same exercises can be furnished by smaller objects equally useful, then these should be preferred. The value of the object must be in the child's work, and not in the amount of material used. This recommendation has a further value, inasmuch as it teaches the child to use small means in effecting ends. Children should be trained to be economical by taking care of those pieces of wood for smaller objects which they have spoiled in making larger ones.

(7) The children should be taught to work in harder and softer kinds of wood—but not in the hardest or the softest (8) Turnery and carving should be used very little. (9) Objects chosen should be such as will develop the sense of form (10) All the exercises (embraced by the particular kind of Sloyd in question) which the child is capable of making, should be properly graduated and included in the series in due proportions.

(1) The series should proceed from the easier to the more difficult, and from the simpler to the more complex; which expressions, as we have seen, are not identical in meaning. (2) A refreshing variety must be afforded. (3) In the early part of the series, the models should be capable of being quickly and easily made, and should be so progressively arranged that, later on, the objects arrived at should require more time and skill, and yet be capable of being done without help. Children expect to have results as quickly as possible. They have not sufficient patience and foresight to derive any benefit or satisfaction from results which are expected to crown their labors in a few days or months. For this reason the objects further on in the series should take more time, in order to cultivate patience and foresight. (4) In the production of the early models, few tools should be required, but as the series progress, new tools and manipulations should be introduced. (5) That every model should be so placed in the series, that the necessary qualifications for doing it exactly are found in the child, who therefore does not need the help of the teacher. It should not relatively be more difficult for a child to do one model than another. A model may be more complex, but this does not imply an increase of difficulty; for the child—when it reaches it—has acquired greater skill. A person who has used one tool will use a second better, although it be of another kind; he will use a centre bit better for having previously worked with a knife (0) The models must be so arranged that the pupils can always make not only a serviceable, but an exact copy. The degree of exactness is a very important feature. It is easy to make a table if exactness be not required. (7) That the knife—as the fundamental tool—be used frequently especially at the beginning By the fundamental tool, we understand that tool with which the *child is most acquainted and can most easily use*, hence we begin with it; secondly, that tool which cultivates the greatest amount of manual dexterity; and thirdly, the tool which in after life will be most useful to the child, and most ready to hand. These advantages the Sloyd knife possesses. We must not be understood to imply that this tool is the one most used throughout the series of models. (8) That generally in the early models the softest wood should not be used. It is more difficult to use a knife on a very soft wood than on a wood not so soft; so that it is advisable to avoid using the softest kinds of pine and fir.

THE PRACTICAL MAN.

IRON AND STEEL.

The following is from Fowler's Mechanical Engineer's Pocket Book for 1900, which contains some five hundred pages of valuable information:

1. Pig Iron.—Impure iron containing over 1.5 per cent. of carbon, and large quantities of other impurities always made in the blast furnace. Used for castings, and as the raw material for the production of malleable iron and steel.

2. Malleable or Wrought Iron.—Nearly pure iron. Has not been fused since the removal of the foreign constituents, *but has been prepared by the welding together of small masses* of spongy iron. It always contains particles of slag and oxide, the elongation of which during rolling produces the fibre. Commercial malleable iron is always made by puddling.

3. Steel.—This includes all varieties of iron containing less than 1.5 of carbon except malleable iron. It may have been fused as in crucible cast steel and mild steel, or it may have been prepared in the solid condition, as in blister steel and puddled steel; the latter is rarely if ever made now. When the steel contains less than .5 per cent. of carbon it is called mild steel, when more, hard steel. Hard steels harden when they are heated to redness and quenched in water.

PIG IRON—CONSTITUENTS AND IMPURITIES.

Pig iron is very impure, containing carbon, silicon, phosphor, sulphur and smaller quantities of other impurities. The carbon and silicon may be considered as being essential constituents. It is always smelted in the blast furnace. The iron ore, which contains oxide of iron and silica, and other earthy impurities, is charged into the furnace with coke and limestone, and air being blown in the coke burns, and a very high temperature is produced. The iron is reduced, and, combining with carbon and other substances present, forms pig iron. As various reducible constituents are always present in the materials, the iron always contains impurities. Carbon is the essential constituent in pig iron, the smallest quantity which will entitle the iron to be called pig iron is 1.5 per cent., and the largest amount the iron can take up—except in presence of large quantities of certain foreign elements—is 4½ per cent. *The carbon is present in two forms, (1) in a state of chemical* combination, (2) as intermixed flakes of graphite. The graphite has very little effect on the iron, except that it breaks the continuity, and thus weakens the metal. The combined carbon is one of the most important constituents. Its influence is to harden the metal, and, within limits to increase its tensile strength. It may vary in amount from about .08 in a soft No. 1 iron to 1½ or more in a white iron. The graphite is the carbon which is not combined. Silicon.—This constituent is always present in pig iron. Its action resembles that of carbon in many ways, and there seems to be no limit to the amount that can be taken up. Silicon has within limits a good effect on the iron, but when in large quantities makes it hard and brittle. Turner gives the amount of silicon which is best as being:

For maximum hardness, under	.8
For maximum crushing strength, about	.8
For maximum modulus of elasticity, about	1.0
For maximum density in mass, about	1.0
For maximum tensile strength, about	1.8
For maximum softness and working qualities, about	2.5
For lowest combined carbon, under	5.

Silicon has two actions, (1) a direct hardening action similar to that of carbon, only much less energetic, and (2) a tendency to throw the carbon out of the combined, and into the graphite condition, the second action being usually the more important. Thus when an iron contains, say 2.5 per cent. of silicon, this will harden the iron to some extent, but it throws the carbon almost entirely into the graphitic condition, and thus prevents the much greater hardening influence which the carbon would have if combined. Grey pig iron is usually high in silicon, whilst white is low. The amount of silicon depends largely on the temperature at which the iron is made, the higher the temperature the more silicon is reduced, so that modern hot blast irons are higher in silicon than those made years ago, when the air was sent in at a lower temperature. Sulphur is rarely present except in small quantities. It has a powerful hardening effect, tending to throw its carbon into the combined condition. It thus counteracts the action of the silicon, and the lower the silicon the more injurious is a small percentage of sulphur. Phosphorus is always present, the quantity varying from a mere trace up to three or four per cent. Phosphorus increases the fluidity of the metal, makes it run well, and set slowly; in large quantities it makes the iron hard and brittle. Manganese.—This element is almost invariably present. Like silicon it has a direct hardening action, and an indirect softening action, the latter being due to a strong tendency to eliminate sulphur. Aluminum tends to throw its carbon into the graphitic form more energetically than silicon. It also improves the *soundness of castings. Hematite or Bessemer Pig.—This iron* is made from hematite or other pure ores. It must not contain more than about .05 per cent. of phosphorus, and .01 per cent. of sulphur, and is usually high in silicon. It is used for

the manufacture of Bessemer and Siemens steel, and more rarely for foundry work. Scotch Foundry Pig.—This is largely used for foundry work. It contains from .7 to 1.1 per cent. of phosphorus and about 2.5 per cent. of silicon. It is an excellent iron for foundry purposes. There are various brands to be had, but as a rule there is but little difference between them certainly not enough to warrant its great difference in price, the prices seeming to depend more on reputation than on actual composition of the pig.

Staffordshire All Mine Pig.—This is a pig iron made in Staffordshire from ore without the addition of cinder pig. It contains .5 to .75 per cent of phosphorus.

Cinder Pig.—This is made in Staffordshire from tap cinder, it is usually high in phosphorus, and is often blown, i.e., full of cavities.

Cleveland Pig.—This is a pig iron made in the Middlesborough district from Cleveland ore. It usually contains about 1 per cent. of phosphorus and 2.5 per cent. of silicon.

Basic Pig.—This is a pig iron made specially for the manufacture of basic steel. It contains 1 per cent. or less of silicon, and from 1 to 3 per cent. of phosphorus.

Cold Blast Pig.—Is iron made in furnaces supplied with a cold blast; it is usually low in silicon.

Charcoal Pig—Is pig iron made in furnaces in which charcoal is used as a fuel. It is now rarely made.

Silicon Iron, or Siliconeisen—Is a pig iron containing 10 per cent. or more of silicon. It is made for special purposes, or occasionally by accident, which is usually called glazed iron. It is white in color, hard and brittle.

Spiegeleisen—Is an alloy of iron and manganese, containing 20 per cent. or so of manganese. It breaks with a fracture showing large mirror-like crystalline pieces, with a high metallic lustre—whence its name.

Ferro-Manganese—Is an alloy of manganese and iron, often containing over 80 per cent. of manganese. It breaks with a granular fracture of a bronze white color. Spiegeleisen and ferro-manganese are used in the manufacture of mild steel.

Chrome Iron—Is an alloy of chromium and iron.

Ferro-Aluminum—Is an alloy of iron and aluminum.

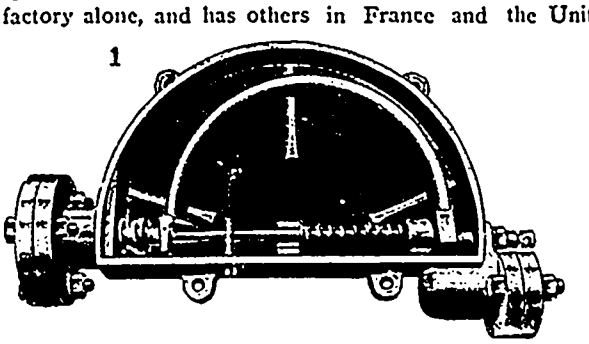
GRADING PIG IRON.

Pig iron is classified into a series of grades, usually 1, 2, 3, 4, mottled white, though the classification varies in different districts. No. 1 is always the grayest iron, and the last, whether indicated by a number or a name, is white. No. 1 is the grayest iron, the fracture is largely crystalline, flakes of graphite being distinctly seen. It is soft and has a low tensile strength, but flows readily when cast. It is usually high in silicon, high in graphites and carbon, but low in combined carbon (about 15 per cent.) No. 2 is similar to No. 1, but the crystallization is less distinct; it is stronger and harder than No. 1, and contains more combined carbon. No. 3 is still closer in grain, and the crystals of graphite are small and hardly discernible. It is stronger and harder than No. 2, and contains usually less silicon and more combined carbon than the lower numbers. No. 4 is very close in grain, and breaks with a dark gray, granular fracture. It is harder and stronger than the lower numbers, but does not flow so freely when melted. It is often subdivided into two. No. 4 (foundry) is, with Nos. 1, 2 and 3, useful for foundry purposes, and No. 4 (forge) is too close and hard, and is only used for the preparation of malleable iron by puddling. White Iron—Is very hard and brittle and has a low tensile but high crushing strength. The silicon is usually low, sulphur often high: the fracture is smooth, almost silver white, and shows no graphite, the carbon being almost all in the combined form. Mottled Iron—This consists of matrix of white iron, with spots of a close-grained gray iron scattered through it. It is therefore intermediate between white iron and No. 4. No. 4 forge—mottled and white—irons are only used for conversion into malleable iron.

The grade is judged entirely by the appearance of the fracture, and the system of grading is most unreliable and unsatisfactory, and there is no standard by which a grade can be judged. One of the great needs in the iron trade is a better system of grading. The only system which has been suggested is based on the percentage of combined carbon, but as this could only be determined by analysis, it is not likely to displace the present rough and ready system.

A STEAM TRAP.

One of the most interesting exhibits at the recent Export Exhibition in Philadelphia was that of the Heintz Steam Saver, the Canadian agents for which are the James Morrison Brass Mnfg Company, 89 Adelaide street west, Toronto. The device was shown in many forms and applications, and for the purpose of better observation, the pipes leading to and from such traps as were in actual service had sections of gauge glass inserted, so that an ocular demonstration was possible, that proved exceedingly interesting to many steam users who had occasion to study economy as well as efficiency. The great development that has taken place in the past five years of the Heintz plants was a topic of much comment amongst people familiar with it. When the inventor, M. Heintz, of Liege, Belgium, first began business in 1874 he was his own workman, salesman, bookkeeper and engineer, and it was several years before he had advanced sufficiently with his efforts to justify his employing an assistant. The development was remarkably rapid from that on, and to-day his plant forms one of the most striking in a locality that abounds in large industries. He employs some six hundred people in this one factory alone, and has others in France and the United



States. To-day the American sales are said to be enormous. The field of usefulness for the Heintz traps is proportionately greater in Canada than in the United States, for the reason that the necessity is greater owing to the severer winters and long continued cold weather; and it is not unreasonable to look for a larger business for this article in the near future. The Canadian agents make a most favorable showing to prospective customers, and it would seem as if, from the nature of it, no steam user could afford to ignore it. It is at least possible under their proposition to ascertain definitely whether or not a steam plant is as well equipped as it is capable of being, without this experiment or trial costing the user any money, if it proved to be unsuccessful, and it would seem as though an offer of this character would appeal to every user of steam.

The inventor claims (and his claims are said to be substantiated by users), that the adoption of his device will save from 10 to 50 per cent. in fuel, and at the same time increase the efficiency of the apparatus trapped, from 10 to 40 per cent.

It is a singular fact that the Heintz trap or Steam Saver enjoys no patent right protection. Anyone who thinks he is capable of doing so, is at liberty to make them, and in the past twenty years, something like fifty or sixty companies have been organized for the purpose of making the effort. That these companies all failed, one after another, speaks volumes for the acumen displayed by Mr. Heintz in not taking out patents for his perfected apparatus, the reason he gave at the time being that as it required seven years constant effort on his part to discover how to make the Heintz trap, he did not believe it was possible for any one else to find out any more quickly than he did.

—The B. F. Sturtevant Co., of Boston, Mass., reports an increase of nearly 40 per cent. in the volume of its business for 1899 over that of the previous year. The shipments, both foreign and domestic, included fan blowers for all purposes, heating, ventilating, drying and mechanical draft apparatus, engines, electrical apparatus, etc. During the past year an addition, covering 20,000 square feet, has been made for the use of the electrical department, which has shown the most rapid growth, the output having more than doubled during the year, and covering principally electric fans and special generating sets. The sale of mechanical draft apparatus has been practically quadrupled while the output of engines has increased one-third over that of the preceding year, and has included many special designs.

COMBUSTION.

C.A.S.E. Executive Office,
Lesson Paper No. 4.

Heat and motion are so intimately connected together that you cannot have one without the other. Any body of matter that is absolutely still would be at absolute zero, or 461° below zero on Fahrenheit's scale. Tyndall tells us that heat is motion; and by combustion we mean the combination of chemical elements commonly called burning. All matter or any body of any material is either an element, a compound or a mixture. Iron, gold, silver and oxygen are elements, wood, water and carbonic acid are compounds. Any substance that can be decom posed or divided into other substances is called a compound. Lime may be divided into two other substances, calcium and oxygen, and is a compound. There are many substances that cannot by any known process be subdivided into other substances, such as gold, sulphur, iron and arsenic; this being the case they are called elements. The elements we will consider are hydrogen, and its symbol is H; oxygen, O; nitrogen, N; carbon, C; sulphur, S. In referring to these elements the symbol is the first letter of its name; as C for carbon, etc. When two or more elements are brought together under favorable circumstances, they will combine and form a new substance entirely different from either of the elements.

Hydrogen is a very light gas and burns with a steady blue flame, and it burns because of a chemical combination with the oxygen of the air, and the product of this combination is water. Just as chemical combination produces heat, so will chemical separation absorb heat. If carbon and oxygen are brought together at a high temperature they form carbon dioxide; hydrogen and oxygen form water; hydrogen, nitrogen and oxygen when combined under certain proportions form nitric acid. Ammonia is formed by a combination of nitrogen and hydrogen, and is a very different gas from either of its components. In making these combinations a certain amount of heat is produced, and if these elements are separated they will absorb exactly the same amount of heat produced by their combination. It is supposed by chemists that equal volumes of all gases, whether simple as elements or compounded, contain the same number of molecules, and that each molecule is composed of two atoms. Suppose that hydrogen and oxygen are in contact with each other and are heated, they will combine and form steam or water. It will be found that two atoms of hydrogen will be seized by one atom of oxygen to form one molecule of water, therefore the volume of hydrogen must be double that of the oxygen. Hence we have for a symbol H_2O, that is two parts of hydrogen to one of oxygen. Hydrogen and carbon also form a compound, each atom of carbon seizes four atoms of hydrogen and forms a molecule of marsh gas, the symbol for which is CH_4.

Mixtures may be formed of two or more elements that may be mixed together, but will not combine to form a new substance. The ordinary atmospheric air is an example. It is composed of oxygen and nitrogen; 23 parts by weight of O to 77 parts of N; these two gases are not chemically combined, they are only mixed. Combustion is only a very rapid chemical combination, in which the oxygen of the air combines with the carbon in the fuel. Oxygen has an attraction for nearly all the elements, but more especially for carbon, and when they meet at their igniting temperature they combine with great rapidity, and make a roaring fire, and give out a great quantity of heat, as in a boiler furnace.

The elements that enter into combustion are carbon, oxygen and hydrogen. When carbon and oxygen combine they form CO_2, or carbon dioxide, and when oxygen and hydrogen combine they form water, H_2O. These are the products of combustion.

In our furnaces we take the oxygen from the air, and the nitrogen passes through the fire with it, but takes no part in the combustion. Now CO_2 or carbon dioxide is composed of 12 parts by weight of carbon to 32 of oxygen. Hence to burn a pound of carbon requires $32 \div 12 = 2\ 2\text{-}3$ lbs. of oxygen, but it will take 11.6 lbs. of air to supply the 2 2-3 lbs. of oxygen, because only 23 per cent. of the air is oxygen; 1 lb. of carbon, if combustion is complete, will give 14,580 B T U., and the product is CO_2, or carbon dioxide; but if carbon oxide, CO, is the product the result is only 4,451 B T U. At the commencement of combustion 1 lb. of carbon (C) unites with 2.66 lbs. of oxygen, and forms 3.66 lbs. of carbon dioxide, setting free 14,580 heat units. The volume of the CO_2 is the same as that of the air from which it was formed, but its density is greater and the combustion is complete, but if the air is wanting in quantity the 3.66 lbs. of CO_2 absorbs 1 lb. of carbon, making 4.66 lbs. of carbonic oxide, CO, or marsh gas, and the heat set free by these 2 lbs. of carbon is 8,902.8 heat units, or 4,451.4 per lb. of carbon. The combustion of a lb. of carbon to make (CO) only requires ½ the quantity of oxygen that is necessary to form (CO_2), because in the gas (CO) one atom of carbon seizes only one atom of oxygen instead of two. To burn 1 lb. of carbon to carbon dioxide (CO_2), requires 11 6 lbs. of air, while to burn it to carbon oxide (CO) would *only* require 5.8 lbs. of air. The quantities of air required for combustion of fuel can be seen from the following table:

1 lb.	Air at 62°	Product.
Hydrogen.....	34.8 lbs. or 457 cu. ft.	Water, nitrogen.
Carbon burned to CO_2..	11.6 lbs. or 152 cu. ft.	Carbon dioxide, nitrogen.
Carbon burned to CO...	5.8 lbs. or 76 cu. ft.	Carbon monoxide, nitrogen.

The air required for the combustion of a pound of fuel is easily determined if you know the percentages of carbon and hydrogen it contains. Example: Your coal contains 90 per cent. carbon, and 10 per cent. hydrogen; now to burn the carbon you would need $152 \times 90 \div 100 = 136.8$ cu. ft. of air, and for the hydrogen, $457 \times 10 \div 100 = 45.7$, $45.7 + 136.8 = 182.5$ cu. ft. of air.

Rule to find the air required to burn a given fuel: To the carbon in the fuel add three times the hydrogen, multiply the sum by 1.52, and the result will be the cubic feet of air required. Example: Composition of coal being carbon, 84; hydrogen, 5; oxygen, 7; ash, 4; to perfectly burn 1 lb. of such a fuel by the above rule: Ans.$= 1.52 \times (C + 3H) = 1.52 \times (84 + 3 \times 5) = 150.8$ cubic feet.

The quantities of heat produced by complete combustion of the elements composing fuels are for

Hydrogen—62,000 B T U per lb.
Carbon to CO_2—14,580 B T U per lb.
Carbon to CO—4,400 B T U per lb.

The chief consideration for economical combustion is the correct air supply. It is not possible to attain perfect combustion with the theoretical amount of air, which is 11.6 or 150 cubic feet per lb. of coal, because in the conditions obtained in our furnaces we cannot get the air into perfect contact with the burning carbon of the coal, for this reason we have to supply about double the quantity of air or 24 lbs. If more air than is actually needed is allowed into the furnace it simply carries heat from the furnace to the chimney, while if too little is used we get marsh gas instead of carbon dioxide. If it were possible to heat the air during the short time it is going through the fuel up to the heat of the fuel the theoretical amount would be all we would require for perfect combustion; one of our losses in the furnace is the driving off by the heat of the hydrocarbons contained in all our bituminous coals, before these coals really begin to burn. These gases are driven off, and are very likely to escape unburned up the chimney. The admission of a small quantity of air above the fire will sometimes burn them. If they are not burned they escape as black smoke.

The best smoke burner in the world is a fireman that knows how to handle his fires in well set boilers with ample draft.

A. M. WICKENS, Secretary.

—The new addition to the works of the B. F. Sturtevant Co., Boston, Mass., which was designed to meet the requirements of its rapidly growing electrical department, is already overcrowded, although completed only a few months ago. Numerous special orders for electric fans and generating sets for the U. S. navy are being filled, and the construction of a complete line of enclosed motors of new design is now under way.

RAILWAY BUILDING IN MANITOBA.

Manitoba has seen a considerable extension of its railway lines during the past year. Construction was carried on upon thirteen lines, of which twelve were in Manitoba, and one in Northwestern Ontario. In the territories west of Manitoba no new railway building has been done, except the Pipestone branch of the Canadian Pacific Railway, which was built across the Manitoba boundary and on westward some miles into Assiniboia territory. The southern half of the province of Manitoba is fast becoming a network of railways, says The Winnipeg Commercial in a recent issue. The new mileage for the year was 351 miles. The province of Manitoba has 2,000 miles of railway. During the past year the C.P.R. Co. has carried on new railway construction at points within Manitoba, including the extension of the Northwest Central and the short link connecting the latter railway with the Rapid City branch of the Manitoba and Northwestern. These two roads are both now controlled by the Canadian Pacific Railway Company. Two new branches in Southern Manitoba, known as the Snowflake and Wascada branches, respectively, are short feeders to the Deloraine branch, affording better railway facilities to well settled agricultural districts south of the Deloraine branch. These two new branches have been completed and are now being operated. The Snowflake branch has a total length of a little over 17 miles, and the Wascada branch, which starts at Deloraine, is something over 18 miles long. A little north from Deloraine we have the Pipestone branch, where a considerable amount of work has been done. An extension of 17 miles was graded on this branch during the summer of 1898, westward from Reston. This 17 miles was completed during the past year, and an additional 23 miles has been graded, and is now mostly ironed, making 40 miles of new road added to the Pipestone branch during the year. This branch is giving much needed railway facilities to a fairly well settled agricultural section. About fifteen miles of the new portion of the Pipestone branch, west of Reston, is in Manitoba and the balance of 25 miles is in Assiniboia territory. The C.P.R. has extended the Northwest Central 22 miles west of the former terminus at Hamiota, and the extension is fully completed and in operation. A town called Miniota has quickly grown up at the new terminus of the line. A three-mile link has been built at Rapid City, between the Northwest Central and the Manitoba and Northwestern Railway. The McGregor-Varcoe branch of the C.P.R. will be about 48 miles long and one-half was graded this season. The Lac du Bonnet branch will run 22 miles from Molson Station on the C.P.R. to Lac du Bonnet. Ten miles are now under construction, and will be completed before spring.

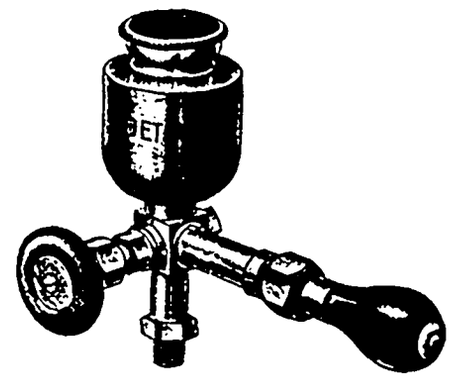
The Northern Pacific Railway has constructed about 30 miles of new railway in Manitoba during the past year. This consists of a new branch, extending in a northerly direction from the town of Portage la Prairie, a distance of nine miles, toward Lake Manitoba, and also an extension of the Portage la Prairie branch in a northwesterly direction, from Portage la Prairie, a distance of 20 miles. The new branch extending toward Lake Manitoba will be known as the Lake branch. The terminal of this branch has been named Oakland. The road runs through a fine wheat country.

The first section of the Manitoba Southeastern was built in 1898, extending from St. Boniface to Marchand, a distance of 46 miles. The work was taken up again last spring and is still being pushed. Over 30 miles have been completed, and it is the intention to continue the work until the road is ironed to War Road, in Minnesota, making in all an addition of about 68 miles for this season's operation.

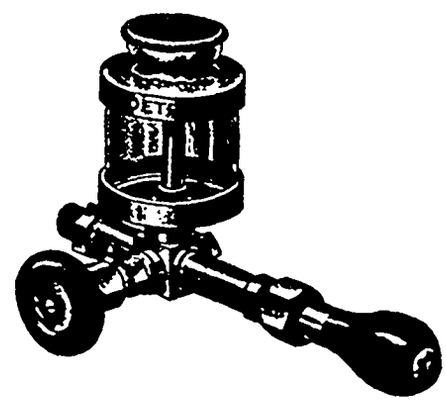
The Canada Northern Railway has continued operations as was expected during the past year. During 1898 this new road was extended in a northerly direction from Sifton to Cowan, a distance of 56 miles. During 1899 a further extension of about 65 miles has been made, from Cowan to a point about 11 miles beyond Birch River. Leaving Cowan, the new line runs in a westerly direction about 30 miles to Swan River, and then turns north again, passing to the east of Porcupine mountain. This road is opening up an entirely new country, in the northern part of Manitoba, which is well adapted to mixed farming and stockraising. There are also large and valuable timber areas which will thus be opened up. The length of the main line of the Canadian Northern, with the addition now about completed, is 240 miles. Construction was begun during the past year on a new branch, running about due westward from the town of Dauphin. This road is known as the Gilbert Plains branch. Work is going on on this branch still, the object being to complete 15 miles at once, and a further extension of probably about 20 miles will be made during 1900.

INTERCHANGEABLE OIL PUMPS.

The accompanying cuts show the new style oil pumps that have recently been put upon the market by the Detroit Lubri-



cator Co., Detroit, Mich. An advantage claimed for them, over the ordinary styles, is that the body can be easily removed from the frame should it be desirable to do so for the purpose of removing any dirt or sediment deposited by the oil, without removing the oil pump proper from the steam pipe. Each style is made with both vertical and horizontal connection shanks, and the bodies of the whole four styles, of the same sizes, are inter-



changeable. For instance, the body of the brass body oil pump with vertical connecting shank can be interchanged with the glass body of the pump shown with horizontal shank, etc. Each style is also equipped with strainer filler. The manufacturers have issued a pamphlet showing these oil pumps, also their new style glass and brass oilers, and will send same to any address on application.

—By Order-in-Council, passed January 18th, the Ontario Government has prohibited the export of pulpwood cut on Crown lands after May 1st. This is a step in the direction of home manufacturing which has been urged so often in The Canadian Engineer.

—An ingenious arrangement to prevent overcrowding of stairways and elevators when entering or leaving a building is used in the main office of the International Correspondence Schools, Scranton, Pa. The time of entering and leaving the building is regulated by clocks on each of the five floors. On the lower floors the clocks are set correctly, but on the upper floors they are a few minutes slow, so that the employees on the lower floors are at their desks before those on the upper floors are due at the building. In leaving the building the employees on the upper floors do not leave their desks until several minutes later than those on the lower floors. Over 500 people are employed in the building, which is used exclusively by the International Correspondence Schools. This institution has over 70 courses of instruction by mail, and its students may be found in all parts of the world.

OILSTONES, HOW TO SELECT AND USE THEM

If the iron be blunt and he do not whet the edge, then must he put to more strength.—Ecclesiastes x., 10.

No article in a mechanic's kit of tools is of greater importance than the oilstone, for no matter how good the quality of his edge tools, they cannot do good work unless properly sharpened. If it were possible to show in figures the total loss in damaged tools and wasted time resulting every year from the use of poor and unsuitable oilstones, the sum would be amazing—far exceeding, doubtless, the total amount of oilstones sold. Notwithstanding this fact, very few mechanics and still fewer tool dealers understand the particular merits of the different oilstones on the market, or how to select them for different purposes. The object of this article is to give a few practical suggestions on the selection, use and care of oilstones, in such terms that the amateur as well as the experienced mechanic may obtain a clear understanding of the subject, and benefit thereby.

Far in the past, while man was fighting his way up from his barbaric condition to civilization, the sharpening stone was one of his most important tools. Old stone implements and weapons discovered in caves, mounds and excavations in various parts of the world give evidence of this; for among those ancient relics have been found stone arrowheads and crude axes with sharp or ground edges. At first, it is probable that these were ground down by rubbing on large rocks. Later on in man's progress, when it was discovered that metal made better edge tools than stone, the sharpening stone became a still more important factor; more care was taken in selecting the kind of stone for grinding these tools, and instead of rubbing the tools on large boulders, he evidently broke off small pieces of rock and faced them by rubbing together.

Many pieces of hones and whetstones of various kinds have been found in the excavations of Pompeii and other ancient cities. Coming down to the time when the art of transmitting written records had been learned, we find whetstones referred to frequently by the earliest historians. The word "whet," as referring to the sharpening of swords and iron tools and weapons, occurs several times in the Bible, and the historian Pliny, writing over 1800 years ago, tells us that there were many different kinds of stone used in those days for sharpening iron instruments. He states that the best ones came from Crete, and gave better results when used with oil. As the well-known Turkey oilstone is still found in Crete, although quarried principally in Asia Minor, it is probable that this is the stone Pliny refers to, which would indicate that the Turkey stone has been in use for nearly two thousand years. It was the principal oilstone of the civilized world until the discovery of Arkansas and Washita stones in the early part of the present century. These two kinds of stone, which are the same geological formation, but vary in hardness and fineness, were discovered in the Ozark Mountains of the state of Arkansas, U. S., somewhere about the year 1815, when it was quickly perceived that they were superior to anything ever found for sharpening edge tools. In those days of slow and costly transportation it was very expensive getting the stone into eastern markets, the rough rock bringing as high sometimes as $2 per pound. In spite of this, the remarkable sharpening qualities of these stones rapidly increased the demand for them, until to-day they are the two leading oilstones of the world.

The first point to be considered in selecting an oilstone is the purpose for which it is required; many mechanics make the common mistake of expecting one oilstone to answer all purposes. It would be just as reasonable for a carpenter to use a coarse-tooth crosscut saw on fine cabinet work, as to expect a coarse-grained fast-cutting oilstone to impart a fine razor edge. The sharpening qualities of a stone depend upon the size of its grains of grit, or crystals. In a coarse-grit stone, these grains are large, and cut deep, far-apart furrows in the tool, leaving a coarse, rough edge. Such stones cut away steel faster than a fine-grained stone (as a coarse-tooth saw cuts faster than a fine-tooth). The coarse edge left by such a stone is all right for working pine or soft woods in which the cells are large, but for working hardwood or any kind of fine work, the tool should be finished on a finer-grained stone. It is therefore safe to lay down the rule that a good mechanic should have at least two oilstones, one for grinding down dull tools, or imparting a coarse edge, and another for finishing. There are some stones of medium grit which answer well for many purposes, but they cannot cut as rapidly as the coarse stone, nor impart so smooth an edge as the fine. A carefully selected Washita stone is stated to be the best general purpose oilstone. The hardness of an oilstone is also an important factor in determining its cutting qualities. For sharpening ordinary tools with broad blades or edges, a medium-soft, fast-wearing stone should be chosen. For sharpening narrow chisels, engravers' tools or pointed instruments, however, it is necessary to use a very hard stone, as otherwise the stone will soon be cut full of grooves or furrows. The difference between a hard and soft Washita stone can be told in several ways; first, by the sight, as in a soft stone the minute pores are usually apparent to the eye, and the surface of the stone will have an open, granulated appearance; second, by scratching with a knifeblade, as a soft stone can be quite readily scratched on the edges, whereas a hard stone will show very little impression; third, by the sound, holding the stone loosely by one end between the thumb and fore-finger and tapping it with a knife, light hammer or any metal substance; the soft stone will sound dead like wood, whereas a hard stone gives forth a metallic ring. Having decided for what purpose the stone is to be used, the next thing is to find a stone that has the desired qualities. This leads to the consideration of the principal oilstones on the market.

The oilstones most widely in use at the present time are: The Washita, Arkansas, Turkey and Hindostan. Although these stones are well known to most mechanics, a brief description of them may not be out of place. The Washita and Arkansas stones are quarried in the state of Arkansas, near the celebrated Hot Springs. They are found in parallel veins, or "mineral leads," and are quite similar in general appearance, both being white or nearly so, but the Arkansas is very much harder, more compact and finer grained than the Washita. There are various qualities of Arkansas and Washita rock, from a perfect, fast-cutting grit to the vitreous, flinty rock that is practically worthless. To the ordinary observer, the appearance of the good stone and the worthless is so nearly the same that it is always advisable to buy the known brand of a reliable manufacturer. At frequent periods, since these stones first came on the market, inferior qualities have been put out by irresponsible or inexperienced manufacturers, which has done serious injury to their reputation in some localities. For the past few years, however, the output of the best quarries has, it is stated, been controlled by one firm.* As this firm has taken great care to select and manufacture only the best rock, both reputation and demand have rapidly increased.

The Arkansas stone is found in two grades, known as hard and soft. Hard Arkansas is composed of nearly 99½% pure silica (one of the hardest, sharpest cutting minerals), and is about 16 times harder than ordinary marble. Steel will not scratch it, but it, in turn, will cut the hardest steel very rapidly. It is white or bluish white in color, and by reason of its very fine, hard grit, is particularly adapted to sharpening fine tools requiring very keen, smooth edges, such as are used by engravers, watchmakers, diesinkers, wood and ivory carvers, surgeons, etc. Owing to the very limited supply of good Arkansas rock, and to the great difficulty in quarrying and manufacturing it (about 85 per cent. being waste), it is necessarily very high-priced, a first-quality stone being worth $2.50 per pound at retail. A stone of extra large size or special shape is worth even more than this. Soft Arkansas is of the same composition as the hard, but is more porous, hence does not impart quite so fine an edge. It is used very largely by machinists, workers in hard wood, cutlers and mechanics in general as a finishing stone. It is carried in stock by most tool dealers, and generally sells at about one-third less price than hard Arkansas.

The Washita oilstone is the most widely used by carpenters and joiners. It has crowded the Turkey stone almost entirely out of America, and is fast superseding it in Europe and other countries. It is composed of nearly pure silica, but is much more porous than the Arkansas stone. It is stated by geologists that a cubic inch of perfectly crystalized Washita stone contains over eight million (8,000,000) cavities, or pores. It is the presence of this vast quantity of evenly distributed pores which enables the grit grains, or crystals (the teeth of the stone) to work freely and thus make it the fastest cutting fine-grained stone.

*The Pike Manufacturing Co., of Pike Station, N.H.

There is no oilstone in which greatef experience is required to select understandingly than the Washita, for it can be found in all degrees of hardness and fineness. For ordinary carpenters' tools, such as planes, bits, chisels, gouges, etc., a medium-soft, even-grained, fast-cutting Washita should be chosen. The Washita stone is put on the market in several qualities by the Pike Manufacturing Co. The Lily White brand is selected by experts from the very best rock; each stone is tested and labeled, telling whether it is a soft, medium coarse or a hard, medium fine grit. Every Lily White stone, whether of coarse or fine selection, is of uniform grit throughout, free from hard or soft spots, or streaks, and of sharp-cutting grit. The No. 1 quality Washita is a well-finished stone, free from cracks, quartz or noticeable imperfections. It is the most largely used brand on account of its lower price, but as there are both hard and soft stones in this grade, and they are not labeled nor warranted, the stone should be selected by a thoroughly experienced judge. The No. 2 quality Washita is, as its name would imply, a second-quality stone. It usually contains some quartz streaks, "sand holes" or other imperfections. In addition to the above-named grades of Washita stone, there is also a brand known as the Rosy Red, which is very similar in cutting qualities to the Lily White, except that it is generally a little softer and coarser. This stone is streaked with orange or dull red color, which in no way affects the grit, but indicates a soft, porous nature. It is a guaranteed brand, and is well adapted for grinding down dull tools or wherever rapid work is required.

The Turkey oilstone, already mentioned, was the leading oilstone for mechanics' tools for many centuries previous to the discovery of the Washita. It is bluish gray in color, with frequent white spots and streaks. It is composed of about 70 per cent. silica, mingled with 30 per cent. lime, clay and iron. The white spots and lines are calcite, or lime, which wear away quickly, leaving holes and rough cavities in the stone. The stone also frequently comes apart in these lines as soon as it is oil soaked. It is nearly impossible to get a perfect Turkey stone, that is, one which is free from these lime streaks or other imperfections. A good Turkey stone will impart a fine edge, but no finer than a fine-grained Washita, while it does not cut steel so fast. It sells for about the same price as Lily White Washita, but very few Turkey stones are now sold in America. Hindostan, although usually called an oilstone, can be used with water with equally good results. It is a very fine-grained sandstone, and is undoubtedly the best low-priced sharpening stone for mechanics' tools. Its cutting qualities are due to small grains of silica, which are remarkably uniform in size in this stone. It is a fast-cutting stone, but owing to its softness, the powder or grit which is cut from the stone soon forms a mud that clogs the pores and makes it cut more slowly unless the stone is kept free by the plentiful use of water. By using a little oil and leaving this dust on top of the stone a fine surface is given the stone, which produces a very fine edge on the tool. It is a very good stone for imparting a quick medium coarse edge, and is used very largely by amateurs and those who do not have to use an oilstone very often. It is sold in three grades, as follows: Export extra quality, which is the finest grained, hardest Hindostan, white or yellowish white in color; Washita finish quality, which is well finished, grayish white stone; and the No. 1 quality, which is generally a very roughly finished stone and varies in color from a bluish gray to almost a yellow. Hindostan stones generally retail at from 10 to 35 cents apiece, according to size and quality.

In our next issue we will deal with other oilstones, and how to use them, also giving a few remarks about stones made from corundum and emery.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

The officers and members of Montreal No. 1, C.A.S.E., met at the residence of J. J. York, mechanical superintendent of the Canada Sugar Refining Company, January 27th, to present him with a handsome silver tea set and tray appropriately engraved. The presentation was made by the treasurer, T. Ryan, with a few well chosen remarks on behalf of the members of the association. Mrs. York was also presented with a bouquet of roses. After thanking his friends for their present to Mrs. York and himself, Mr. York invited all present to supper, and a pleasant evening was spent in songs, etc.

J. M. Williams, chemist for the wholesale drug firm of Winer & Co., gave an address before the Hamilton Branch C.A.S.E. at the monthly meeting, January 16th. The subject was "Boiler Feed Water," and it was skilfully handled, the speaker illustrating his subject as he went, on a blackboard. Mr Williams divided his subject into several parts, viz., water in the abstract, water as we find it, water for the boiler, and water in the boiler. Under the first head he explained the component parts of water and their chemical relation. Under the second head, the different kinds of water, rain, spring, lake and salt water were dwelt on, and their merits pointed out. The third division, water for the boiler, was dealt with at some length, Mr. Williams stating the condition and quality of water to be used for such purpose. The altered condition of water subjected to heat and the actions of chemicals was also dealt with. Finally, the speaker explained the cause of the formation of scale on a boiler and the various kinds of corrosion that boilers are subjected to.

C.A.S.E., Toronto No. 1, held its regular meeting on Wednesday, January 17th. The attendance was good, and the members had a treat in the way of a paper by E. J. Philip, on "Ice Making and Refrigerating Machinery." The date of the annual "At Home" was fixed, and it will be held in the Confederation Life Building on Wednesday, February 14th.

WE ARE WELL HATED.

Wm. Kennedy, C.E., of Montreal, has returned to Canada after an extensive tour through Great Britain and the Continent. As may be imagined, one so observant as Mr. Kennedy would see a great deal of interest from the standpoint of a civil engineer, as well as from that of a politician. In noticing the development of manufactures on the continent, particularly in countries like Switzerland and Austria, it was curious to observe how a Chinese conservatism can exist side by side with the most revolutionary notions of scientific progress. In the immediate neighborhood of a factory operated by a modern electric plant and equipped with the latest machinery one may see some old mill whose primitive wooden machinery is moved by an ancient undershot or overshot water wheel, or a lumber mill containing wheel pits where saws are still operated partly or wholly by hand. And yet the old mill seems to have a fair hold on life, if not positively thriving in these lands. Mr. Kennedy confirms the reports brought by so many other tourists of the prevailing hatred of Britain throughout Europe, even among those nations who have not so much as a sentimental cause of quarrel with the British people, and whose national liberties, if British power were destroyed, would not be worth a week's purchase. This hatred seems to be born at least partly of ignorance of Great Britain's real position and motives, and of this ignorance there appears to be a colossal stock among otherwise well educated people. A highly educated Swiss gentleman, who could speak several languages, asked Mr. Kennedy with the utmost seriousness, whether there was really any friendly feeling in Canada towards Great Britain. In the course of conversation this gentleman disclosed his real notions concerning this country, which were that Canada was held in subjection to Great Britain by military force, and that Canadians were only awaiting a good opportunity to "shake off the yoke," and that any contributions in men to help the Mother Country in the Boer War were raised by a sort of conscription such as ruled in Germany or France. It is needless to say that the fantastic reports circulated through the Leyds' agencies regarding Britain's relations with South Africa are fully believed by the average European, while it is difficult for any friend of Great Britain to get a hearing among these people.

NEW CATALOGUES.

We have received the catalogue of the Standard Tool Co., Cleveland, O. It contains some 80 pages, devoted to the goods made by this firm, and differs but slightly from catalogues published by the original makers of twist drills in the United States, the main point of distinction being a red label in the shape of a shield which ornaments the top of each page, and other blank spaces.

ONTARIO MINERALS.

The following table presents by quantities and values the statistics of metallic production in Ontario for nine months ending September 30, 1899, and for twelve months ending December 31 in the years 1896 and 1893 respectively, as published in the Report of Bureau of Mines, Vol. VIII, second part:

Metals	1899 (9 mos.)		1896 (12 mos.)		1893 (12 mos.)	
	oz.	$	oz.	$	oz.	$
Gold...	20,210	318,212	7,154	121,848	1,695	32,960
Silver..	98,000	58,800	.....	.....	.....	.....
	lb.		lb.		lb.	
Nickel.	4,608,000	566,633	3,897,000	357,000	3,306,000	454,702
Copper.	4,642,000		3,736,000	130,660	2,862,000	115,200
	tons.		tons.		tons.	
Pig Iron	48,216	693,455	28,302	353,780	.....	.....

No silver was produced in the province in 1893 or 1896. The mines were closed down in 1892, and were not reopened until 1898. The first production of pig iron after an interval of more than thirty years was in 1896, and the first production of gold after almost as long an interval was in 1892. The total value of metallic products in 1893 was $602,862, and in 1896 $963,288. For the nine months of the present year it has been $1,637,100, and if the same rate of production be maintained to the end of the year it will reach $2,200,000. The total value of the metals produced in the province for the twelve months of last year was $1,655,968, made up of $290,919 gold, $51,960 silver, $514,220 nickel, $268,080 copper, and $530,789 pig iron. The revenue from sales and leases of mineral lands has been $147,665 for the nine months of the present year, as compared with $97,762 for the whole of 1898, $40,588 for 1896 and $26,159 for 1893.

"TEMPERATURE."

Editor CANADIAN ENGINEER:

Under the above heading in your January issue the following question is worked out in detail:

"If water is at the temperature of 60° F., how many pounds of it will it take to condense 1 lb. of steam at 5 lbs. pressure, the resultant water to be 110° F. ?"

The answer is given as 20.8 lbs.

The following will show that an error has been made. The water is raised from 60° to 110°, or each pound takes up 50 heat units, and as the total number of heat units to be taken up is 1,073, therefore $\frac{1073}{50} = 21.46$ lbs. water required.

Let x = number of lbs. of water required.
t = initial temperature of water.
t_1 = final temperature of water.
H = heat units in steam.

The loss of heat from the steam = the gain of heat by the water

$$xH - (t_1 - 32) = x(t_1 - t)$$
$$H - t_1 + 32 = x(t_1 - t)$$
$$1151 - 110 + 32 = x(100 - 60)$$
$$\therefore x = \frac{1073}{50} = 21.46 \text{ lbs.}$$

The error arises in treating one quantity "from 32" and the other from zero, making a difference of fully 3 per cent. This error is commonly made in calculations of the kind.

Toronto, January 24th, 1900. A. WOOD.

AMERICAN STOKER CO. VS. GENERAL ENGINEERING CO.

In our October issue a short history was given of the case of the General Engineering Co., of Ontario, Ltd., vs. the American Stoker Co. and the Dominion Cotton Mills Co., of Montreal. The original action, the reader may remember, was brought to recover damages for the infringement of the patents held by the General Engineering Co. on the Jones Underfeed Stoker, and to restrain the defendants from using or erecting these stokers in Canada. The action was carried by the defendant companies from one court to another, till it reached the Exchequer Court, to which it had been taken when our last report was given. The Exchequer Court had given a strong judgment in favor of the General Engineering Co., granting the injunction asked for and restraining the defendants from setting up or using any of the Jones Underfeed Stokers in Canada, with damages. This judgment confirmed the rights of the General Engineering Co. to the Jones' patents, which the American Stoker Co. was adjudged to have infringed. A new point was now raised for the first time, we understand, in connection with the Canadian patent law, and that was the contention by the American Stoker Co. that the Jones patent became invalid in Canada by reason of the expiry of the British and Italian patents for the same invention. In a judgment handed down last month the court held that the American Stoker Co. were not entitled to a writ of *scire facias* for the repeal of the patent in question on this ground. The judgment, however, did not go into the merits of one of the questions raised "as to whether the Canadian patent referred to means a patent issued here after the foreign patent has been issued, or if it means a Canadian patent applied for after the foreign patent has issued. The identity of the Canadian and Italian patents was disputed, but was not dealt with by His Lordship, neither was the question of whether the expiration of a foreign patent by forfeiture before its potential term expired would operate as a termination of the Canadian patent." The court gave permission to the defendants to test these points in a new trial, but the evidence in such new trial would have to be limited to these points, and would not affect the judgment previously given in favor of the General Engineering Co. The American Stoker Co. is thus prohibited from doing business in Canada in the meantime, and should the new trial sought for be pushed and decided in its favor the General Engineering Co. has other subsequent patents on the Jones Stoker as improved, and which patents would not be affected by any decision on the point here raised.

MARKETS OF CANADIAN GOODS IN GREAT BRITAIN.

Harrison Watson, curator of the Canadian section of the Imperial Institute, London, England, is in receipt of the following enquiries: A Liverpool house desires to hear from Canadian manufacturers of wood blocks for mangle rollers for which they could place several orders. An importing house possessing a connection with picture frame makers asks for names of Canadian manufacturers who can supply oak mouldings. A Midlands firm of manufacturers wishes to hear from Canadian importers of elastic boot webs, boot looping, garter webs, skirt bindings, ladies' belts, etc. The manufacturers of a patent metal seek a Canadian resident agent of good standing. A London dealer in high-grade goods would like to hear from Canadian packers of smoked salmon in thin slices, in oil, in tins. A Glasgow importer would like to hear from Canadian manufacturers of cheap bedroom furniture. A Bristol house is open to import ash hay-forks and hickory pick-handles. A Glasgow firm of merchants possessing a connection with the confectionery and wholesale grocery trade seeks agencies of Canadian products. They also have a house in China and are open to consider agencies for the far east. A Paris, France, commission agent asks for samples and prices of Canadian wood bicycle rims for which he has an opening.

FIRES OF THE MONTH.

Jan. 11th. J. I. Lloyd's foundry and machine shop, Kentville, N.S.; loss, $15,000; now rebuilding.——Jan. 15th. R. S. Porteous, Stratford, Ont., furniture factory; loss, about $5,000. ——Jan. 20th. Cox & Johnson's box factory, Vancouver; loss about $3,000.——Jan. 25th. S. Bicknell's cheese box factory, Peterborough; loss, about $3,000.——Jan. 30th. F. W. Shaw's pork packing house, Forest, Ont.; loss, $7,300.——Jan. 31st. Drying house of the Empire Tobacco Co., Granby, Que.

HEIRS WANTED.

Editor CANADIAN ENGINEER:

Sir.—I am looking for the heirs of Braddock Nyle, who is supposed to have lived in Montreal in 1844. Any information will be received with thanks.

Box 523, Houston, Texas. HENRY MALMGREN.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

The fourteenth annual meeting of the Canadian Society of Civil Engineers opened in the society's rooms, Montreal, on the 31st inst., the president, W. T. Jennings, in the chair. There was a large attendance of members.

The various committees presented their reports, and all the regular business of the convention was concluded on this day, except the reports of the scrutineers on the election of members of the council. The elections for the chief offices resulted as follows: President, Prof. H T Bovey; vice-president, C H. Duggan, Percival W. St. George and E. H. Keating; treasurer, H. Irwin; secretary, C. H. McLeod; librarian, E. Rhys-Roberts. It was agreed that the report on the election of the members of council should be presented at a meeting to be held on the 8th February.

The following were elected as nominating committee for the ensuing year: For Quebec—L. G. Papineau, C. le B. Leprohon. For Ontario—C. H. Rust, J. Galbraith, G. A. Mountain. For Manitoba and N W.T.—Col. H. N. Ruttan. For Maritime Provinces—Dr. Martin Murphy. For Newfoundland and Foreign—L. Skaife. On motion of W. J. Sproule, seconded by I. S. Pariseau, Duncan Macpherson and T. Harry Jones, it was decided to devote $200 to the Patriotic Fund. The resolution was followed by "God Save the Queen."

The meeting adjourned at 6.30 p.m., and the members took a special train for Boston, the train being provided by courtesy of the Grand Trunk Railway. A report of the meeting and an account of the excursion and dinner at Boston will appear in next issue.

SCHOOL HEATING AND VENTILATING.

The question of heating and ventilating school buildings is a most important one in Canada, owing to the length of our "closed-in" season. The various systems now in use were criticized in The Canadian Engineer some months ago, when the report of the Toronto Board of Health on the subject of school ventilation was dealt with. The chief engineer to the Board of Education of Boston, Mass., T. J. Waters, in a report on school ventilation in Boston, made to F. W. Chandler, professor of architecture, Massachusetts Institute of Technology, takes up the following, the chief points of which were printed in the City Record, Vol. III., No. 1, which is an official publication of the city of Boston:

(1) It has been my practice to install furnaces in all buildings containing six rooms and under, although I have placed low pressure gravity steam heating apparatus in some buildings containing but four class-rooms The small buildings in which furnaces are installed are of a temporary character, and constructed of wood in the outlying districts. (2) The cost of heating and ventilating apparatus of two school buildings, each containing eight class-rooms, and an assembly hall, the equivalent of two class-rooms, erected in 1894, is as follows:

Steam heating and mechanical ventilating apparatus.... $5,188
Furnace heat and natural ventilation..... 3,200

(3) The amount of coal and cost of same for each building for a period of two years follows: Steam-heated building—

1896-97, 372,710 pounds bituminous coal, at $2.30 per ton. $428 61
1897-98, 440,175 pounds bituminous coal, at $2.05 per ton. 451 18

Furnace-heated building—

1896-97, 393,435 pounds anthracite coal, at $5.60 per ton. $1,101 61
1897-98, 297,250 pounds anthracite coal, at $5.72 per ton. 850 14

(4) Repairs to apparatus from 1894 up to date: Steam-heated buildings, $84 62; furnace-heated building, $454.35. (5) A steam-heating apparatus, such as I now design, will certainly last twenty-five or thirty years. I know of a school building in Chicago which was equipped with a steam-heating apparatus in 1856, and the wall coils, which extend around the class-rooms under the windows, are still in position and doing service. The boiler I removed about six or seven years ago, as it was inadequate to generate sufficient steam for additional heating surface which was placed in the building. Now, with regard to furnaces, I wish to state that the life of a fire-pot is rarely over two years Of course, when a defective fire-pot is removed and a new one substituted, the furnace is practically as good as new. The large cast-iron tubular furnaces give better results, but the large arch-plates are liable to crack at any time, thus allowing smoke and gases to pass up into the rooms with the incoming air. During the past ten years furnaces were removed from thirty-six school buildings in the city of Chicago, with an average of about fifteen class-rooms each, and steam-heating and mechanical ventilating apparatus substituted. The Board of Education of the city of Chicago has not installed furnaces in any first-class school-building for the past sixteen years, except the one referred to in this communication, which is an addition to an existing building, the same being heated by furnaces, and the character of the old building was such that the introduction of modern steam-heating and ventilating plant to heat both buildings was not permissible.

THE MARINE ENGINEERS.

The first meeting of the Grand Council of the National Association of Marine Engineers of Canada, took place recently, at the Albion Hotel. The object of the association, which is intended to include all the marine engineers from the Atlantic to the Pacific, is to promote the interests of the engineers, to advance the standards, and see that none but those duly qualified according to law be employed in that capacity. Its intention is thus to protect passengers and the property of the steamship companies from all risks.

Several questions of interest to the calling were discussed, and the following officers were appointed: Grand president, D. L. Foley, Toronto; grand vice-president, Wm. I. Barton, St. John, N.B.; grand secretary-treasurer, S. A. Mills, chief engineer, Toronto Ferry Co., Toronto; grand conductor, Jas. A. McCarthy, Montreal; grand auditors, J. Fred. Williamson and G. T. G. Blewett, St. John, N.B. The constitution which will govern the society was adopted, and the meeting went on to discuss the bylaws. The next annual meeting will be held at St. John, N.B., in January, 1901.

LITERARY NOTES.

British Policy in South Africa. By Spenser Wilkinson. Publishers, Sampson Low, Marston & Co, London. One shilling.

Paul Kruger: His Life Story. By Fred. A. Mackenzie. Publisher, James Bowden, 10 Henrietta street, London. Illustrated. one shilling.

An illustrated catalogue describing the new McEwen gas engine will be issued in a day or two by the Waterous Engine Works Co., Brantford, Ont.

The Transvaal Trouble; How it Arose, being an abstract of the biography of the late Sir Bartle Frere. By John Martineau. Publisher, John Murray, Albemarle street, London. One shilling

The History of the Great Boer Trek and the Origin of the South African Republics. By the late Hon. Henry Cloete, Her Majesty's Commissioner for Natal, 1843-4; edited by his grandson, W. B. Cloete. Publisher, John Murray, Albemarle street, London. One shilling.

The Blacksmith and Wheelwright sends out a most attractive special number, which commemorates the twentieth anniversary of its establishment. An interesting feature of the issue is the announcement of the "20-year advertisers," as those are called who have occupied space in the Blacksmith and Wheelwright for that length of time.

The Mechanics' Supply Co., Quebec, has sent out this year the daintiest New Year souvenir that we have seen. It is a delft blue covered folder, tied with white ribbon, bearing on the front cover the words, "Greeting, 1899-1900." Inside, some apt quotations are followed by a couple of pages referring to the position and goods of this well-known company.

A great deal of attention is now directed to the Topeka Capital, a Kansas daily, which is to be placed absolutely at the disposal of C. M. Sheldon, author of "In His Steps," etc., that he may show what a Christian daily newspaper ought to be. If the experiment is continued long enough it is certain to succeed, because Canada has had for over sixty years a journal which has been consistently conducted upon this plan. It is The Daily Witness, Montreal.

"Machine Shop Companion," by Wallace Bentley, A.M.I. Mech.E., consulting mechanical engineer, Halifax, Eng., author

of "Sketches of Engine and Machine Details," etc. This book, which has thirty-six illustrations, is specially written for practical Engineers and Mechanics. It is bound in flexible cloth covers, suitable for the pocket, and is full of useful notes, rules, and tables for everyday workshop use, it shows in a simple way how to calculate speeds of pulleys, cones, wheels, etc., and includes an illustrated chapter on "Screw-Cutting," with list of Change Wheels, Notes on the Lathe, Drilling, Planing, Shaping, Slotting, Milling and Gear Cutting Machines; Notes on Materials, Forging and Welding, Hardening and Tempering, Case-Hardening, Templates, Gauges, Tables of Whitworth's Standard Screws, Taps, etc. The Bentley Publishing Co., Crossley street, Halifax, England.

"The First Night of a Play," "Through the Slums with Mrs. Ballington Booth." "What it Means to be a Librarian," by Herbert Putnam, Librarian of Congress, and "The Pew and the Man in it," by Ian Maclaren, are among the notable features of the February Ladies' Home Journal. An American Mother answers conclusively "Have Women Robbed Men of Their Religion?" and there is an interesting article on Mlle. Chaminade, the famous composer and pianist. Another article describes "Frank Stockton's New Home in West Virginia" The opening chapters of "The Parson's Butterfly," a new serial by Mrs. Charles Terry Collins, are also presented. Molly Donahue discusses woman's rights with Mr. Dooley, and "Edith and I in Paris," "Her Boston Experiences," and "The Autobiography of a Girl!" continue with increasing interest. The pictorial feature, "In Honor of St. Valentine," by Alice Barber Stephens, will recall some happy bygone days. By The Curtis Publishing Company, Philadelphia. One dollar a year; ten cents a copy.

No subject of interest to citizens of the British Empire in common has been so befogged with half-truths and with misrepresentations as the South African question. It is now generally known that besides the London edition of The Standard and Digger's News, controlled by the Transvaal Government, the Boers had—and in some cases still continue to have—subsidized newspapers on the continent and in the United States, which published and reiterated the most distorted and untruthful statements of affairs in the Transvaal. As many of these travesties of history originated as official statements from the Transvaal Government itself, and as British readers are apt to credit any other Government with the same respect for truth in official documents as would characterize their own Government, the Boer official falsehoods had been so widely and industriously circulated that when the war cloud burst a great proportion of people were in a mist as to the real facts of the case. The series of articles which have been appearing in this journal (now reprinted in pamphlet form under the title of the "Boer War") may have helped to dispel these mists from the minds of Canadian readers, but we are glad to call attention to the cheap and handy volumes above quoted, as further contributions to the literature of the subject, which will enlighten the Canadian reader still further on many points. The first named summary of the recently published biography of Sir Bartle Frere turns the search-light on the dealings of the Gladstone Government in South Africa at the time of the retrocession of the Transvaal to the tender mercies of the Boers. Leaving out of view Sir Alfred Milner, the present governor of the Cape and High Commissioner for South Africa, whose work is not yet accomplished, there have been in the history of colonial administration there three great governors, who understood and wisely estimated the problems of British relations with both the Dutch and the natives. These were first, Sir Benjamin Durban (whose mortal remains rest in the old Papineau Road military burying-ground in Montreal), Sir George Grey and Sir Bartle Frere. If the policy of the first two governors had not been thwarted by the Home Government, who sent them out, there would have been no Republic of the Orange Free State or the Transvaal to prove the thorns in the flesh of the rest of South Africa which they have; and if the policy of the last named had not been similarly thwarted even these separated communities would have been reconciled to the neighboring colonies, and we should have had a peacefully confederated South Africa to-day. One cannot rise from a perusal of "The Transvaal Trouble" without the feeling that Sir Bartle Frere was basely betrayed in his efforts to carry out his great aims, not only by the Gladstone Government, but by the Conservative opposition of that day, who selfishly sacrificed the higher interests of empire for party advantage in home politics. In the light of present events Sir Bartle Frere's estimate of the men with whom he was dealing from 1877 to 1880, and his judgment of the effects of the political movements then transpiring shows him to have been a man of extraordinary wisdom and foresight, and his predictions of what would happen if such and such a policy were carried out read now like pages of inspired prophecy. The statement in one of his letters that his administration would add another to the list of those whose teachings and work were not understood or appreciated till he was dead and gone, was itself a prophecy and has received its fulfilment in a way that must bring the blush of shame to some public men still sitting in the House of Commons, who deserted him in the hour of his trial. The memory of no governor in South Africa is to-day in higher regard, both among British and Boer, and if the British Government had only stood by him there would have been a confederation instead of a war there to-day. The "History of the Great Boer Trek," is a series of re-edited lectures on the motives of the great treks which led to the founding of the Free State and Transvaal, and in part to the colonization of Natal. The author, a loyal British subject of Dutch descent, treats the Boer's sentiments with natural sympathy, and shows us how they regarded the emancipation of the slaves in 1834-7, and how the blunders of governors combined with the vacillation of the British Government to produce that distrust and suspicion which are the regrettable national weakness of the South African Dutch, and which unfortunately have only been confirmed by the policy of the Gladstone and other recent British administrations. Mr. Wilkinson in his "British Policy in South Africa," takes up the question from the British and Imperial standpoint, but shows none the less clearly from this point, that party politics at home have been the curse of British rule in these colonies. Though this book was written before the war broke out Mr. Wilkinson saw that if Britain failed to maintain her position as paramount power or deserted the cause of the Uitlanders the Afrikander Bond would agitate for the independence of South Africa and British subjects, feeling deserted by their own Government, would make common cause with the members of the Bond. The loss of South Africa could then be only a question of a short time. Mr. Mackenzie's little book gives us a sort of crayon sketch of Paul Kruger, and avoiding politics as much as he can, desires to show us the man himself. He gives the old man credit for great virtues, but does not by any means hide his great faults. The result is a readable book, which has a number of half-tone illustrations. To those who wish more light on a subject of such vital interest to the future of the British Empire we can commend all of the above books.

AUTOMOBILE NOTES.

The whole of the Russian Imperial family, excepting the Czar, are enthusiastic chauffeurs.

The traction engines in use by the British army in South Africa do not seem to be very successful, according to some accounts.

In Algeria steam omnibuses are doing good work, and it is expected that they will be employed very largely in Madagascar.

There is scarcely anyone connected with the cycle and carriage building trades in France who is not interested more or less in the autocar industry.

A French count was sentenced to two months' imprisonment and fined $1,500 for breaking a lady's leg through his careless driving in the Bois de Boulogne.

The Stirling Motor Carriages, Ltd., of Hamilton, Scotland, has paid a five per cent dividend, and written $25,000 off goodwill account, as the result of last year's business.

The autocar as a delivery agency for newspapers in long, straggling country districts should prove invaluable. Two of the London Sunday journals have tried it with great success.

The Autimobile Club of France has a membership of 2,000; a yearly income of $80,000, and the finest clubhouse in the world. Similar clubs have been formed in Berlin, Brussels, London, Turin, Geneva, London and New York.

A steam postal van has been sent to Ceylon from the Lancashire Steam Motor Co, of Leyland, England. It will carry a ton of mail matter in bags, and will make an average speed of ten miles an hour on ordinary country roads.

The Velo states that in France during December there were 708 accidents—52 deaths and 656 injuries—due to horses, and only 21 automobile accidents (causing one death) in the same period. There are about 4,000 automobiles running in France.

"Inshaw's Steam Wagon," or lorry, is running in Birmingham, made by the son of the worthy machinist of that name, whose early production of a steam carriage was illustrated in The Canadian Engineer last year from a photograph obtained from another member of the family.

The Municipal Council of Paris, France, has reduced autocar speed to 12 kiloms, in the Bois de Boulogne. The French correspondent of the Autocar suggests that the authorities should take in hand the task of regulating the horse traffic, and thus remove the chief source of danger to the automobilist.

The Motor Trades' Association has been organized in England "to afford mutual protection to its members, and to promote such measures as may be found useful in the interest of the motor industry in the United Kingdom, including the encouragement of invention, regulation of prices, and arrangement of shows."

The Autocar, of London, England, says everything points to a big motor year during the next twelve months, most of the manufacturing houses having experienced no "dead season" this year, as they have sufficient orders to keep them fairly busy all winter. One firm sold four motor cars in one week. The position of the autocar to day is immensely superior to what it was twelve months ago.

Belgium, Germany and the United States will contest with the French champions for the Gordon-Bennett cup. It is reported that Mr. Riker and Mr. Winton have offered to represent the American Club, and that the former is having an electric car built specially for the race, which will be over a course of 125 kiloms. M. A. Lemaitre is having a 100 h.p. car with 8 cylinders built for this race.

The British Motor Car Club offer eight cash prizes, four of £100 each and four of £50 each, for the following inventions: An exhaust deodorizer, an automatic starter, the best ignition, and the simplest and cheapest design of motor and car complete. The winners of the prizes will retain to the full their interest in the inventions, which the club will assist them to get properly patented throughout the world.

A correspondent of the Autocar suggests "power-vehicle" as a comprehensive generic name for automobiles, while classes would be named "power-carriages," "power-carts," "power-wagons," and these again would divide up into sub-classes, as "power-landau," "power-victoria," etc. He objects to "motor," because of the many confusing senses in which it can be used. By the way, "Steamobile" appears in the Automotor journal.

The makers of steam carriages in the United States have struck a snag in a law which requires that anyone operating a steam road engine must be an expert engineer and be properly certificated. The Locomobile Co., who manufacture the Stanley steam carriage, are trying to get the regulations modified to allow the issue of "third or fourth class" certificates to owners of steam cars, who show themselves proficient in their use.

The Automobile Club of England is organizing a 1,000 miles efficiency trial, with the full approval of automobile manufacturers of Great Britain. The London Daily Mail has voluntarily offered prizes of $500 for the first, $250 for the second car coming through the trials best, and in addition, $50 to each car successfully accomplishing the journey. This club has been asked to officially take charge of the English automobile section of the Paris Exhibition.

The Autocar has made a careful calculation and reports that during 1899 very close on 2,000 automobiles of various kinds were made in or imported into Great Britain—this number being about equally divided between autocars and various descriptions of motor cycles. The trade in 1900 is likely to be increased at least 50 per cent.—most probably doubled. The demand will be higher than this, but the ability to supply will affect the total at end of year.

The Autocar urges the British War authorities to investigate autocars as the German military man and the Emperor did, to their great satisfaction, the cars having carried weights up to 2¼ tons over bad roads, up hills, across stony and sandy track, and even on loose ploughed lands, and finally two baggage and two passenger wagons, heavily laden, satisfactorily competed with the Brocken railway in crossing the Brocken. The Emperor highly praised the performance.

The Chinese ambassador visited Coventry, Eng., in December, was met at the station by a fleet of motor cars, and after inspecting the factories made a speech in which he said: "The services rendered by the motor car to the field gun in time of war, as well as to the collection and distribution of mails in time of peace, are simply invaluable, and I have no doubt that when all our roads in China are restored these vehicles will be introduced into the far East, as well as they are now introduced into the West."

Here is an item from the Horseless Age of New York: "The Canadian Government has been experimenting for some time with various motive powers as a propelling force for mowers, reapers and other agricultural machinery. The tests have been made at Montreal, and one of the most recent was the driving of a gang plough by a gasolene motor, built by the Haynes-Apperson Co., Kokomo, Ind. It is said the motors will be attached to other farm machinery and produced in quantities."

H. Wilcke has written a pamphlet on "The Haulage of Goods on Common Roads," in which he shows that cheap production necessarily involves cheap transport; that British railways have made competition with other countries a difficult matter, instead of helping the producer; that within at least forty miles radius all transporting of goods can be done quicker and cheaper by self-propelled vehicles on common roads than by railways, and that all works on farms, no matter where, may thus have the equivalent of a railway siding.

New York has a new motor—not adaptable yet to carriages, but likely to develop on that line. It is called the "Secor," uses kerosene or heavy oil, feeding oil and air in chemically correct proportions straight into the cylinder, exploding by electric spark. It has neither oil pump nor vaporizer, exhaust invisible and almost odorless, while the motor runs 300 or 400 revolutions a minute, and governs so perfectly as to be able to drive a dynamo for variable electric lighting without going more than one volt out of the way—which is as good as steam engine performance.

The power required for motor vehicles may be gathered from the following figures showing tractive resistance, pounds per ton—ordinary metal tires and plain bearings being used: Railroads, 10; tramways, 30; good asphalt, 13, asphalt, 22; poor asphalt, 29; wood paving, 30; good setts, 35; best macadam, 42 to 46; good macadam, 50; ordinary macadam, 60 to 80; soft macadam, 97; best gravel, 57; cobbles, 60; ordinary cobbles, 130; very bad cobbles, 240; best clay, 110; hard dry clay, 100; sand road, 360; loose sand, 560. The authorities for above figures are Telford, Whyte-Smith, United States Agricultural Bureau, and Society of Arts.

A striking illustration of the unfairness of the British law limiting the speed of autocars to 12 miles per hour is shown by examining the time-table of the Tally-Ho Independent stage-coach, which ran between London and Birmingham in 1830. The distance, 100 miles, was covered in 7½ hours, the average speed, allowing for changes of horses, being over 13 miles per hour, and the actual speeds being as follows for the seven sections into which the trip was divided: 16.17, 18.75, 11.85, 14.64, 12.45, 16.50, 14.59. Only in one case is the speed below the autocar limit; yet this was in the days when the main highways were carrying their maximum of traffic, and were the only means of intercommunication, except canals.

Jenatzy, the famous French chauffeur, has driven his torpedo-shaped car, the "Jamais Contente" (never content), for one kilom. at the rate of 106 kiloms. an hour, and offers to bet $20,000 that he can drive it 100 kilom. in sixty minutes. The bet will likely be taken up by sporting men, and Jenatzy will risk this tremendous stake, as well as his life, on the result. The car would have to carry about two and a half tons of batteries, and this enormous weight added to the friction in flying over the

roads at such a rate, would, it is feared, very soon tear the tires to pieces. It would be interesting to calculate the force exerted by a four-ton vehicle at this speed in the event of meeting with an obstacle—a contingency not at all impossible.

Mr. Pennington, to whom The Canadian Engineer in its earlier days paid its compliments, is to the fore again in a characteristic exploitation. He seems to have joined forces with the equally well-known H. J. Lawson, of British Motor Co. fame. It appears that a company called the Anglo-American Rapid Vehicle Co., has been registered under the laws of the State of Delaware, the nominal capital being $75,000,000, and the working capital $10,000,000. It is understood that this company will take over the whole of the Pennington rights, both in Britain and abroad, as well as a considerable interest in the patents held by the British Motor Co., that it will also secure the Daimler patents for the United States, and organize for business throughout the world.

The weekly Horseless Age, of New York, devoted its issue of December 6th to steam, and that of January 17th to explosive motors. Some of the articles in the steam number were: Steam Boilers for Motor Vehicles, General Data on Steam and Fuel, Shell or Water Tube Boilers? Boiler Feeding Apparatus, A Practical Method of Utilizing Exhaust Steam, The Elihu Thomson Flash Boiler and Steam Vehicle System. Jas A. Wright, of Montreal, wrote, strongly commending this issue and giving his opinion that steam would find its most perfect expression through American work. The Explosive number contained articles on the Hydrocarbon Engine as a Source of Energy, Gasolene Engine Indicator Diagram, Ignition and Ignition Troubles, Vaporizers and Carburetters, Coils and Sparks, Vibration, Gasolene and Gasolene Mixtures, Multi-Cylinder Engines, Explosive Motor Data and Details. A correspondent of The Age objects to the term "Explosive Motor," saying, "An explosion does not occur in a gas engine; therefore it is wrong in principle to call it an explosive engine."

Hugh Dolnar, the able American correspondent of the Autocar, cleverly summarizes the situation in the United States thus: "Winton and Charron did not make a match, Davis and wife by dint of hard work and constant repairs of their 'National' wagon finally reached Chicago and stopped there instead of pushing on to San Francisco, the Walker $2,000 prize run was called off, and there has really been no clean cut and well defined item of autocar advancement in the United States the whole summer through. There have been charters granted, with vast nominal capitalizations, to many new companies, but when one goes out to look for the new and altogether satisfactory wagon he simply does not find it. It is pretty well understood that compressed air has something to talk about and nothing to show. The liquid air schemes, as all even tolerably well informed mechanics are aware, have not a ghost of a chance until somebody finds out something no one knows yet. The Stanley steam wagon has been delivered to many purchasers, and has given plenty of trouble to those who have tried to use it, in the way of scorched boilers and small water tank room. If a steam wagon is to be really popular it must condense its steam, and it must carry its water automatically; these two prime necessities are imperative demands, and cannot possibly be ignored. But underneath all of this seeming stagnation in automobile matters there is a fierce and stubborn contest going on between, perhaps, as many as 500 American inventors and the reluctant forces of nature. Everyone of these experimenters has set up a high standard of excellence, and is keeping well under cover, waiting the day of triumph before giving out anything to the public. We have come to pretty fully and clearly understand the severe exactions of the motor problem, and some of the Yankee mechanics will find good answer to the riddle, you may be sure of that."

—In the December issue of The Canadian Engineer an article on "Tall Buildings Under the Test of Fire," by H. De B. Parsons, was published. This article was written originally for The Engineering Magazine, but was republished in the reports of the British Fire Prevention Committee.

—Canadian trade in Australia increased between 1896 and 1898 at the rate of more than three hundred per cent.

Industrial Notes.

Tadoussac, Que., is to have a system of waterworks next year.

The Berlin, Ont., waterworks earned $5,000 for the town last year.

The Abbott-Mitchell rolling mills at Belleville, Ont., are now in operation.

The O. W. Thums Co. is starting a factory at Walkerville, Ont., for the manufacture of fly paper.

A new bridge is proposed over the Castor R.. between Carleton county and Prescott and Russell.

The new glass factory at Kingsville, Ont., started up the first week in January, using natural gas as fuel.

Five new buildings are being erected at Granby, Que., in connection with the Granby enamelware works.

Moose Jaw, Assa., is discussing the raising of $75,000 to be spent in local improvements of a permanent sort.

The W. W. Ogilvie Co. is applying for incorporation to carry on the flour milling business of the late W. W. Ogilvie.

The Shawenegan Falls Hotel Co. is being incorporated to build a $25,000 hotel at Shawenegan Falls, Que. B. Shepherd, manager.

The Hamilton Iron and Steel Company, Hamilton, has just put in a new boiler which was supplied by the Goldie & McCulloch Co., Ltd., Galt, Ont.

J. McCrois' new foundry at Lindsay is nearly completed. It is 35 x 68 feet, and two stories high. A second building, 45 x 45 feet will be put up in the spring.

The Bain Wagon Co., Woodstock, Ont., has built for the Department of Militia sixteen special wagons, which are being sent out with the Second Contingent.

The ratepayers of Cookshire, Que., have voted a $15,000 bonus to the Canada Food Supply Co., and it is expected that the company will start its cannery building at once.

The Goldie Milling Co., Highgate, Ont., has put in a Moffatt Feed Water heater. The Goldie & McCulloch Co., Ltd., Galt, Ont., is sole Canadian maker of this heater.

Mrs. Doran, of North Bay, widow of Judge Doran, formerly of Perth, Ont., has sold a water power on the Spanish River, near Webbwood, Ont., for $12,000, to a pulp syndicate.

The St. Charles Condensing Co., Ingersoll, Ont., has received some heavy special machinery from the Goldie & McCulloch Co., Ltd., Galt, Ont., for the new condensing works.

The Smart-Eby Machine Co., Ltd., Hamilton, Ont., is turning out a 75-ton refrigerating plant for a large brewery. The plant is modeled on the Buffalo Refrigerating Co.'s plans.

An elevator and flour mill company has been formed at Morinville, Alberta, under the title La Compagnie d'Elevateur et de Moulin a Farine de Morinville. The capital is $15,000.

The Walkerville, Ont., Match Co., promoted by Peter Stenius will have their new match factory running some time in March. A large part of the machinery comes from Sweden.

The present output of the Nova Scotia Steel Company is about 100 tons of steel per day. Seven hundred men are employed at the company's works at Trenton and Ferrona, N.S.

Work at the Maritime Clay Works, Pugwash, N.B., will be resumed shortly, it is said. A continuous kiln for burning brick is to be built, and it is said will take 450,000 bricks to build it.

A great deal of activity is evident at the charcoal iron plants at Radnor, Que., operated by the Canada Iron Furnace Co., and also at the Drummondville furnaces worked by the McDougall estate.

The Paisley, Ont., Pork Packing Company, Ltd., recently organized there, with a subscribed capital of $10,000, has bought the old Northern Hotel property, and intends fitting it up immediately.

J. Oliver & Sons, Ltd., has been incorporated to manufacture and deal in furniture in Ottawa, Ont., and carry on the business now being done by Jos. Oliver & Sons; the capital of the company is $90,000.

The Canadian Food Supply Co., Montreal, is being incorporated with $50,000 capital, to can meat, vegetables, etc. W. Pendy, J. Lawson, A. Dunlop, E. Bailey and S. Jamieson are the provisional directors.

The Keewatin Lumber and Manufacturing Company, Keewatin, Ont., is building a mill dam and putting in a new and larger water wheel. Before spring one of the circular saws will be replaced with a band saw.

The very large quarries at Marble Mountain, N.S., have been bought by the Dominion Iron and Steel Company. Quarrying operation. will begin at once and shipments will be made over the I.C.R. to Sydney, C.B.

Tenders for the steel or wooden bridge across the Thompson River at Kamloops, B.C., will be received up to February 28th. Plans are at the Lands and Works office, Victoria, B.C. W. S. Gore is deputy commissioner.

A. Roy is to establish a foundry at Toronto Junction. The town grants a site at a nominal price and Mr. Roy undertakes to put up a brick building, 100 x 50 feet, to be completed by June 1st, and to employ at least five men.

Application for incorporation is being made by the Stuart-Arbuthnot Machinery Company, Ltd., to take over the business of Stuart & Harper, machinery, Winnipeg. John Arbuthnot, lumber dealer, is a new member of the firm.

A company has asked for incorporation to own and operate a threshing and flour mill and a lumber mill at Beaumont, Alberta. The name of the company is Le Compagnie des Moulins de Beaumont, and the capital is $4,000.

It has been announced in Toronto that the Heinz Pickle Mnfg. Co. would at once establish its proposed Canadian factories in Toronto. The company has started a European trade, and the English market will be supplied from Canada.

The new Maria street bridge, Ottawa, will have two stone piers and two stone abutments. There will also be about twenty little foundation piers, on which will rest the end of the iron pillars that will support the structure over the railroad tracks.

The Goldie & McCulloch Co., Ltd., Galt, Ont., has shipped a high-speed Ideal engine to Sarnia, Ont., for the Canadian General Electric Co., of Toronto. The Montreal Rolling Mills Co. recently purchased one of these engines from the same company.

J. E. Murphy, Amabel; R. P. Butchart, Keppel; G. S. Kilbourne, J. Lucas, J. M. Kilbourne and D. M. Butchart, Owen Sound, Ont., have been incorporated as the Shallow Lake Portland Cement Co., Ltd., capital, $199,000, chief place of business, Owen Sound.

Redpath-Reid automatic smoke consumers have recently been supplied by the Jubilee Grate Bar Co., Ltd., to McClary Mnfg. Co., London, Ont.; Canada Screw Co., Hamilton; Beaver Mnfg. Co., Hamilton; Lyman Bros. Co., Toronto; Sanford Mnfg. Co., Hamilton.

The Gyrator System of Flour Milling, of which the Goldie & McCulloch Co. is sole Canadian maker, is meeting with great success in the milling world. The company has recently shipped a car-load of this kind of machinery to the Farmers' Milling Co., Fort Saskatchewan, N.W.T.

La Compagnie de Pulpe de Jonquiere is applying for legislation to enable it to expropriate lands on Riviere aux Sables and on Lake Kinogami in the county of Chicoutimi, Que., and develop the water power of the Riviere aux Sables, throughout its entire length, and to build pulp mills.

The Halifax Herald stated recently that a new wing and pattern shop have been added to the Cape Breton Foundry and Machine Co., Sydney, C.B. The St. John brass founders, T. McAvity & Sons, who have large contracts with the Dominion Iron and Steel Co., are preparing to erect a branch foundry at Sydney.

The following application to the Ontario Government for power to issue bonds are made: Meaford, $56 000, to bonus the Botsford-Jenks Co., of Port Huron, Mich., and the G. T. R. elevator; Dunnville, $10,000, to bonus F. R. Lalor in establishing a tanning factory; Port Perry, $5,000, to aid a House of Refuge and Industrial farm for the county of Ontario; Port Hope, $20,000, to enlarge the waterworks.

The Ironsides Mining Company, Ltd.; capital, $100,000; headquarters, Ottawa, is being incorporated to develop iron mines near Ottawa city. The provisional directors are: W. L. Holmes, Detroit; J. L. Robertson, W. R. Hinsdale, New York; J. O. Hibbard, C. B. Hibbard, D'Arcy Scott and W. H. Curle, Ottawa.

R. F. Prefontaine, Q.C., Montreal; J. A. C. Madore, Q.C., A. R. Angers, O. Rolland, J. L. Decarie, A. Beauvais, J. L. Warren, M.D., J. A. Drouin, Montreal; P. V. Savard, Chicoutimi, and J. Warren, Pointe a Pic, are being incorporated as the Great Northern Elevator Co., to build elevators in Quebec city and elsewhere.

The Weymouth, N.S., mill of the Sissiboo Pulp and Paper Co. is now turning out 300 tons of dry pulp per month. New machinery is being added and preparations are under way for building a new dam and a large mill in the spring, for which machinery is now being contracted for. The new plant will be in operation by November 1st next.

The North River Lumber and Pulp Company, Ltd., is being incorporated, with a total capital stock of $50,000; headquarters at Valmorin, Que.; to carry on the manufacture of pulp, paper, etc. The following are the names of the petitioners. C. R. Burleigh, Whitehall, N.Y.; G. W. Macdougall, Wm. J. Henderson, A. R. Macmaster and H. McKay, Montreal.

A circular issued by the G.T.R. announces that the special rates on pulp wood out of Canada to points in the United States have been withdrawn, and the regular tariff at a much higher rate has gone into effect. This has been done, it is said, to help encourage the manufacturers of pulp and paper in Canada. The low rates on pulp wood to and from local points will continue the same as before.

Canada is gradually taking her place among countries who can manufacture for the world. Last autumn the Goldie & McCulloch Co., of Galt, shipped to Mexico two car-loads of bagasse filters to be erected on Mexican sugar plantations, and each season the same company exports to Cuba several thousand dollars worth of sugar machinery. Before the Boer war they also shipped mill machinery to Lorenzo Marques, in Portuguese South Africa.

J. L. Jennison, one of the directors of the New Glasgow Milling Company, recently stated that the company proposes to build mills at St. John, N.B., and Halifax, N.S., in addition to that at New Glasgow. They have obtained a new charter from the Dominion Government granting them more extensive rights than the local charter under which they have been working. The name of the company has been changed to the Maritime Milling Company.

The B. Greening Wire Co., Hamilton, Ont., has now completed the issue of all the catalogues of perforated metals, wire cloth and screens of all widths, sizes and grades, wire rope, steel or iron wire, window guards, flower stands, counter railings, foundry supplies, etc., handled by the company. To mail any of these catalogues to interested parties will be a pleasure to the company, if they will state which department they are interested in.

The American School of Correspondence, Boston, Mass., is now exceeding its operations in Canada. A folder recently issued repeats what a number of Canadians write about this school. Among those who have examined the literature and examination papers of the school, and certified to their value, are H. T. Bovey, L.L.D., M.I.C.E., F.R.Sc., McGill University; J. Galbraith, principal of School of Practical Science, Toronto, and a large number of others.

About 150 couples, among whom were many prominent labor advocates, attended the annual concert and "At Home" of Toronto Branch No. 46 of the Plumbers', Steam and Gasfitters' Association, held January 26th, in the Confederation Life Building, Toronto. Mr. Robert Harrison presided at the concert. The program was contributed to by Messrs. W. Street, A. Parker, H. Bates, W. White, F. Hancock-Matthews, J. Dempster, F. Wray and Master Owens. During the concert the handsome silver cup donated by the Toronto Letter-Carriers for the best appearance of any one union organization in the Labor Day parade, and which was awarded to this union, was handed over to the victors.

A deputation, of which E. F. B. Johnston, Q.C., was spokesman, waited on Hon. E. J. Davis last month, and asked a concession from the Ontario Government of certain lands on the Montreal river, which flows into Lake Temiscamingue. The syndicate proposes to expend $100,000 on a plant, and agrees to employ 25 men during the first year. Those interested are: W. C. Phillips, Dr. Lynd, P. McArthur, R. Davies, W. R. White, W. Kerr, John Gray, A. Niven, John Ferguson and E. F. B. Johnstone.

The Dowd Milling Co., Ltd., is applying for incorporation; capital, $100,000; headquarters, Quyon, Que., to mill oatmeal, flour, etc. The following are the applicants: H. S. Dowd, Quyon; B. W. Dunnett, Pakenham, Ont.; J. A. Cameron, Dominionville, Ont.; G. T. Mohr, J. Amm, Quyon; J. Pritchard, North Wakefield, Que.; D. B. Maclaren, Fitzroy, Ont.; R. H. Sayer, Aylmer, Que.; E. Graham, Bristol, Que.; W. H. Meredith, Quyon; G. Walsh, Onslow, Que.; C. Brooks, Quyon, and W. Harrison, Quyon.

Some time ago the boiler in the Crescent Milling Company's factory, London, Ont., exploded, wrecking the brick engine-house, but not damaging the factory close by. The force of the explosion moved the boiler about fifty feet. Fragments of the engine-house were afterwards found two hundred feet away. J. Hetherington was the only man in the engine-house at the time. He was seriously scalded about the head and shoulders, but was not fatally hurt. The cause of the explosion is said to have been the giving way of a patch in the end of the boiler.

It is stated from Quebec that a new proposition for the establishment of refrigerators and abattoirs in the district of Quebec is to be made shortly to the Provincial Government by various tenderers for its consideration before the coming session. The proposal contemplates a fixed subsidy not exceeding $30,000 a year for a certain period, instead of the previously proposed guarantee of 3 per cent. on $1,000,000, not to be paid till the business has been established, and some $500,000 spent on buildings and plant.

A special train took 500 laborers from Boston, U.S., for Sydney, C.B., recently. They will be employed on the construction of the large plant of the Dominion Iron and Steel Company, Ltd. Workmen of all kinds, from all parts of the country, are going to Sydney, where an opportunity for employment awaits most who apply. It is expected that within six months from two to three thousand workmen will be employed upon the plant in the capacity of carpenters, blacksmiths, steamfitters, plumbers and ordinary laborers. In all cases those who have gone have paid their own railway fares.

Justice Rose, Toronto, has granted an order to wind up the business of the Canadian Locomotive and Engine Company of Kingston, and appointed A. F. Riddell, of Montreal, accountant, as provisional liquidator. The application was made on behalf of James W. Pyke, of Montreal, a creditor, and the order was consented to by the Bank of Montreal, who are the heaviest creditors of the company, which admitted its insolvency. A meeting of creditors, shareholders and contributories will be held at Kingston on Feb. 10, when the question of the appointment of a permanent liquidator and other matters will be decided upon.

The Canada Paint Co., Ltd., Montreal, Toronto and Victoria sent out a circular at the end of last month stating that the price of the best paints, such as the "Elephant," "Prism" and "Stag" brands had been advanced to $1.20; their extra grade floor paints to $1.10, and their standard grades to $1 per gal. The reason given for these advances is the rise in the price of turpentine, oil, lead, zinc and tin cans. Since "Elephant" paints were $1 lead has advanced 2c. per lb., zinc 1½c. per lb., linseed oil 18c. per gal., turpentine 20c. per gal., and tin cans average an advance of 4c. per gal. This advance is said to be equivalent to 28c. per gal.

The Ontario Association of Architects held its annual meeting, January 16—19th in Toronto. The business proceedings have to a great extent centered on the resolution to establish themselves in a headquarters on King street, with a suite of rooms suitable for the usual meeting of the society, and for classes, sketch clubs and other assistance to the education of students, which it is desirable to establish. The new council of the association are: President, A. Frank Wickson; first vice-president, Fred Henry, London; second vice-president, Grant Helliwell; treasurer, F. S. Baker; council, G. E. Belcher (Peterborough), S. H. Townsend, W. A. Langton, G. A. Pearson, A. H. Gregg; honorary registrar, W. R. Gregg.

The proposed system of waterworks and sewage for the town of Gananoque, Ont., as designed by Willis Chipman, C.E., is estimated to cost $120,000, as follows: Intake pipe laid, $5,000; pump house, $4,000; machinery, $5,000; water tower, $7,000; 300 tons of cast-iron pipes and specials with 41 fire hydrants, valves, etc., $13,000; trenching, cartage, pipelaying, lead backfilling, and all other labor exclusive of rock work, $6,000; one-third cost of rock in 18,000 feet of trenching, and all the cost in 2,500 feet, $16,000; two sewer outlets, each 400 feet long, $3,000; 24,000 feet of sewer pipes and all other materials, $11,000; 25,000 feet of excavating, pipe laying, jointing, backfilling, and all labor exclusive of rock work, $14,000; two-thirds the cost of rock in 16,500 feet of trenching, and all on 8,500 feet, $36,000.

The following company announcement is among the most important that has been published for some time in the Ontario Gazette: Francis H. Clergue, Bertrand Clergue, Ernest V. Clergue and H. C. Hamilton, of Sault Ste. Marie, and E. S. Douglas, W. P. Douglas and F. S. Lewis, of Philadelphia, U.S., have been incorporated for the following purposes: (a) As a contractor, to construct railway and public and private works of all kinds and to equip the same and operate any of the works constructed by the company except railways; (b) To acquire by legal title mines and mining lands, timber and timber lands, and other lands, and to lease, sell, or otherwise dispose of the same; and (c) To manufacture and sell the products of raw material; the corporate name of the company to be the Algoma Commercial Company, Ltd.; and its share capital to be ten million dollars, divided into 200,000 shares of $50 each; the head office of the company to be at the town of Sault Ste. Marie.

The Elastic Carbon paint which is being put on the market by the Atlantic Refining Co., Toronto, is being warmly recommended for roofing purposes. The company states it to be unexcelled for roofing purposes of every description. It will make a worthless roof practically as good as new and make it serviceable for years at a comparatively small expense when otherwise an entirely new roof would be necessary. It is said to make a roof, be it metal, canvas, wood, felt or shingle, impervious to water; also makes a splendid appearance on metal roofs, it filling the seams and small holes, making them perfectly waterproof, preventing formation of rust. In covering capacity it far exceeds ordinary paint it is said. On felt, paper, canvas and shingle roofs, one gallon covers 100 square feet, while on metal and other smooth surfaces one gallon covers 250 to 300 square feet. It is used for painting bridges, steel plates, vessel bottoms, piers, etc. Gives a lustre similar to enamels and possesses all desirable features of a metal paint. It can be used for agricultural implements, painting fences, pumps, and iron work of any description.

As a result of a meeting of the Canadian Furniture Manufacturers' Association held in Stratford, Ont., on December 27th, 28th and 29th, the British American Furniture Co., Ltd., has been incorporated with a capital stock of $3,000,000 divided into 30,000 shares, of which 20,000 shall be preferred. J. R. Shaw, J. L. Tangher, Toronto; W. H. Hobbs, T. S. Hobbs, London, and Wm. McN. Shaw, Walkerton, Ont., are the provisional directors of the company, which will have its head office in Toronto. So far as at present known twenty-four firms will come under the syndicate. They are: W. R. Hobbs, London; Snyder, Roos & Co., and Schaefer, Keeler & Co., Waterloo; J. S. Anthes Manufactory Co., The Simpson Co., and H. Krug, Berlin; Burr Bros., Guelph; Knechtel Furniture Co., Hanover; Krug Bros. & Co., Chesley; Siemon Bros. Manufacturing Co., Hill Chair Co., and Jas. Young, Wiarton; Watson Malcolm, Kincardine; Broadfoot & Box, Furniture Co., Seaforth; Thos Bell & Son Manufacturing Co., and Button & Fessant, Wingham; E. F. R. Zoellner, Mount Forest; The Furniture Manufacturing Export Co., Berlin; L. Hahn, New Hamburg; American Rattan Co., Walkerton; Jos. Orr & Sons and George McLagan, Stratford; Union Furniture Co., Wingham.

—The fifteenth annual meeting of the Illinois Society of Engineers and Surveyors was held in Moline, Ill., 24th, 25th and 26th ult. A number of valuable papers were read. Almon D. Thompson, president, presided.

Personal.

The employees of the I. E. & D R.R. presented mechanical superintendent Austin with a Morris chair and an address a short time ago.

Jas. McGregor, British Columbia inspector of metalliferous mines, was reported to be in the Greenwood, B.C., hospital seriously ill with pneumonia recently.

Robert Surtees, C.E., late city engineer, Ottawa, Ont., has been appointed consulting engineer of the Government Commission appointed to expend $60,000 annually in beautifying the city.

T. B. Hart, one of the best known contractors in Ontario, died at his home in Toronto recently, aged 71 years. Mr. Hart was the contractor for the crib-work at the Eastern Gap, Toronto harbour.

J. R. Adamson, manager of a department in the Vancouver, B.C., Hardware Co.'s store, who was formerly in the employ of the Rice Lewis & Son, Ltd., Toronto, was fatally shot while out hunting, January 13th.

The Grand Trunk Literary and Scientific Institute has been made the recipient of a handsome large portrait of Frank W. Morse, the superintendent of motive power, which will adorn the walls of the institute alongside those of other officials of the company.

H. J. Somerset, operating manager of the Winnipeg Electric Street Railway, has received and accepted a position as general manager of the tramways, Perth, West Australia. He is a son of W. B. Somerset, business manager of the Winnipeg Free Press.

Alfred Rubbra, who has been for many years manager for H. W. Petrie, Toronto, has removed to Montreal to take charge of the sales department of the Laurie Engine Co., succeeding Charles Bethell, who has been appointed manager of the Northrop Loom Company's works at Valleyfield, Que.

Samuel Walker, who for seventeen years has been foreman and general foreman at the shops of the Grand Trunk system, at Point St. Charles, having been selected general foreman of the Dominion Bridge Company's works at Lachine, has received a handsome parting presentation from his late fellow employees.

The Cataract Power Company has appointed H. R. Leyden, manager of the Hamilton Electric Light Company, in place of Gordon Henderson. Mr. Henderson and Mark Thomas, late manager of the Hamilton and Dundas railway, have been offered other positions by the company. C. K. Green is manager of the consolidated lines.

The following changes in the staff of the Grand Trunk Railway shops consequent upon the resignation of Samuel Walker are announced: Foreman of erecting shop, J. Farrar; assistant pro tem. to Mr. Farrar, R. Cowan; foreman of machine shop, J. Millington; assistant to Mr. Millington, F. Dalrymple; foreman of wheel shop, A. W. Dutton.

Napoleon Savard, 23 years of age, a telegraph lineman, died from an electric shock which he received while at work in Montreal, January 2nd. He and his brother were replacing and coupling wires at the top of a pole. Napoleon Savard was in the act of splicing two ends of wires He had no rubber gloves on, and received a strong shock. He grasped the wires convulsively with both hands, and was badly burned, the shock proving fatal.

A. D. Benjamin died in Toronto of heart failure last month. Until about a year ago he was senior partner in the well-known firm of M. & L. Samuel, Benjamin & Co. Mr. Benjamin was born in Melbourne, Australia, 1848, and in 1854 removed to England with his father. He graduated from the University of London in 1865, receiving the degree of B.A. with honors. He first located in Montreal, then returned to England, but finally settled in Toronto about the year 1878, and became a partner in the business already mentioned.

W. A. Carlyle, late Government mineralogist of British Columbia, and a most distinguished graduate of McGill University, Montreal, left London, Eng., for Spain about the 1st of Jan., to assume a position which is the best obtainable in the mining profession, namely, the managership of the Rio Tinto mines, Spain, where his salary will be $25,000 a year. In an interview before leaving London he denied the report that his resignation of the managership of Le Roi mine in British Columbia was due in any way to a disbelief in its future. It was simply a question of accepting an infinitely better position. The mining future of British Columbia, he said, was very bright. He spoke of the incalculable harm which he said had been done by the eight-hour law, which checked mining work at a very important time in its history.

J. R. Roy, son of Rouer Roy, Q.C., Montreal, whose appointment as secretary to the Public Works Department was announced a short time ago from Ottawa, received very pleasing testimony to the esteem in which he is held in British Columbia before he gave up his position as Dominion resident engineer there. The New Westminster city council unanimously passed the following resolution: "That this council desires to place on record its appreciation of the services rendered this corporation, from time to time, by J. R. Roy, Esq., C.E., during the four years he has been at the head of the Public Works Department in British Columbia, and, while gratified to learn that his removal to headquarters at Ottawa is in the line of promotion, it cannot but express regret at the departure of an official so painstaking and courteous, and with whom the council's relations have been invariably pleasant and satisfactory." Mr. Roy was also tendered a dinner, which was attended by a large number of well known people.

Electric Flashes.

The Niagara, St. Catharines & Toronto Railway Company will build an electric railway to Hamilton.

The Belleville, Ont., city council has refused an unlimited franchise to the Trenton Electric and Water Company.

The Woodstock, Ont., council, has refused a 50-year franchise to an electric railway between that town and Ingersoll.

An electric line is spoken of to connect the graphite mines near Calabogie, Ont., with the Kingston and Pembroke Railway.

We have received a handsome steel letter opener with bone handle from the well-known electrical firm of Ahearn & Soper, Ottawa.

The right of way granted the Preston and Berlin Railway expired on 15th ult., but it was extended for six months by the Berlin, Ont., council.

Jos. Hughes, formerly employed by the Montreal Street Railway Co., is now superintending the construction of San Paulo Railway, Brazil.

The Electrical Construction Co., of London, Ltd., has recently installed a 500-light dynamo for the North America Bent Chair Co., of Owen Sound.

The London Printing and Lithographing Co., has recently installed a 150-light dynamo, the Electrical Construction Co., of London, Ltd., having the contract.

Alfred Fairbairn, who for a number of years has been paymaster of the Montreal Street Railway, is now comptroller of the West India tramway, Kingston, Jamaica.

Young Bros., iron founders and machine builders, Almonte, Ont., have installed a plant to light their works. They built most of it themselves, and it is most successful.

The Ottawa and Dundas Electric Railway is applying for a charter to build a line from Ottawa, Ont., to the St. Lawrence River in Dundas county, and to build branches.

The Renfrew Electric Light Company has been incorporated and is getting their plant ready. The authorized capital is $75,000. A. A. Wright is president and manager.

The returns at the Interior Department at Ottawa show that the receipts for the first two months that the Yukon telegraph line was in operation amounted to over $13,000.

The Fire and Light Committee of Woodstock, Ont., has been authorized to obtain figures for the purchase of the electric lighting plant and the introduction of an all-night lighting service.

The Electrical Construction Co., of London, Ltd., has received an order from John Starr, Son & Co., of Halifax, for an 8-h.p. motor.

The Fraser Cap and Fur Co., of London, has recently placed an order with the Electrical Construction Co., of London, Ltd., for a new increased size of motor for its factory.

The villages surrounding Lake St. John are being gradually lighted by electricity. Roberval has been so lighted for some time, and now Jonquieres is to be similarly illuminated.

The Beattie Mnfg. Co., Toronto, has placed an order for a larger motor with the Electrical Construction Co., of London, Limited.

The dates decided upon for the twenty-third convention of the National Electric Light Association are the 22nd, 23rd and 24th of May, 1900. The meeting will be held in Chicago, Ill.

Achille Gagnon proposes to connect Victoriaville and Arthabaskaville, Que., with an electric railway, providing the ratepayers of Arthabaskaville vote the bonus offered by the council.

The Hamilton-Galt-Berlin Electric Railway Company will apply to the Legislature at its next sitting for an Act extending the time for the building and completion of the company's lines of railway.

The Stratford Clothing Co. has recently placed an order with the Electrical Construction Co., of London, Ltd., for an 8 h.p. motor.

Three motors for operating from 110 volt private isolated plants have been shipped to Winnipeg by the Electrical Construction Co., of London, Ltd., of 12, 4 and 3 h.p. capacity respectively.

The Sydenham Glass Co., of Wallaceburg, Ont., is still adding to its fine equipment of machinery, having recently placed an order with the Electrical Construction Co., of London, Ltd., for a 60-light dynamo.

The Toronto and Hamilton Electric Co., manufacturer of dynamos, motors and all electrical apparatus, has moved into the new premises, which is a ten-story building, 60 x 100 feet, Nos. 99, 101 and 103 McNab street, Hamilton, Ont.

A number of Ingersoll, Ont., business men are taking steps to secure a charter for an electric railway. The charter aims at the same running powers between the towns as the Woodstock, Ingersoll and Thames Valley Railroad Company are seeking.

The Electrical Construction Co., of London, Ltd., has already placed several of the eighty second-hand machines recently returned from Winnipeg. Those who have inspected these machines say there are many good bargains among them.

The city engineer of Hull, Que., is at present engaged in preparing plans for the new dynamo house to be erected, to be in operation by August next. The plans call for 75 arc lights. About six miles of streets will be lighted. Powe will be secured from two 50-light dynamos.

The Woodstock Sentinel Review has been considered lately as a model printing house. It has recently added to its already extensive plant an 80-light dynamo and wiring; the contract for which was given and has been completed by the Electrical Construction Co., of London, Ltd., for the multipolar type apparatus

Hon. P. Garneau, V. Chateauvert, J. T. Ross,, Hon. J. Tessier and the Hon. J. Sharples, Quebec; J. McNaught, New York and H. H. Melville, Boston, are being incorporated as the Labrador Electric Light and Power Company, to develop water powers on the Murray Bay River, Quebec, and to build electric lines and paper mills.

The James Cooper Co., Montreal, are suing the War Eagle Gold Mining and Development Co., Ltd., for $150,000, for alleged libel and slander, in connection with the installation of the electric hoist and compressor plant in the War Eagle mine. It is claimed an untrue statement was made, damaging to the Cooper Co., as a business concern.

The inventive talent of the best engineers has been taxed ever since alternating current became popular, to devise a voltage regulator which would be simple in construction and yet be satisfactory in operation; few are said to have attained this. The Chapman Voltage Regulator seems to be meeting with unqualified success. The regulators are manufactured by the Belknap Motor Co., of Portland, Maine, whose Canadian business has been placed in the hands of Munderloh & Co., the well-known electrical firm of Montreal.

Jack & Robertson, Canadian sales agents for Sprague Electric Co., New York, specially call attention to the Flexible Metallic Conduit (pages 103-112, of their new catalogue No. 75), which, owing to its low price, and saving of labor in installing, is said to have considerably reduced the cost of modern conduit work; even more so than did the introduction of uninsulated plain iron pipe.

The Divisional Court at Toronto held recently that the Lord's Day Act does not restrict electricians from working on the Sabbath, as they are not expressly mentioned. Electrician Mashinter, of Huntsville, Ont., was convicted lately for violating the provisions of the Act while at work in Shaw, Cassels & Co.'s tannery, but on the application of solicitors the court quashed the conviction.

The Bell Telephone Company has just completed and opened a heavy long distance copper metallic circuit line between Ottawa, Carleton Place, Smith's Falls and Brockville, Ont. It required upward of 3,500 poles, 4,000 cross-arms and 75,000 lbs. of copper wire. This line gives Ottawa a direct long distance service with Buffalo, N.Y., and other western points, and a material reduction has been made in the rates.

The Niagara and Southwestern Electric Railway Company, Ltd., is applying for incorporation to build an electric railway from Niagara-on-the-Lake through St. Catharines and Smithville to Hagersville, Ont., with branches from Decew Falls to Hagersville via Dunnville and Cayuga, and from Niagara-on-the-Lake to Queenston, passing where necessary through the counties of Lincoln, Welland, Haldimand and Wentworth.

The Electrical Review, New York city, begins the new year with a special double number which is remarkable for its valuable contributions, handsome illustrations and typography. A new dress of type, a change in the color of the cover and a more up-to-date arrangement of reading pages are some of the improvements made. The contents include a review of electrical progress during 1899 in the United States, Great Britain and the continental countries of Europe.

A plan is proposed by Messrs. Denniston and Payne for the development of power at two points at Niagara Falls. The first would be where the Chippewa flows over the bluff in the park. Here it is thought 30,000 h.p. could be developed. Then by conducting the water in a canal through the park to a point below the Falls, and utilizing the fall into the River Niagara, the power could be increased to 100,000 h.p. For this scheme, it is stated that English capital is forthcoming.

That the Canadian Niagara Power Co. will develop power in the Victoria Park is now stated on the authority of W. B. Rankine, vice-president of the company. The actual work will commence next fall, although some preliminary steps will be taken before then. The Canadian plant will be completed within two years, as this was the period required to sink the wheel-pits and construct the tail race on the American side. The first development will consist of from 15,000 to 25,000 h.p.

The Shawenegan Water and Power Co., at the falls of that name, is spending $300,000 this winter, over 1,000 men being engaged. The Shawenegan Carbide Co., of which William Mackenzie, Toronto, is said to be a leading shareholder, has agreed to take 10,000 h.p., while the Pittsburg Reduction Co., whose works are also to be established on the St. Maurice, will also take a great deal of power. Thirty houses a month are being built, and it is expected that the St. Maurice will be dotted all the way from Three Rivers up to the Great Northern Railway by a flourishing manufacturing community.

W. H. Browne, general manager of the Royal Electric Company, Montreal, stated a short time ago that the company had despatched to the Nova Scotia Steel & Iron Company a complete electric lighting plant, consisting of a two-phase generator and complete equipment of sixty alternating current-enclosed arc lamps. This is said to be the first installation in Canada where an alternating current generator has had its entire capacity taken up with arc lamps alone. He stated further that the company, in conjunction with the Waterous Engine Works, had secured the contracts for the new electric light service to be installed at Greenwood, B.C.

The Court of Appeal has reversed the judgment of the Court of Review and confirmed the judgment of the Superior Court in the case of the Ottawa Electric Company and the Hull Electric Company. By the present judgment the Ottawa Electric Company is declared to have the right to compete with the Hull Electric Company; the bylaw of the city of Hull, Que., giving exclusive rights to the Hull Electric Company, is declared to create a monopoly, and the act of the legislature confirming said bylaw is declared to be unconstitutional.

The establishment of the Marconi system of wireless telegraphy in the northern part of Newfoundland, and along the Labrador coast, seems to be contemplated by the Newfoundland Government, whose Minister of Marine and Fisheries, in a recent interview, stated that the plan at present thought of, if arrangements can be made with Marconi for instruments, fitting up, etc., is to connect the Labrador coast with the nearest telegraph station on the island, probably Tilt Cove. The distance between Tilt Cove and Rameo, Northern Labrador, in a line along the coast, is something over 850 miles. This means that 18 stations at a distance of about 50 miles apart would be placed.

The Metropolitan Electrical Co., Ottawa, is employing 300 men and 50 teams of horses on its power works at Britannia, Ont. There are in operation five steam drills, three steam derricks, a steam dredge, two locomotives and fifty flat cars, comprising part of the plant. The total length of the canal is about 3,000 feet, about 1,200 feet of this is solid rock, through which there is a cutting of about 150 feet wide and varying in depth from eight to fourteen feet. In the blasting of this rock about one ton of dynamite is used a day, and about two car-loads of coal are consumed every day, in operating the plant. The company expects to be in a position to deliver power May 1st. J. Aylen, C.E., is in charge of the works. Thos. Lyndsay, Ottawa, is president of the company.

The Niagara Falls Park Commissioners have reached an agreement with the Fort Erie Electric Ry. Co., under which the latter will be allowed to extend its line for a distance of thirteen miles along the bank of the Niagara River to Slater's Point. This brings the line within two miles of Chippewa, but the ground between the two points is already occupied by the Niagara Falls Park and River Ry., which did not run cars between Slater's Point and Chippewa last season, and the Park Commissioners may cancel the existing agreement and transfer running rights to the Fort Erie Company. In return for the franchise from Fort Erie to Slater's Point the Fort Erie Co. has agreed to buy a right of way, giving a width of 66 feet over the land to be traversed, and to pay a yearly rental.

A recent report respecting the good understanding which is known to exist between the Royal Electric, the Chambly Water and Power Company, and the Montreal Street Railway, is that the latter corporation will buy large blocks of the Water and Power Company's stock. It is also said that the Royal Electric will buy a large interest in the same corporation. It is a well-known fact that the Montreal Street Railway will take a good share—if not all—its power from the works at Chambly, and it is generally believed that between the Street Railway and the Royal Electric, the two consumers of electricity will be able to use up about all the power that the Chambly Company can furnish. The officials of the different companies, while not denying that there are plans on foot, refuse to say anything at the present.

Marine News.

A marine railway is building at Parrsboro, N.S., this winter; local capital having been subscribed.

Innes, Hemeon & Co., general merchants, shipbuilders, etc., Liverpool, N.S., are applying for incorporation as Innes, Hemeon & Co., Ltd.

The Montreal Harbor Commissioners have empowered the chief harbor engineer, John Kennedy, C.E., to prepare estimates and specifications of a powerful dredge, a derrick and four scows, for use in the harbor improvement works next summer. It is estimated that this additional plant will cost about $100,000.

There is a considerable revival of wooden shipbuilding in Nova Scotia, notably at Parrsboro' and Port Greville, where a number of four-masted schooners are being built.

Adam Mackay, Hamilton, Ont., who has returned from England, says the two new boats being built for the Hamilton and Fort William Navigation Company will be ready by June 1.

The Davies Dry Dock Co., shipbuilders, Kingston, Ont., have the contract to build a steamboat, 70 feet long, for a Rat Portage firm. It will be completed in time for the opening of navigation.

The new wharf to be built by the Richelieu & Ontario Navigation Company at the foot of Scott street, Toronto, will be completed by the 1st of April, and will cost $23,000. The wharf will be 357 feet long and 54 feet wide. On it will be erected freight sheds, waiting rooms and ticket offices for both the Hamilton Steamboat Line and R. & O. Company.

R J Leslie, Halifax, N.S.; J. McLean, Souris, P.E.I.; William McKenzie, Pictou, N.S.; E. G. Kenny, Halifax, N.S.; J. G. Binet, Magdalen Islands, Que.; G. C. Hart, Halifax, N.S., and W. G. Leslie, Magdalen Islands, are applying for incorporation as the Magdalen Islands Steamship Company, Ltd., with a total capital stock of $100,000, headquarters at Halifax, N.S.

Railway Matters.

The pension system recently introduced by the Pennsylvania railways is taking root on the other lines.

The Quebec Central Railway Co. gave its office employees a raise of ten per cent. on their salary as a Christmas present.

The Mineral Ry. Co. asks a charter to build a railway from Gros Cap Harbor on the north shore of Lake Superior to the Canadian Pacific Railway.

It is said that the Canso and Louisburg Railway Co. is contemplating the construction of a bridge across the Strait, which, it is estimated, will cost $3,000,000.

The Montreal and Ottawa Railway Co. is applying for an Act extending the time within which it may complete its railway and connect it with the railway of the C.P.R. in Ottawa.

The Canada Atlantic Railway Co. intends building a second elevator at Depot Harbor, Ont., with a capacity of 1,500,000 bushels, this season. It will also add three new steamers to its grain fleet on the upper lakes.

Incorporation is asked for the Crow Lake Railway and Development Co., to construct a railway from White Fish Bay, Lake of the Woods, easterly to a point in Crow Lake, and to operate same by steam or electricity.

Application will be made for incorporation of a company to construct a railway from near Cascade, B.C., in a westerly direction to Carson, with a branch from Grand Forks fifty miles up the North Fork of the Kettle River, following the valley of the same river, also with a branch from a point at or near Grand Forks in a southwesterly direction by way of Greenwood, to Midway.

The Manitoulin and North Shore Railway Co. will apply to the Ontario Legislature at its next session to empower it to build from Little Current to James Bay, and from the township of Drury to Sudbury, and also from Little Current to the south shore of Manitoulin Island, and from Tobermoray in the county of Bruce to Meaford, passing through Wiarton and Owen Sound, Ont.

The Athabasca Central Railway will apply for a charter at next session of the Dominion Parliament to build a railway from Edmonton to Victoria Settlement and the Athabasca River, and on to Vermillion Falls on the Peace River. The company will also ask power to mine, smelt and manufacture iron, etc., and develop asphalt, gas, tar, and petroleum deposits, and do a general trading business in lumber, etc.

Application will be made to the Ontario Legislature for incorporation for the Wabigoon, Manitou and Rainy Lake Railway Co. to build a steam or electric railway from the south-eastern end of Minnetakie Lake or Mine Centre, and from a point on the Canadian Pacific Ry. between Dryden and Tache

Station, southerly (east of Manitou Lake), to a point on the Ontario and Rainy River Railway between Fort Francis and Sturgeon Falls.

Application will be made at the next session of the Dominion Government for a charter for a company to construct a line of railway from Collingwood to Toronto, Ont., and also to maintain a fleet of vessels to run between Toronto and the River St. Lawrence. W. Mortimer Clark, Q.C., is the solicitor for the applicants, the names of whom have not as yet been made known. Mr. Mortimer Clark says there is plenty of money in the company, which is composed of financial men. The new railway will do a grain-carrying business principally.

Application will be made to the Ontario Government for the incorporation of the Crow Lake Railway and Development Company, with power to construct a railway from a point on White Fish Bay, Lake of the Woods, to a point on Crow Lake, and to operate same by steam, electricity or other motive power, also with power to build and operate steamboats, saw mills, electric power plants, hotels, stores, wharves, milling plants, and to operate and develop mines, and to obtain the exclusive privilege of carrying on the business of fishing in Crow Lake.

The Dominion Iron and Steel Co. propose to construct a line of railway from its quarries at George's River, to connect with the I. C. R. about midway between the George's River station and the North Sydney junction. Grading has already commenced, and it is anticipated that early this month, when the stone crusher and compressor are expected to arrive, the company will be in a position to ship material over the new line to the works here. A bridge will span the river opposite the quarries. Martin Stephens, of Belle Isle, Nfld., has been appointed manager of the quarries.

Mining Matters.

T. B. Caldwell is developing extensive water powers at his iron mines at Calabogie, Renfrew county, Ont.

It has been announced that the Slocan, B.C., miners have accepted the Payne's offer of $3.75 per day of eight hours.

The expenditure of the Dominion Coal Company in Nova Scotia exclusive of royalty and wages is about $600,000 annually.

The big shafts being sunk by the Dominion Coal Company, near Glace Bay, C.B., are down, air shaft 100 feet and main shaft 130 feet.

A great boom in copper development is predicted by M. H. Fitzpatrick, Pictou, N.S. The Crown Copper Co. is making great progress.

Very extensive discoveries of hematite are reported from Visso's Ridge, near Portugal Cove, Nfld. The ore is similar to that at Belle Isle.

There have been fresh discoveries of petroleum in Cape Breton at Lake Ainslie. A flowing well was recently struck at 565 feet, the Sydney Record says.

The Lake Superior Mining Institute will hold its next meeting at Iron Mountain, commencing 6th February next. The secretary is F. W. Sperr, Houghton, Mich.

The prospectus of the Sultana Mine of Canada, Ltd., states that the mine was bought from J. F. Caldwell, Winnipeg, for £225,000, all of which Mr. Caldwell took in stock.

Natural gas was struck in the Queen Victoria Park at Niagara Falls, Ont., where test borings were being made preparatory to calling for tenders for the power tunnels.

A. E. Martin has discovered extensive veins of graphite running from 35 to 50 per cent flake graphite on the farm of O. McCoy, on the River Blanch, St. Malachy, Que. There is said to be a fine water power in the neighborhood.

Great activity is noticeable in mica mining in the Gatineau River district, particularly in Hull, Wakefield and Templeton townships. The Blackburn Bros., Wallingfords, Sills Mica Co., A. H. Murphy, and a great many smaller operators are producing large quantities

The prosperity in the iron industry has directed renewed attention to the iron resources of Quebec, and it is likely that the Bristol, Old Ironsides and Haycock mines in Ottawa county, which have been shut down for a number of years, will be reopened shortly.

The Crown Copper Company expect to have their furnaces in operation in about four weeks or sooner. The engine is up and has been tested. A powerful dynamo has been set up, and the wiring of the large buildings is going forward.—Mining Record, January.

C. E. Mitchener, M.E., New Philadelphia, U.S.; C. H. Howland, Cuyahoga Falls, O.; H. Totten and N. F. Davidson, Toronto, Ont.; and W. McVittie, Sudbury, Ont., are applying for incorporation as the Canadian Nickel Co., Ltd.; capital to be $900,000; head office, Worthington, Ont.

It is understood that by the opening of spring arrangements will have been completed for the construction of a silver-lead smelter at Moyie Lake, B.C. Both furnaces at the Hall Mines smelter at Nelson are in blast. The one hundred ton furnace is running on lead ore, and the big one on Silver King ore.

At Thetford, Que., the Bells Asbestos Co., King Bros. and Johnsons are the principal operators in asbestos. At Black Lake mining has been resumed by the Glasgow and Montreal Asbestos Co. The property formerly worked by the American Asbestos Co. is now known as the Union Mine and is being worked by a German company.

The Mikado Mining Co., of which T. R. Deacon, C.E., of Rat Portage, is the Canadian director, has just installed a sorting plant in their 20 stamp mill at the Mikado mine near Rat Portage, in order to increase the efficiency of their present batteries. By this means it is expected that the output of bullion which has been running about $12,000 per month, will be increased, as there is plenty of good ore in sight.

J. Patterson, J. Moodie, W. Southam, C. W. Moodie, J. R. Moodie, J. M. Harris, S. Barker, W. W. Osborne, J. J. Scott, J. Dixon, A. T. Wood, T. H. Macpherson, J. T. Glassco, J. Knox, J. H. Tilden, J. Milne, G. E. Tuckett, H. B. Witton and J. W. Sutherland, Hamilton, Ont., and J. A. Kammerer, Toronto, have been incorporated as the Nickel Copper Co., of Ontario, Ltd.; capital, $10,000,000; head office, Hamilton. The company proposes to carry on in all its branches, mining, milling and reducing.

Mining industries are still attracting attention in the vicinity of St. Stephen. The English syndicate is working on its shaft on the Hall farm. The ore is looking well. Another company is now at work near Moore's Mills getting ready to sink a shaft. They claim to be on the same nickel ore that crops out on the Hall farm. Still another company, a Boston syndicate, will soon operate on the Magguerrock Mountain claim, on the American side of the river, above Milltown. It looks as if there would be quite a mining boom on the St. Croix in the near future.—St. John, N.B., Telegraph.

News was brought by the steamer "Danube," from Skaguay to Vancouver, December 19th, of the reported discovery of a vast body of free milling ore, within ten miles of Dawson. The Yukon Sun says it is one thousand feet in depth, one mile wide, of unknown though great length, assaying as high as $860 to the ton. Over twenty claims were recorded in that locality up to November 7th. The exact location of this ore body is given as the left bank of the Yukon, seven miles above Dawson It is neither a deposit of gravel nor a quartz ledge. As defined by a Dawson metallurgist, it is an oxidized mass of quartzoric porphyrite rock, containing more or less gold throughout the porous oxidized material, as well as in hard quartzite.

S. J. Ritchie, Akron, O., has begun a suit for $1,200,000 damages in the Common Pleas Court against Stevenson Burke, N. P. McIntosh, C. W. Bingham and the other directors of the Anglo-American Iron Company. Mr. Ritchie, who originally discovered valuable deposits of mineral in the Sudbury district of Ontario, has been in constant litigation for years with the Cleveland capitalists who were interested with him in developing the field. The suit filed January 13th, alleges that the defendants are in the control of the Anglo-American Iron Company, who also control the Canada Copper Company, which has properties in the same neighborhood; they have neglected and refused to

operate the mines and mills of the former company, while pushing the property of the latter. The Anglo-American Iron Company, he says, could earn $300,000 a year, and he asks the judgment in behalf of all the shareholders, except the defendant directors.

MEASURES AND RULES.*

BY P. TROWERN.

Before I enter on fractions or decimals I would like to tell you how the mechanics' rule was brought into use (our foot rule I mean). A long time ago measurements of land were made by a person stepping it, one foot before the other in a straight line, which were called so many steps by the land surveyor, and the small pieces were measured by their feet, the heel of one foot touching the toes of the other, which made it so many steps, and feet disputes soon arose between the people and the surveyors so that the Government had to make laws for the people, and in 1760 a number of men's feet were measured, and they came to the decision that a step should agree with 3 feet, called a yard, and that a foot should be divided into 12 equal parts, called inches, so you see the yard became a unit, and a foot was 1-3 of a yard, a fraction or piece, and the inch, 1-12 of a foot, became a fraction, or a small part of the 36 inch yard, a gold rod was made and marked off in feet and inches as a standard belonging to the Government in England. All countries do not agree with regard to the length of the foot; 46 French feet is equal to 49 English, 35 German feet are equal to 57 French; the Russian foot is equal to the English foot, the old Turin foot was equal to 20 inches, and the inch was divided into 12 parts; in all the Prussian States the length of the foot differed; the inch in England and Canada is divided into 8 parts to commemorate or keep before our eyes or knowledge the very useful and mechanical members of our bodies, our two hands and arms, our two legs and feet, equal 4 or ½ inch, and our two eyes and our two ears make the 8 parts, or the vulgar fractions; this word was not then used as it is now, but to show the parts of the whole unit, the yard. The French said that we have as great a national right to show our love and respect to our five fingers and toes as to any other part of our body, which induced them to divide their foot into 10 parts, and their inches into 10 parts; by so doing they brought into general use among themselves the decimals, 5 on one hand and 5 on the other, equal 10, and 10 toes equal 20, and this $20 \times 5 = 100$, which they called a unit; this unit x by $10 = 1{,}000$, and so on. I will now draw your attention to the fractions of our 12 inch rule, we say so many feet, inches and eighths; what I conceive it to be our duty in this society is to keep before our mind the use of our rule and calculations of our foot rule; if you wish to practise fractions make your calculations with the different fractional parts of it, keeping before you our mechanic's rule as a unit; ½ of 12 inches equals 6, ¼ equals 3, 1-12 equals 1; the division of the 1 inch are vulgar fractions, ½ of an inch equals 4-3, ¼ equals 2-3 and ⅛ equal to 1 of the 8 parts the inch is divided into, or if you wish to divide it more, 1-16, 1-32 and so on, and to have mixed fractions you may say 1 foot 3 inches and ⅞ and a 1-32; and if you wish to add a number of them together it is easily done.

In 1788 the French people asked their Government to have a standard by which all their weights and measures might be made and compared. A number of scientific men were called together to devise a standard, which they did by taking a fourth part of a meridian of circumference of the earth. This fourth part of the line was divided into 10,000,000 equal parts, and each part was called a metre, which is equal to about 39 English inches; this metre is divided by 10, and called a decimetre, and by 100 and called a centimetre, by 1,000 and called a millimetre. To obtain the other measures a cubical box was made, exactly on each of its sides 1-100 part of a metre, or one centimetre; this was filled with water at its greatest density, and the weight of this water was called a gramme; a gramme was divided by 100, and it was called a centigramme.

*From a paper read before No. 1 C. A. S. E.

METAL IMPORTS FROM GREAT BRITAIN.

The following are the sterling values of the imports from Great Britain of interest to the metal trades for the month of December and the twelve months ending December, 1898-99.

	Month of Dec.		The year to December.	
	1898.	1899.	1898.	1899.
Hardware	£1,278	£2,299	£21,578	£21,69
Cutlery	2,831	4,102	51,374	53,795
Pig iron	42	2,043	11,043	38,366
Bar, etc.	1,429	1,133	10,478	34,061
Railroad	12	100	9,195	152,981
Hoops, sheets, etc.	1,627	1,282	63,605	111,653
Galvanized sheets	623	322	65,176	69,515
Tin plates	13,090	14,043	168,627	249,513
Cast, wrought, etc., iron	2,182	5,892	26,820	67,783
Old (for re-manufacture)	—	683	4,324	8,408
Steel	2,282	17,149	48,844	157,504
Lead	1,041	1,277	36,092	44,855
Tin, unwrought	759	1,979	16,601	25,922
Alkali	1,705	2,332	50,028	44,656
Cement	487	449	25,595	38,749

ONE FIRST-CLASS MARINE BOILER

Eight feet long, 4 feet 8 inches wide, 26 2½ tubes, 6 feet long. Allowed 115 lbs. steam. Been in use 4 years. DAVIS DRY DOCK CO., Kingston. 2-1

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A good Water Power, 300 horse, situated one half mile from railway, every facility for making siding to power. Address

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Bridge Tenders Wanted.

Sealed Tenders (marked tenders for bridge) for the superstructure of a steel bridge over the South Nation River at Lemieux, on the boundary line between Prescott and Russell, Ont., will be received by the undersigned up to the 20th January next, inclusive (1900).

Separate Tenders for the construction of the abutments of said bridge will be received by the undersigned up to said 20th day of January next, inclusive.

Plans and specifications of said bridge (iron work and masonry) may be seen and further information obtained, at the office of the undersigned, in the Court House in the Village of L'Orignal.

The lowest or any tender not necessarily accepted.

E. ABBOT JOHNSON,
Clerk United Counties of Prescott and Russell.

L'Orignal, December 12th, 1899.

ST. LAWRENCE CANALS

NOTICE TO ENGINE AND BOILER MAKERS.

Sealed Tenders addressed to the undersigned and endorsed "Tender for Engines and Boilers," will be received at this office until sixteen o'clock on Monday, 5th February 1900, for the construction &c of two non-condensing marine engines and a Clyde boiler.

Specification of the work can be seen at the office of the Chief Engineer of the Department of Railways and Canals at Ottawa, and at the Superintending Engineer's Office, Corn Hill, where forms of tenders can be obtained on and after Saturday, 20th January, 1900.

In the case of firms there must be attached the actual signatures of the full name, the nature of the occupation and place of residence of each member of the same, and, further, an accepted bank cheque for the sum of $500 must accompany the tender; this accepted cheque must be endorsed over to the Minister of Railways and Canals, and will be forfeited if the party tendering declines entering into contract for work at the rates and terms stated in the offer submitted. The accepted cheque thus sent in will be returned to the respective parties whose tenders are not accepted.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES
Secretary

Department of Railways and Canals,
Ottawa, 18th January, 1900.

Newspapers inserting this advertisement without authority from the Department will not be paid for it. 2-1