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For THE CANADIAN ENGINEER.

NEWFOUNDLAND AS A FIELD FOR MINING INVESTMENT.

BY ALEXANDER DICK, C.E., M.E., HALIFAX.

Newfoundland has long been known to be wealthy in many kinds of minerals, but it is only very recently that the colony has been opened up in a manner suitable for the proper examination of its resources from an economic point of view. From 1854, at which date the records begin, to the end of 1891, the value of all ores and products of ores exported from the island was as follows:

Copper	$9,193,790
Iron pyrites	247,087
Lead	119,804
Nickel	29,604
Sundry minerals	6,540
Total	$9,596,825

COPPER AND PYRITES.

The mining of these has been entirely confined to the shores of the great bay of Notre Dame, on the north-east coast. At this place there are large deposits of sulphurets, yielding an average of 12 per cent. of copper, and since 1864 work on these has gone forward with greater or less vigor, as the price of the metal rose and fell, at the various mines in Tilt Cove, Betts' Cove, and Little Bay. Associated with these copper ores are large bodies of magnetite and iron pyrites. Considerable quantities of the latter have been worked at the foregoing mines; and at Pilley's Island, in the same district, a large lode containing over 60 per cent. of sulphur has been extensively mined, and shipments have been made to the United States. Since 1891 there have been exported of these minerals:

Copper, 100,926 tons, valued at	$1,337,034
Pyrites, 113,647 " " "	829,392

IRON.

The foregoing figures represent the entire mining industry of Newfoundland up to the end of 1894. In that year, the attention of capitalists was directed to the brown hematite iron ores of Great Bell Island, Conception Bay, and in September, 189., the writer was instructed to make an examination and report for an American syndicate. Prior to that visit, however, several mining areas on the western end of the island had been secured by the Nova Scotia Steel Co., and these are being extensively worked by them at the present time. As a result of this report, the balance of the island is now secured and will soon be operated. The geological formation of the island is so simple, it seems amazing that the value of these deposits was not sooner appreciated. The island, containing about 11 square miles, is made up of a series of sandstones, slates and iron beds perfectly and regularly stratified, dipping at an easy inclination towards the north. The ore beds vary from two to fourteen feet in thickness, and the mineral is easily separated from the over and underlying strata. The ore has a perfect cleavage, both on "butt" and "cleat," and breaks readily into cubical blocks of a size convenient for handling. Its structure is of a fine granular nature, showing a steely lustre on being freshly fractured, and the easy grade of dip (not over 8°) enables large quantities to be mined "opencast" along the line of outcrop. The cost of production is low, and the ore should be easily put on board ship at a figure that would enable it to compete with any ore entering the eastern markets of the American continent.

The Nova Scotia Steel Co, operating the eastern end of the island, has shipped about 40,000 tons since they began operations in the fall of 1895. A considerable portion of this quantity was shipped to Baltimore, U.S.A., under contract, and the balance to the company's own works at Ferrona, Nova Scotia. The ore is mined opencast, a rock cover of about 4 feet in thickness, overlaid by a foot of soil, having to be removed to lay bare the ore. It is loaded into cars carrying each about one ton of mineral, and these are conveyed by endless haulage about 1½ miles to the shipping pier. The cars dump the ore into hoppers on the pier from which the ship is loaded. Twenty-four feet of water is obtained at the pier, and a steamer carrying 2,000 tons can be loaded and dispatched within a few hours.

The following are some analyses of the ore, the first being an average of a number of samples taken from the east end of the island, owned by the Nova Scotia Steel Co., and the other from a sample from the west end of the island.

EAST END OF ISLAND.*

(Average of a number of Analyses.)

	Per cent.		Per cent.
Metallic iron	54.000	to	59 000
Silica	5 000	to	12 000
Alumina	2.000	to	4.000
Phosphorus	0 500	to	0 700
Sulphur	trace	to	0.012
Carbonate of lime	3.000	to	5.000
Oxide of manganese	trace	to	0 400

WEST END OF ISLAND.

	Per cent.
Metallic iron	56 020
Oxygen with the iron	23.400
Silica	9 100
Aluminum	4·690
Lime	1 600
Magnesia	0 504
Oxide of manganese	260
Sulphur	trace
Phosphorus	0 514
Titanic acid	none
Water and organic matter	2 820
Undetermined matter and loss	1.092
	100 000

Besides these Bell Island deposits, there are enormous masses of various kinds of iron throughout Newfoundland, notably along the north-east coast, the west coast and the northern shores of Conception Bay. Amongst the more common are: magnetite, hematite of different varieties, specular iron and arsenical pyrites, whilst associated with the carboniferous series, to which I will refer shortly, are a number of beds of clay band ironstone whose extent and value are yet to be determined. During a recent visit to the colony I was shown some samples of bog iron ore of very good quality which had at that time been brought into St. John's for analysis.

CHROMITE.

Another economic mineral, which is now in the hands of the Canada-American Company, and which promises well, is an extensive deposit of chromite on the west coast. Some exploratory and development work has been done there during the past summer, and about fifty tons were shipped as a test quantity.

COAL.

Regarding the coal deposits of the island, it is impossible at present to say much. They have long been known to exist, but the country has been entirely devoid of means of internal communication until the railroad from St. John's to Port aux Basque, which is now nearing completion, opened up what was pretty nearly unexplored land. R. G. Reid, of Montreal, the builder of the road, has paid a great deal of attention to the mineral deposits along the line, and, amongst other things, he has exposed several seams of coal. I have examined some samples of these, and while I have not yet made any analysis, I am fairly well satisfied as to their quality. One seam, in particular, is of a hard, clean, bright nature and very free from dirt bands. The coal fields are confined, so far as is at present known, to the western side of the island, in the neighborhood of Grand Lake and Bay St. George. The new railroad passes through or very close to the two main areas, so that there should be no difficulty about their development. The knowledge of these seams is as yet scant, and it will require the services of an expert economic geologist to determine their extent, quality and commercial value.

GOLD.

For the last fourteen or fifteen years there have been periodic rumors of the discovery of gold in Newfoundland. The first real find, specimens of which may be seen in the Museum at St. John's, was at Brigus, on the western shore of Conception Bay. There are several sights of free gold in the specimens; the metal is secreted in cavities in the quartz, but unattached to it, being merely kept in place by a felspathic matrix, and when this rotten felspar is picked out the gold may be shaken from the specimen. The quartz at Brigus is pockety, however, and, to quote the Government geologist, "was rarely of any extent, and a few blasts not infrequently resulted in the disappearance of the lode rock." At Ming's Bight, on the north-east coast of the island, close to the copper deposits of Notre Dame Bay, some very fine specimens of dolomite crystals have been found. These are plated with gold as if electroplated, and the metal can be seen penetrating and plating the cleavages of the crystals. Gold has been detected in all the copper ores of Notre Dame Bay, and that it is in appreciable percentages seems evident from the fact, as stated to me by the Government Geologist, that the owners of the Union Mine, at Tilt Cove, had received as much as $50,000 of gold from the copper in the process of refining during twelve months. The refuse slag heap of former years has also been carefully picked over with considerable profit. Recently some excitement has prevailed in regard to reputed finds of gold-bearing quartz at Cape Broyle, on the Peninsula of Avalon, about 40 miles from St. John's. Several veins of quartz, some of them of considerable thickness, have been discovered running through beds of diorite in the Huronian rocks, of which the peninsula is chiefly formed. The quartz is white, carrying quantities of galena and pyrites. Assays have been made by reputable English firms, and as much as 2 ounces 19 dwts. 12 grs. of gold, and 1 ounce 11 dwts. of silver per ton have been obtained. Shafts have been sunk in several places and work will be resumed in the spring. Perhaps the most promising feature of the prospect lies in the fact that the diorite in which the quartz occurs has been found to yield 8 dwts. 12 grs. per ton, and if this is obtainable in any quantity it should be worthy the attention of capitalists as a profitable low grade investment.

SILVER AND LEAD.

The various ores of lead are liberally disseminated over the entire island, but the richest deposits have been found near Placentia, on the southern extremity of the Peninsula of Avalon. Mining operations have been carried on in a desultory manner since 1857, and up to 1892 over 2,500 tons of galena were mined. The ore is found in the quartz veins of the Huronian system, and the percentage of silver is variable. During my recent visit I obtained specimens of lead ore from a new find, picked samples of which yielded a really large percentage of silver to the ton.

PETROLEUM.

A local company has been doing considerable boring on the west coast, and strong indications of the presence of oil are said to have been found. The shares of the company are above par, and the excitement is very great in St. John's at present, but no reliable information could be obtained as to the exact results. There is no doubt, however, of the existence of oil, but whether it may be found in paying quantities or not, I am unable to say. From the position of the field I expect the oil would require to be piped a considerable distance to reach either a seaport or railroad.

*Journal Can. Mining Inst., Vol. 1, Part 1.

MINING LAWS.

The mining laws of Newfoundland are so framed that one must either spend some money in development or relinquish the claim. Once, however, a property has been proved satisfactory, it may be obtained on reasonable terms for a long lease. There are, doubtless, some points (which I will not dilate on here) upon which reforms are much needed, but in conversation with several prominent public men, I found a strong desire existing to do everything which might be necessary to obtain security of title and tenure.

According to chapter 13 of Consolidated Statutes, [second series], any person may search for minerals in the colony without first obtaining a license, but must not remove minerals. Having selected his ground—called a "mining location"—the extent of which must not exceed one square mile, the prospector must notify the Surveyor-General, and deposit a fee of $20. This establishes priority of claim or license for twelve months. If licensee desires to hold the claim after expiry of this time, he must deposit $30 more, which entitles him to a similar period, during which time he must spend $200 or its equivalent in labor exploring. If he desires a third year he must pay $50, and spend $400 or its equivalent in labor. At any time during this license a lease may be obtained for the minerals, along with a lease for fifty acres of surface land, by paying $25. The lessee must expend $800 per annum during the first four years of the lease, and during the fifth year $2,800, making $6,000 per square mile in all, or the lease shall be forfeited and the 50 acres of surface also. Extra land for railways and right-of-way may be granted at rate of 30 cents per acre. Gold areas are one-quarter square mile in extent, and are leased for 21 years. An initial payment of $50 has to be made on application for lease, and a royalty of 3 per cent. is to be paid on gross amount of gold mined. The lessee must lay out and expend $500 per annum on such leasehold, otherwise it shall be forfeited.

In conclusion, I can only say that there are vast possibilities for the ancient colony as a mineral-producing country.

ELECTRICAL PROGRESS DURING 1896.

In making up the forms for the press last month a sentence was dropped from one of the paragraphs in Mr. Armstrong's interesting review of the electrical progress of last year. The paragraph in full reads as follows :—

"In alternating work the battle of the phases and of rival types of generators has gone merrily on. The engineering considerations which should govern in any given case have, perhaps, not always been given due weight in the face of commercial exigencies requiring the sale of a particular system or make of machinery. Experience would seem, however, to have made certain conclusions reasonably evident, such, for example, as that resting on the authority of Dr. Louis Duncan that 'the best system for the transmission of energy for general purposes is the three-phase alternating system.' A point which may be conceded is the superiority of generators of the revolving field or inductor type for work requiring the use of currents at very high or very low potentials, the obvious facilities afforded by these designs for additional insulation or ventilation, as the case may require, rendering them especially well suited to certain classes of service. Where lighting alone is in question, the compounded single-phase alternator seems under ordinary conditions best adapted for the requirements of simplicity and close regulation."

It is rather a curious coincidence that on the same day this article appeared in THE CANADIAN ENGINEER, the *Western Electrician* of Chicago published a review of the electrical developments of 1896, under the same title, and by a writer of the same name (C. G. Armstrong), and further, that the Chicago writer, though dealing with local events, comes to the same conclusions on many of the problems of interest to the electrical world.

THE LATE E. CARL BREITHAUPT.

E. Carl Breithaupt, whose tragic death was the result of an explosion which took place at the Berlin gas works, January 26th, was well known as an engineer, and in the department of electrical work was an authority. Mr. Breithaupt was born in Berlin, Ont., on February 19, 1866. In early life he attended the public and high schools of the town, where he got a general education, afterwards going to the Northwestern College at Napierville, Ill., U.S. Later he attended Johns Hopkins University, Baltimore, Md., where he obtained the degree of E.E. About six years ago he was appointed manager of the Berlin Gas Company, which position he continued to hold. He was an active member of the American Electric Engineers' Association, and at the time of his death was second vice-president of the Canadian Electrical Association. He was one of the first directors of the Breithaupt Leather Company (Ltd.), of Berlin, Listowel and Penetang; and was also a member of the Toronto and Berlin Boards of Trade, and at one time director and president of the Berlin Board of Trade. He was president and manager of the Berlin and Waterloo Street Railway, and secretary and manager of the Gas Company. Mr. Breithaupt was a member of Beta Theta Pi fraternity at Johns Hopkins, where he graduated in electrical engineering in 1891. He has been a member of the Canadian Electrical Association since its inception, and a most active and valuable member of the executive committee. Last June he was elected to the office of 2nd vice-president, and it was hoped that within a year or two the association would have the benefit of his invaluable services as president. Mr. Breithaupt was an enthusiastic amateur photographer, and his work in this direction was of the highest artistic and technical value. He contributed from time to time papers to various American electrical publications, principally dealing with Canadian developments in electrical engineering, and his papers read before the C.E.A. were marked by a broad and comprehensive grasp of the subject. Deceased was the fourth son of the late Louis Breithaupt, mayor of Berlin in 1880, and was also a brother of the present mayor, J. C. Breithaupt.

E. CARL BREITHAUPT.

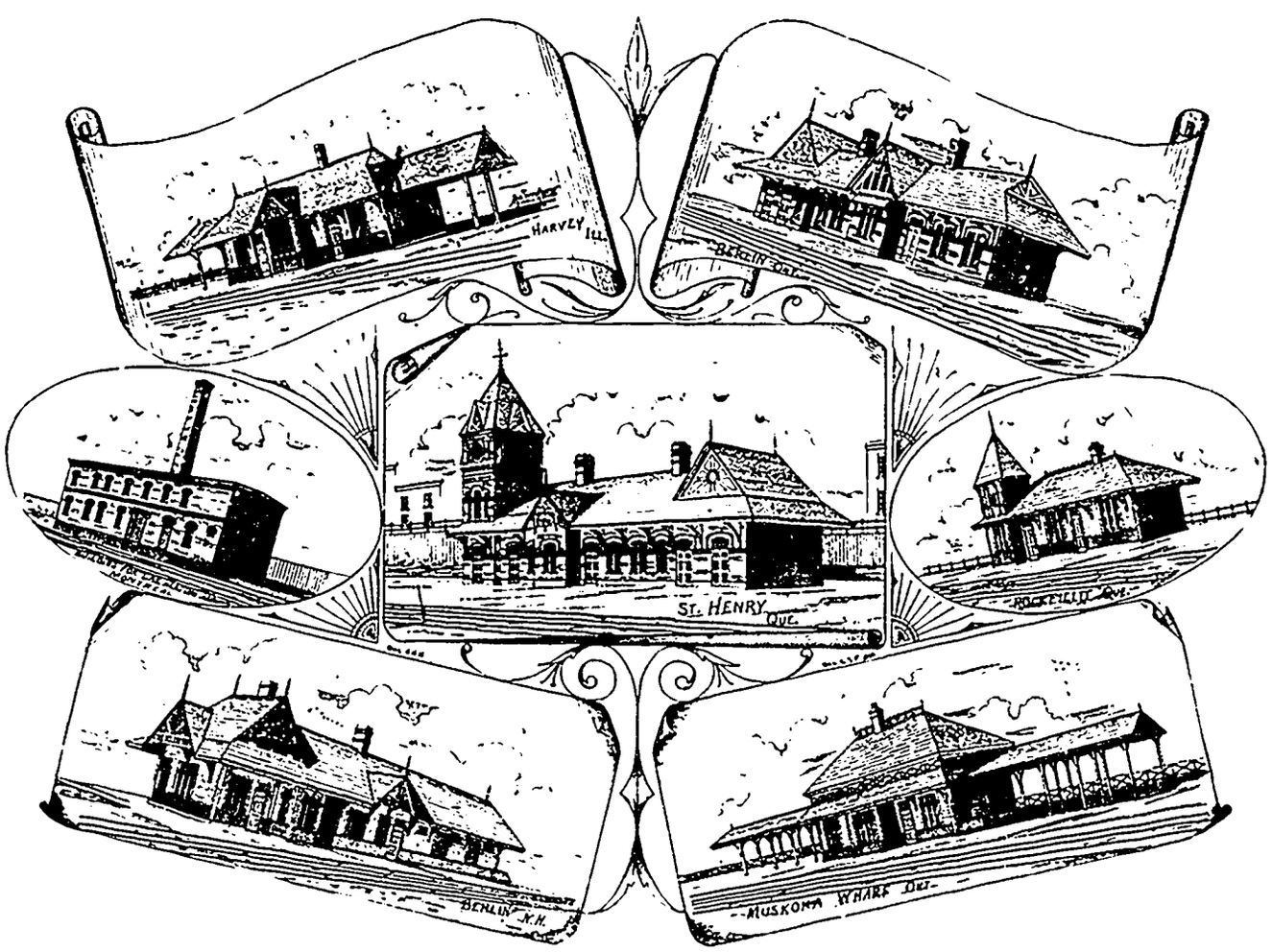
GRAND TRUNK RAILWAY IMPROVEMENTS.

The new management of the Grand Trunk Railway, since taking office about a year ago, has not allowed any time to elapse in inaugurating its policy of improving the lines and equipment of that great system.

On this page will be found drawings of a few of the passenger stations and other important buildings erected during the past season. Among those deserving of more than a passing notice are the car-heating and air-brake testing building at Bonaventure station, Montreal; car shops at London, Ont.; elevator at Portland, Maine, and the passenger station at St. Henri, P.Q.

CAR-HEATING AND AIR-BRAKE TESTING BUILDING

is a brick building on stone foundations. The plant consists of two new locomotive-type boilers, mounted on cast-iron ash pans, and suitable cast-iron supports at the smoke-box end. These boilers are connected into a brick chimney 80 feet high, with a three-feet circular flue. The working pressure is 125 lbs. to the square inch. The steam from the boilers is discharged through a four-inch "Mason" reducing valve at 50 lbs. pressure, into a four-inch wrought iron steam main, placed below the ground in a suitably insulated box, immediately in front of the buffer stops at the end of the tracks running into the depot. The steam main itself is also thoroughly insulated with magnesis and asbestos pipe covering. From it, conveniently placed near the tracks, rise twelve 1½ inch branches, to which are attached standard "Sewell" car-heating valves, steam hose and couplings, which engage with those attached to the cars, and admit of their being warmed from the main, in the same manner as they are from the locomotive while in transit. The condensed water is returned to the boiler house, where it is connected to a Worthington automatic feed pump and receiver, which pumps the condensed water to the boilers, thereby keeping the mains free and saving feed water. In addition to the car-heating main, and in the same insulated box in front of the buffer stops, are placed air mains with suitable outlets and connections which enable the Westinghouse brakes and the air whistle signals to be charged and tested before the train is coupled to the locomotive. The compressed air is obtained from a receiver placed in the main boiler room, which is stored by a standard 8-inch Westinghouse air pump. The receiver pressure is 100 lbs. per square inch, which is again reduced through Mason valve to 70 lbs. for the air mains. The outlets to the brake testing main are controlled by specially constructed 3-way cocks, which enable the inspector to apply and release the brakes on any train without being attached to the locomotive.



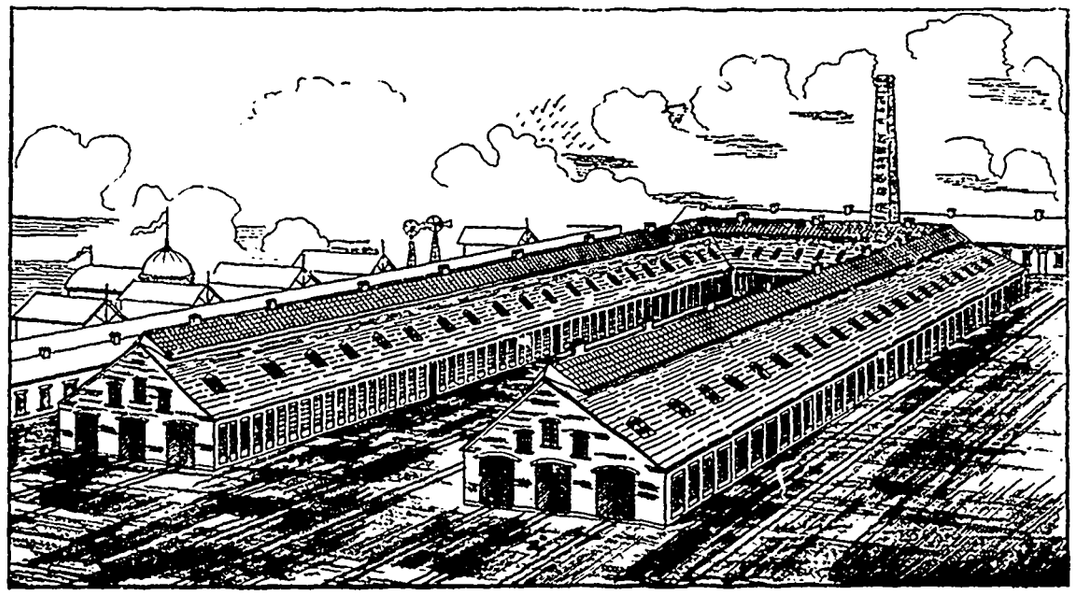
The whistle signal testing main which leaves the boiler house, carrying 70 lbs. pressure, runs to a distributing box situated near the middle of the system, which box contains a standard Westinghouse reducing valve and air signal valve and whistle. The air, after passing through the reducing valve, is carried to the right and left of the box by two lines of pipe, which are provided with regular Westinghouse air signals, stop cocks, and hose connections to couple to the cars. The pressure in this main is 45 lbs. When coupled to a train of cars, the air signal apparatus is tested by opening any of the signal valves throughout the train, and if everything is in working order, it will cause the alarm whistle, which surmounts the testing box, to sound.

The testing box, in addition to this apparatus, contains one steam gauge, connected with the steam main; two air gauges, connected with the brake and

signal mains; and a "Pintsch" gas gauge, which is connected to the gas main which, along with the water pipes, occupies the insulated box. The whole apparatus is looked upon as one of the most complete on the continent, and adds greatly to the comfort and safety of the travelling public.

The passenger station, St. Henri, Province of Quebec, is in course of construction in the town of St. Henri, and is faced with red pressed bricks, with cut stone plinth course. The roof is covered with blue slate for the main portion of the building, and cut red slates for the tower. It contains accommodation as follows:—General waiting room, 25 x 25 feet; women's waiting room, 25 x 20 feet; women's retiring room, 12 x 9 feet; agents' office, 30 x 12 feet; baggage room, 25 x 12 feet; express room, 14 x 12 feet; store room, 13 x 13 feet; men's closets, 12 x 11 feet. The furnace room and coal cellar adjoining are located in the basement. All rooms will be finished with pine sheeting, with wainscotting and ornamental ceilings, and the heating system will be hot water. The station at Rockfield, P.Q., and Harvey, Ill., are suburban stations, frame buildings sheeted inside and outside, shingled roof, and arranged to meet the respective requirements of these places. The Berlin Falls, N.H., passenger station is also a frame structure with shingled roof. The station for Berlin, Ont., will be faced with pressed brick, stone foundations, slate roof, sheeted with pine throughout, ornamented ceilings, and it will be built in the early spring.

The London car shops consist of the following:—Passenger car shop, 238 x 80 feet; paint and varnish shop, 238 x 80 feet; cabinet shop, 60 x 80 feet; wood-working shop, 275 x 80 feet; freight car and truck shop, 536 x 80 feet; blacksmith, iron machine, and wheel shop, 237 x 80 feet; tinsmith shop, 125 x 32½ feet; upholsterer's shop, 125 x 32½ feet; oil and paint store, 115 x 32½ feet; fire engine house, 30 x 32½ feet; dry lumber house, 300 x 50 feet; scrap shed; dry kiln, stores and offices.



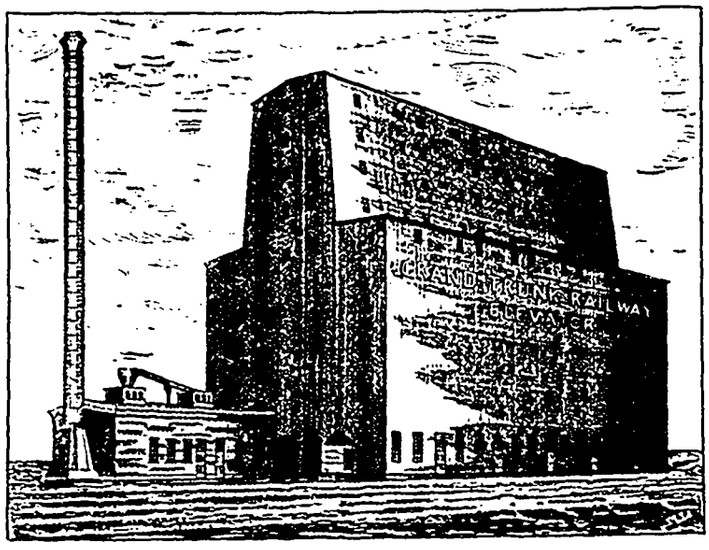
NEW GRAND TRUNK RAILWAY SHOPS AT LONDON.

The walls of the buildings are of white brick, and the roofs covered with slates. There are continuous skylights along the apex of the roofs and at intervals along the sides, which, in addition to the large windows, provide abundance of light to every part of the buildings.

The woodworking shop is equipped with the most modern machinery, and so arranged that the rough material will be unloaded from cars at the door, and pass from one machine to another, until, when finished, it will be at the entrance of the erecting shop without unnecessary handling. There is a system of overhead track by which one man is capable of transferring the heaviest timbers to any part of the shop. The shavings, etc., will be drawn direct from the machines by an exhaust fan, and delivered through an iron tube into the boiler room.

The equipment of the wheel shop consists of four wheel borers, two axle lathes, three hydraulic wheel presses and four wheel lathes for turning tires of wheels up to 43 inches diameter.

The iron machine shop is equipped with all the appliances and machinery necessary to turn out all the ironwork required at the shops and out stations of the Middle and Northern Divisions of the railway. Shop service tracks



NEW GRAND TRUNK RAILWAY ELEVATOR AT PORTLAND, ME.

of narrow gauge, with switches and turntables, are laid throughout the entire works, for the economical handling of all material. All the shops are well ventilated and heated with steam.

A complete system of fire hydrants is arranged both inside and outside the buildings, and connected to the city water mains, and the doors in fire walls are "sliding" and fire proof, and so fixed that in the event of fire they will close automatically. There are also lavatories and other conveniences in each shop for the comfort of the employees, and a general dining-room 32 feet by 50 feet.

The Portland elevator, which is in course of construction, is a plank and frame structure 221 feet long by 98 feet wide. The foundations are supported on piles with proper grillage, the piles being cut off and capped at about 2½ feet below the level of mean high tide. The dimension stone of the foundation masonry is of first-class granite pier stone, and the rubble used is good flat-bed ledge stone of uniform thickness. The first story will be built of heavy post and girder work. The bins are to be 65 feet deep, made of laminated two-inch planking, and surmounted by a cupola running the entire length of the building, and five stories high; the walls will be covered with galvanized corrugated iron, and the roofs with tar, felt and gravel. The building will be equipped with ten elevator legs, five on either side, five belt conveyors being located in the basement, to carry grain across the house and discharge it to the five elevators on the south side. In the first story there will be ten pairs of power-shovel machines for unloading cars, and two car pullers are so arranged that cars can be handled on both railroad tracks, which run through the elevator. There will be ten hopper scales, having a capacity of 72,000 lbs. each, surmounted by a hopper of 1,200 bushels capacity. On the bin floor there will be a complete system of iron trolley spouts for discharging the grain into the bins. All the belt conveyors and elevators will be supplied with friction clutches, so that they can be stopped and started when the shafting is running at full speed. On the south side of the elevator and extending nearly the full length will be a belt-conveyor gallery, which will be connected with branch galleries on either side of the Atlantic wharf; these galleries will be equipped with self-propelling iron trippers for discharging the grain into the spouts, which conduct the grain to the hatches of the vessels lying alongside the wharf. The capacity of the elevator is a little over 1,000,000 bushels. The engine and boiler-room is of brick, 80 feet long by 41 feet wide, with walls 24 feet high. The smoke-stack will be 160 feet high, with flue 5½ feet in the clear, and will be built of steel plates, lined with brick the full height.

As an example of how crude some of the English horseless vehicles are, a correspondent of THE CANADIAN ENGINEER writes from London: "Our Mr. B. was at the recent London-Brighton race, and there observed among the best of the horseless carriages one which was driven by a belt, and the brake was applied on the outer surface of the belt as it runs over the pulley. Of course the belt would be stretched and the lacing cut off in a very short time. The gear wheels also have the great objection of being open to the dust and grit which blows up when travelling over dusty roads."

PRODIGAL ONTARIO.

Ontario has no coal, or if she has, it is not at present available; south-western Ontario has no wood, and so the most densely settled portion of the province is dependent on fuel which is brought great distances for heating and power purposes. When this is the case it would be expected that such other natural sources of power as she may possess would be most carefully preserved against exhaustion, and employed exclusively in the development of her own industries. How far this is from being the case is shown by the fact that the Ontario Government actually accepts $25,000 from an alien corporation as payment for preventing anyone in Ontario benefiting by the enormous supplies of power allowed to go to waste at Niagara. There is one other source of power in south-western Ontario, and this is in large part sent out of the country and used to develop competing industries. This is natural gas. In 1895 the gas wells of Ontario produced 3,320,000 feet of gas, and $73,328 were paid in wages for its production. Of this it is safe to say that the greater part was used outside the country, and that no benefit accrued to Canada from its use aside from the money spent in its production.

In this connection, it is of interest to note the comparative value, as a steam producer, of natural gas and anthracite coal. The average constituents of the two fuels are:

	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Sulphur.	Calorific value.	Calorific intensity.
Anthracite	91.86	3.33	3.02	0.84	0.92	8,337	2,380° C.

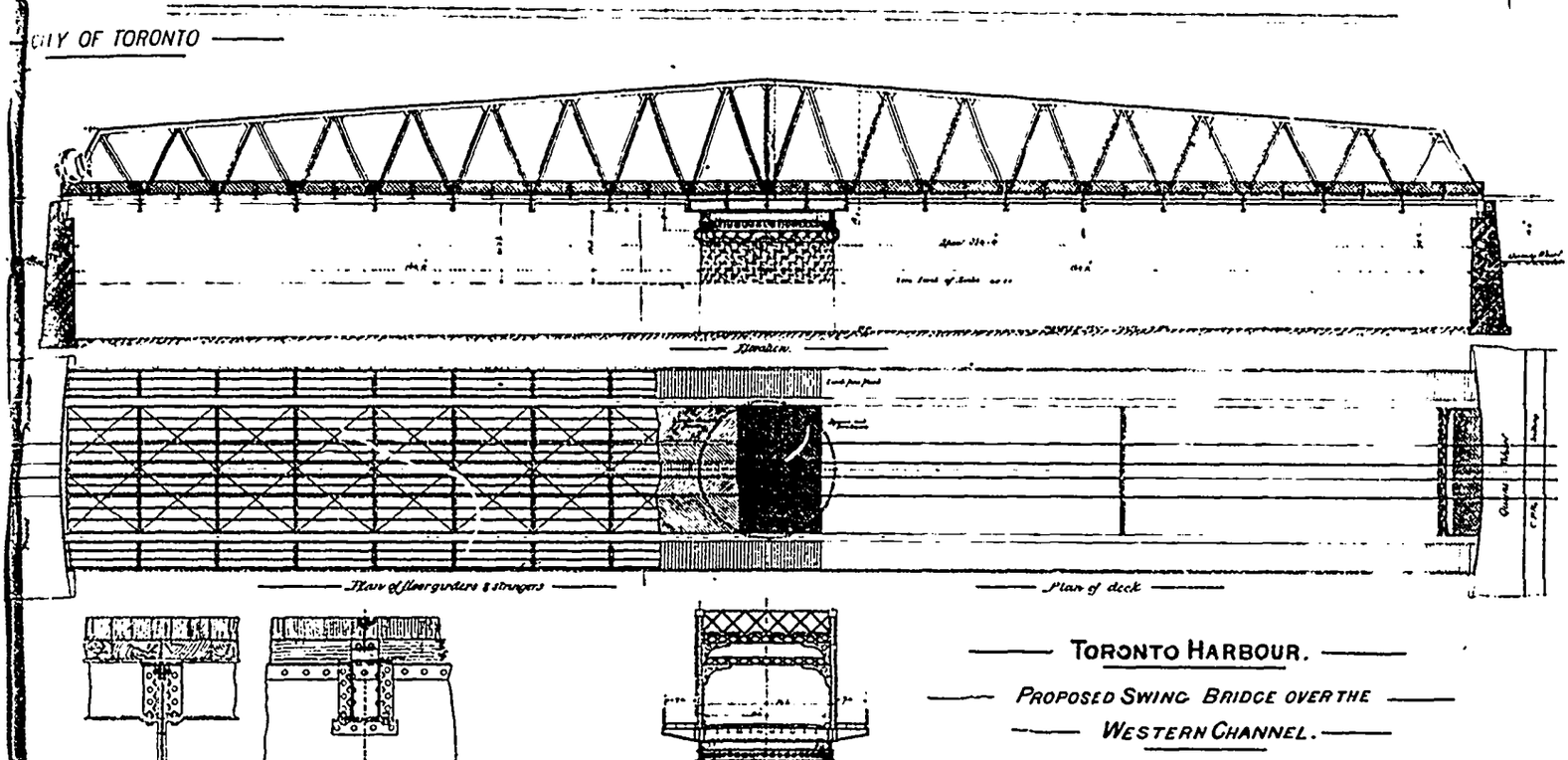
	Methane CH_4.	Hydrogen.	Oxygen.	Nitrogen.	Ethylene C_2H_4.	C_nH_n.	CO_2.	CO.	Calorific value.	Calorific intensity.
Natural gas...	67	22	0.8	3	5	1	0.6	0.6	15,000	2,750°C.

From this it is easily deduced that one thousand feet of natural gas is equal to slightly more than one hundred pounds of coal. The gas product of Ontario, in 1895, is therefore equal to over 166,000 tons anthracite coal, an amount equal to one-half that received at the port of Toronto during the season of 1896.

ONTARIO LAND SURVEYORS.

The general annual meeting of the Association of Ontario Land Surveyors will be held this year, for the first time, in the comfortable rooms of the association at the new Parliament Buildings, beginning Tuesday, 23rd February. Among the papers which will be read are the following: "Irrigation in the Canadian North-West Territories," by Wm. Pearce, D.L.S., Dominion Superintendent of Mines; "Macadam Streets in Towns," by W. A. Campbell, D.L.S., Provincial Instructor in Road-making; "Sewage Disposal," by Capt. W. F. Van Buskirk, D.L.S.; "Surveying and its Instruments," by Sherman Malcolm, D.L.S.; also a number of others. The meeting will occupy three days.

AT the annual meeting of the Hamilton, Grimsby and Beamsville Railway, the financial statement showed that the gross earnings for the year have been $35,277.91, and the expenditure charged to current account, $24,121.87, leaving a net revenue of $11,156 04. This is equal to about 9¾ per cent. on the capital stock. The number of passengers carried was 243,394, and receipts from freight amounted to $3,886 97.

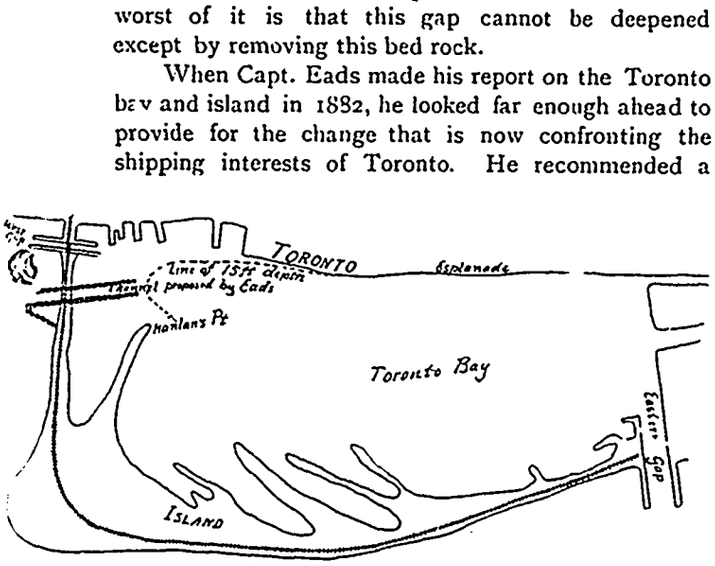


PLAN OF PROPOSED TORONTO ISLAND RAILWAY BRIDGES ACROSS WESTERN CHANNEL.

TORONTO ISLAND RAILWAY.

Some of the advocates of the proposed Toronto Island electric railway have overlooked a question which the citizens, and more especially those who are interested in the shipping facilities of Toronto harbor, will soon have to take into account—that is the question of deepening the canals of the Canadian waterway system. The American commissioners of the Deep Waterways Commission have already reported, recommending a deepening of all the canals and channels of the upper lakes and St. Lawrence system to a uniform depth of 22 feet, and it is understood that the Canadian commissioners will recommend action on the same lines to the Canadian Government. If this is done, how is Toronto to get her share of the lake and ocean traffic under the new conditions? None of the steamers of large draught could enter the western gap of Toronto harbor, for last summer vessels drawing only nine feet of water bumped on the bed rock which forms the bottom of the present channel. And the worst of it is that this gap cannot be deepened except by removing this bed rock.

When Capt. Eads made his report on the Toronto bay and island in 1882, he looked far enough ahead to provide for the change that is now confronting the shipping interests of Toronto. He recommended a channel through the eastern end of the island and the construction of the western gap, not where it is now, but about 1,400 feet from the Queen's wharf, so that the gap would lead directly from the line of 15 feet depth of water in the bay to Lake Ontario, without any blasting whatever. The authorities took what time has shown to be a short-sighted view of the question, and carried out only half of Capt. Eads' recommendation by constructing the eastern channel. The western gap was maintained as originally fixed, close to the shore near the Queen's wharf, where a depth of only ten feet is available, and where expensive blasting will have to be done for large vessels, and even then it would be subject to greater annual deposit of silt. If the proposed bridge for the island railway is put across this present channel, with its tower of stone in the middle of the waterway, it will be a further and serious obstacle to vesselmen, as it will make the services of a pilot or tug necessary in many cases.



Against the scheme of the island electric railway in itself, we can have nothing to say, but before it is started its bearing on the impending changes in the conditions of lake navigation had better be considered. It should not be forgotten also that the object for which the island is consecrated to the city is to bring its citizens into contact with the lake and its fresh summer breezes, and transportation thither by water is the more natural means, and will perhaps remain the most popular means, even after a railway over the channel is built. The present ferry service is, on the whole, a good one, but it might be improved greatly for the citizens by an arrangement with the ferry company whereby regular trips should be made around the island, as well as to it. A trip round the outside of the island would be a very healthful one, and the steamers could be allowed to run at full speed in that part of the trip.

H. F. KELLEY, manager of the Northern Nail and Wire Co., says the present output is 200 kegs per week; more machinery is to be put in at once.

CANADA'S FIRST MOTOCYCLE.

The credit of owning the first motor vehicle in the Dominion of Canada belongs to F. B. Featherstonhaugh, patent solicitor, Toronto. This vehicle, which is modelled on the lines of the hansom cab, can be closed in front when required by means of a flexible, transparent, celluloid blind. The vehicle has been constructed from Mr. Featherstonhaugh's design and under his own supervision. It is mounted on three pneumatic-tired bicycle wheels of especially strong construction, and is braked by a foot-brake operating on a drum on the driving axle.

The electrical equipment is the invention and production of W. J. Still, of Toronto, and is covered by patents issued and applied for. It consists of a battery of 12 cells, a motor of about 4 maximum h.p., and a series multiple controller. The cells are of the lead-lead type, and contain about 140 ampere hours at a 5-hour discharge rate: their average voltage being about 1.9 for the entire discharge. This equals a capacity of 266 watt hours each, or a total of 3,192 watt hours, or 4.27 h.p. hours. They weigh each 23¼ lbs., or a total of 279 lbs., equivalent to a weight of about 66 lbs. per h.p. hour.

This light weight of the batteries is due to the peculiar design of the plates, they being constructed of a spiral ribbon of a special highly compressed lead sustained by non-metallic supports so as to admit of the free expansion and contraction of the active material without any strain or disintegration. Whilst exceedingly permeable, and permitting an uninterrupted circulation of the acid, no buckling and short circuiting of the plates can occur. This gives them an exceptionally high discharge rate, without an abnormal drop in potential, and enables them to maintain an immense output without injury.

The motor, which is of the disk armature type, is six polar, the fields being series wound, the commutator is of the flat type, and the current is supplied by 6 copper brushes running on end. The efficiency of the motor is extremely high, its electrical efficiency on ordinary loads being about 93 per cent., and it is fused for about 250 amperes of current. It will develop up to 4 h.p. without heating, and is absolutely sparkless under ordinary working conditions. The weight of the motor is about 100 lbs., and it is journalled on the main driving axle and geared to it by a gear of 12 to 1; a differential gear is employed to permit different rates of speed in the two driving wheels when turning corners, and the motor is spring cushioned to prevent sudden strains to the gears when starting. The controller is of the series multiple type, and has three positions, 6, 12 and 24 volts, and contains a separate reversing cylinder operated by a small lever. The head lights are illuminated by small incandescent lamps, fed from the battery and controlled by separate switches. The vehicle is steered by the same handle as controls the speed and is so nicely adjusted that it may be readily turned by a very slight pressure.

The total weight of the vehicle is about 700 pounds, of which not more than 279 pounds is weight of battery, the type of rig being a comparatively heavy one.

The batteries used in conjunction with the electric vehicle described in the foregoing article were designed especially for the high discharge rate work required for electric rail traction, such as interurban and locomotive railway work, where it would be simply impossible to carry battery power, even with such light cells as Mr. Still's, to supply power for any great length of time.

In the *Motocycle* of July, 1896, Leland Summers gives the weight of present electrical equipments at:

1,420 lbs. per h.p., with a capacity of..... 8 h.p hours
1,010 " " " " ..... 5 h.p. "
710 " " " " ..... 3 h.p. "

And a possible maximum of

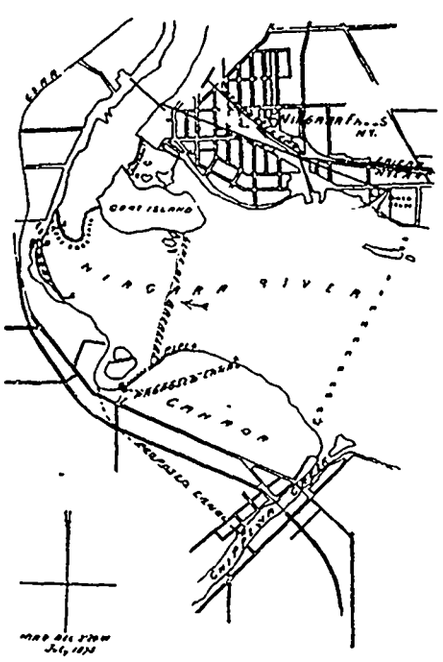
400 lbs. per h p., with a capacity of..... 1 h p. hour

This shows a weight of 177 lbs. per h.p. for an eight-hour discharge rate, 202 lbs. per h.p. for a five-hour discharge rate, and 296 lbs. per h.p. for a three-hour discharge rate, with a possible maximum of 400 lbs. per h.p. at a one-hour discharge rate. Mr. Still informs us that he is able to make cells of his design that will not weigh more than 90 lbs. per h.p. on one-hour discharge rate, thus making a battery that will develop 1 h.p. for one hour at a weight of 90 lbs.

THE NIAGARA FALLS ELECTRIC POWER QUESTION.

The article in our January number dealing with the case of the Canadian Niagara Falls Power Co. has been taken up by many contemporaries in a spirited manner, and an agitation has been started which has already resulted in strong protests from various public bodies against the alienation of the water privileges on the Canadian side of the Niagara Falls. It is satisfactory to note that, generally speaking, this agitation is of a non-political character, and we hope it will continue so. The letters of Wm. T. Jennings, C.E., to the Toronto daily papers, have given strength to these protests, and we trust the Ontario Government now realizes the full sense of its responsibility in this matter. At the time the agreement was made with the Canadian Niagara Power Co., through the commissioners of the Queen Victoria Niagara Falls Park, it was thought to be a very favorable one. The Park commissioners needed money to carry out the improvements required for the park, and the annual rental of $25,000 per year gave them what they considered a very nice income for their purposes. This amount still looms very large in the eyes of the present commissioners, and even in the eyes of some members of the Ontario Government. The commercial and industrial bearings of this transaction are not so vital a consideration to the commissioners, and this is where the mistake has come in. So long as the æsthetic tastes of the Park commissioners were gratified, the commercial features of the bargain were of secondary interest, and the enormous commercial value of this franchise is evidently not yet realized by them. But men like Col. Shaw, late American Consul at Manchester, Eng., and the other New York gentlemen who compose the so called "Canadian" company, knew what they were about. They were quite willing to gratify the Park commissioners with a handsome present income, provided they could hold a good long mortgage on the future; and they succeeded beyond their expectations. They knew the growing value of electrical power, and they knew what the near future had in store for a falls which could furnish 7,000,000 h.p., if all of it were developed. And so it came about that they stipulated for a monopoly of the power on the Canadian side for one long century. Like Esau, in dealing with Jacob, the commissioners were hungry, and sold the Province's birth-right for the mess of pottage. It will be remembered by readers of our last article that the members of the Canadian company are, financially speaking, all citizens of the United States, and are the same gen-

tlemen who compose the Cataract Construction Co. on the United States side, where industries are springing up, and where the business activity is in strong contrast to the stagnation that exists on the Canadian side. Although the power can be developed in Canada much cheaper than on the American side, the Co.'s United States interests are so large that the annual rental of $25,000 will be a mere bagatelle so long as they can retain their monopoly and prevent a Canadian rival from entering their field. Hence it is that the company took care to have stipulations made as to their power to carry their electricity across the river from Canada, and they are not compelled to use, in Canada, more than one-half the electricity produced on the Canadian side. The act incorporating them also gives them the power to hold stock in any new companies that may be created that have any relation to the use of the power which they generate; and they are exempted from the law which prevents bonuses being given by municipalities. In fact they would appear by the agreement made in 1892, to have a complete monopoly of this enormous power, the value of which is only now beginning to dawn on many who should have looked into this question more closely at the time.



A, A, A.—Proposed intake for supply to original Power Company at *B*.
C.—Proposed intake for Canadian Niagara Falls Company.
D.—Proposed site of Canadian Niagara Falls Co. power-house.
E.—Proposed point of discharge for tail race.
F.—Railway Co. power-house.

The accompanying diagram shows the scene of the company's operations on both sides of the river, and the comparatively trifling distance and cost of developing first on the Canadian side, will prove how completely anti-Canadian the interests of this corporation have been, and still are, when they have spent $5,000,000 in carrying out their works on the United States side in preference to those in Canada. We may mention incidentally, as an indication of the character of the monopoly which the people of Ontario will have to deal with, that a company formed some time ago to create a water power by cutting a channel from Chippewa Creek to the Niagara River for power purposes, applied to the Canadian Niagara Power Company and the Park commissioners for liberty to carry out their work. Though this work would not have interfered with the company's water privileges, they refused permission. They then asked to be allowed to lay a pipe so as to discharge in the Niagara River at a point above the company's intake. This, of course, would have increased rather than diminished the volume of water in the river at that point, and would have been a benefit rather than a damage to the company's power. This also was refused on a pretext which reminds one of the dialogue between the wolf and the lamb, in which the wolf charges the lamb with contaminating a stream which ran in a direction that rendered this effect an impossibility.

Now that the Canadian Niagara Falls Co. has applied for an extension of time, it is the duty of the Ontario Government to retrieve their past mistakes and terminate an agreement which, if carried out, must work inconceivable injury to the manufacturing interests of Ontario, and especially of the Niagara peninsula. It is not a question whether any other purely Canadian company is prepared to take the place of the American. It is a question of the unrestricted utilization for Canadian interests of this colossal power, not in the present, but in the future.

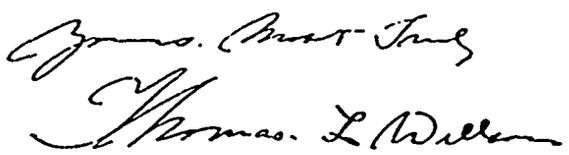
If it will pay the American corporation to lay out $25,000 per year for the purpose of tying up the business on the Canadian side, what will its retention and development not be worth to Canadians? Mr. Willson, of the Carbide and Acetylene Works, has made an offer for 60,000 h p. at $1 per h.p. per year. This will bring a much better return than that offered by the American Co., but even if that offer were not in sight, it would still be the duty of the Government to pay back this $100,000 already paid in by the company and hold the power for future demands. In this power the Government would have an asset that would be one of its best revenue producers in the near future. In the hands of the Government its utilization and development would be carried out fairly, and entirely in the public interest. The interests of the Queen Victoria Park, and the commercial and manufacturing interests of the Niagara Falls as a water power, should be immediately and entirely divorced. Let the Government maintain the park out of the public funds, and let the power of Niagara Falls be run on business principles. The present state of affairs is surely evidence enough that it is a mistake to allow the industrial development of the Niagara Falls to be sacrificed for the æsthetic whims of a Park Commission.

There is time yet to undo the terrible mistake that was committed in 1892, and if this last opportunity is not taken of keeping the Canadian side of the Niagara in Canadian hands, the Province of Ontario will be galled for one long century to come by the most injurious monopoly ever inflicted on it. We cannot blame either the Ontario Government or the Park commissioners for failing to see in true perspective the priceless value of the franchise they gave away at a time when electrical developments were not so clearly understood; but to confirm this needless monopoly would be, not merely another mistake, but an act of madness. We believe in the patriotism, as well as the good sense of the men who form the Ontario Government, and we cannot, therefore, conceive of their betrayal of the interests of this Province in such a crisis. It is the duty, however, of every one who has the principle of Canada for the Canadians at heart, to join in the protest against the alienation of the greatest water power on the globe, and to make this protest in the most solemn manner, throwing aside all question of political feeling.

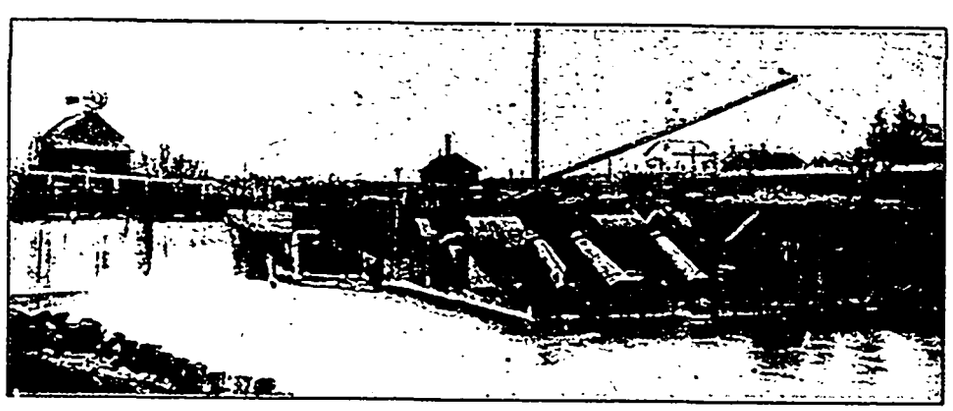
CANADA'S FIRST CALCIUM CARBIDE WORKS.

As previously noted in this journal, the new calcium carbide works erected at Merritton, Ont., by Thomas L. Willson, the discoverer of calcic carbide as a commercial product, are now in regular and successful operation, and are producing increasing quantities of carbide, which is exported to foreign countries as fast as produced. Our readers will remember that in our issue of January, 1896, there appeared a full description of the method of producing calcium carbide and the evolution of acetylene gas therefrom, with illustrations and a biographical sketch of Mr. Willson himself—the

Photograph by J. T. Groves, of the St. Catharines Camera Club.
WILLSON CARBIDE AND ACETYLENE WORKS.



first that appeared in any paper. If the history of electricity is repeated in acetylene, the works at Merritton will become historical, and it is quite within the mark to say that no new industry begun in Canada within recent years has awakened more interest among manufacturers and scientific men. Some account of the new works will therefore be instructive to our readers.



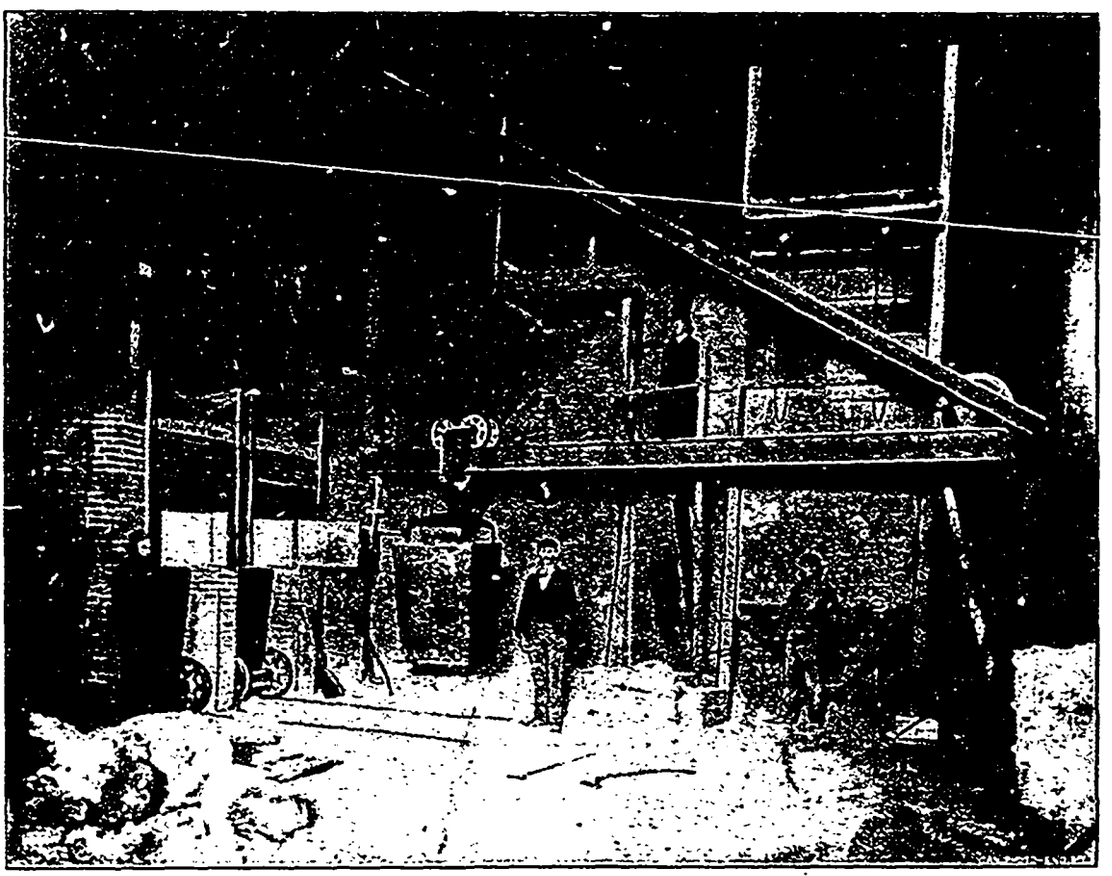
Photograph by J. T. Groves, of the St. Catharines Camera Club.
WILLSON CARBIDE AND ACETYLENE WORKS—NEW DAM AND POWER AT LOCK.

It will be remembered by the many who began to devote attention to this subject in Canada last year that a controversy began as to whether calcium carbide could really be produced at a price sufficiently low to make it a commercial product, and certain writers, working apparently in the "old vested interests," were not content with essaying to prove that neither the carbide nor acetylene could be made a commercial product, but questioned the motives of Mr. Willson and those acting with him. This happens almost as a matter of course to every great invention and to every great inventor or discoverer. To anonymous writers who accused Mr. Willson of misrepresentation for the purpose of "company promoting," he answered by deeds and not words. He quietly took his own money, and selecting a site on the old Welland Canal at Merritton, set to work to establish a calcium carbide factory on a commercial scale, and under such ordinary industrial surroundings, that the question of its commercial success could no longer be held in doubt. With an energy and faith all his own, he laid out plans for water power, occupying the site of old mills, which had either burned down or fallen into decay. He commenced operations on the 13th April, 1896, and on the 15th August of the same year produced the first pig of 200 lbs. of carbide. On the day the writer called, in December, the Willson Carbide and Acetylene Works were preparing their first shipment of 30,000 lbs. of calcium carbide to Germany, and exports of the product are now being regularly made in 60,000 lb. lots to foreign countries, but chiefly to Germany. The fact that the demand from Germany alone is ten times the present capacity of the works, would seem to be a sufficient answer to Mr. Willson's former detractors, and at the same time an index of what future is in store for calcic carbide and acetylene gas, for in the application of chemistry and chemical products to the practical business of civilized life, the Germans, it must be conceded, stand in the front rank.

For the establishment of these works, Mr. Willson acquired the power of three canal locks, known as Nos. 10, 9 and 8, having each a fall of about 12½ feet, and yielding a total of 1,650 electrical horse-power. The first day water was let off, the work of excavating for

the flume and wheel pits was commenced, and a cutting 25 feet wide, 10 feet deep, and 120 feet long, was made in eight days. Two pairs of 50-inch turbines will be operated at each lock; one set of wheels is now in operation, another is being put in, and the third will be installed as soon as the work of the wheel pits can be finished. The lowest of the three installations is on the site of an old lock put in the first Welland canal 68 years ago, and at this point, which is 1,200 feet away from the works, two pairs of 45-inch wheels, at 120 revolutions per minute, will develop about 400 electrical horse-power.

The wheels now in operation are connected to a fly-wheel 11 feet in diameter and running on a 7-inch shaft. The fly-wheel has a pulley face of 31½ inches, and is belted to a General Electric Co. 150 k.w., 60-volt dynamo, having a stationary armature and revolving field. The current is carried on a cable of 21 00-wires,



Photograph by J. T. Groves, of the St. Catharines Camera Club.

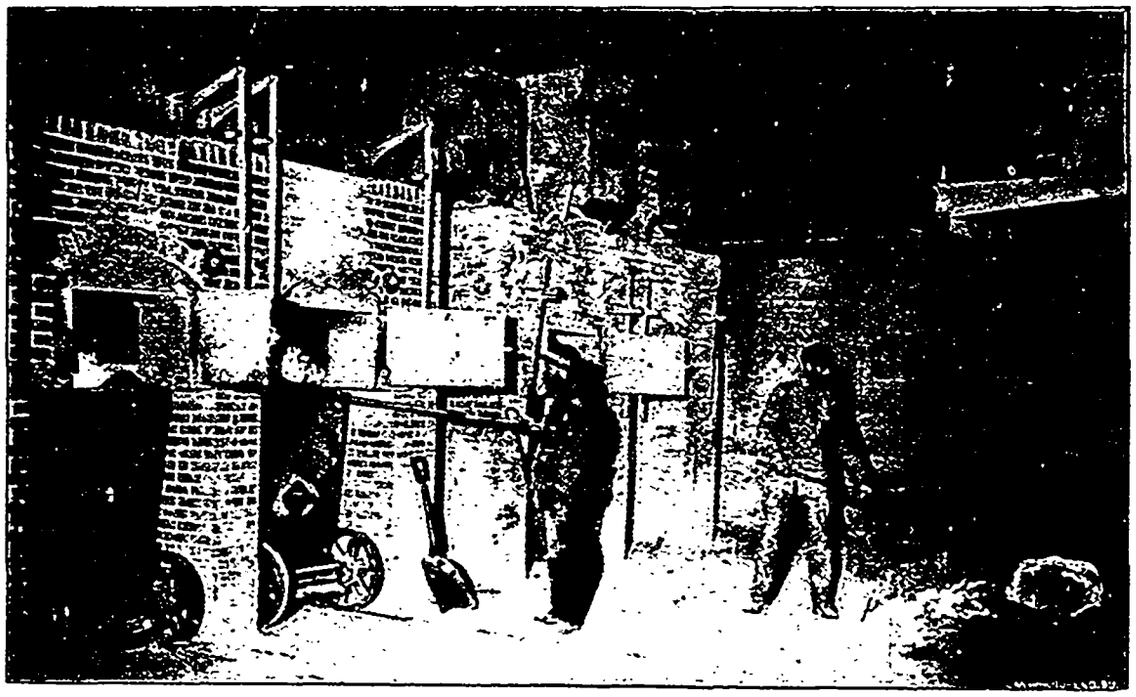
WILLSON CARBIDE AND ACETYLENE WORKS, VIEW OF FURNACE ROOM WITH CRANE.

working a mass of 2½ or 3 inches diameter. The dynamo and transformer rooms are floored with cement and the former structure is so planned that the retaining walls of the canal bank really form part of the walls of the dynamo room. In this room is also placed the gas holder supplying the acetylene gas with which the office and works are illuminated. The shaft which runs the machinery, such as the pulverizers, mixers, etc., runs from this room underground to the main building shown in the illustration.

The carbide is made from a mixture of lime and coke (charcoal is preferable when it can be obtained), the proportions being 100 lbs. of lime to an average of 68 lbs. of coke—the latter varying from 65 to 70 lbs., according to circumstances. The coke and lime are brought in carloads on a St. C. & N. C. siding built direct to the works. These materials are shoveled from the car door into a hopper in the side of the building, and through the hopper they are conveyed to the boot of an elevator, upon which they are carried to the crushers. After being ground the materials are screened off in rotary screens, and that which is not already reduced to powder is conveyed to a set of stones like those used in the old stone floor mills, where it is ground up. The lime having been treated the same as the coke, they are both carried into a rotary mixer, where they are thoroughly mixed, and then brought by conveyors to the furnace room. Here the crucial and most interesting part of the process of manufacture is carried out. At the date of the writer's visit only two furnaces were in operation, but the furnace room is planned for ten furnaces, and these are rapidly being completed. Each furnace absorbs nearly 200 electrical horse-power, which, being transformed into heat, produces in a day of 24 hours four pigs of carbide of 500 lbs. each. The dynamos are now running, and will continue to run, night and day, each furnace turning out its full capacity of four pigs per day. The unit of electromotive force used is 75 volts, the current varying from 1,600 to 2,000 amperes. The furnaces are plain brick receptacles lined with firebrick and ranged side by side, having a square opening in the face of each from which sparks of molten lime are constantly flying, to indicate the fervent heat within. And what a heat!* Almost every reader has seen the carbon pencils used in the ordinary arc lamp. These are about half an inch in diameter, and for certain special purposes the largest carbons hitherto used are 3 inches in diameter—some bar carbons being 4 inches thick—but imagine a carbon "pencil" 6 inches thick, a foot broad and 18 inches long, and one gets some idea of the heat and light evolved in this furnace. If the arc in this

*The heat in the electric furnaces used to produce carbide is, as nearly as can be estimated, 10,000° Fahr.

furnace were exposed to view, two seconds' glance at it would blind the beholder by paralyzing the optic nerves. Yet it requires six hours constant application of this heat to build up a 500-lb. pig of calcium carbide, which is brought out of the furnace in the shape of an elongated egg. The carbon bars are held in position by a chain hoist—a modified form of the Harrington 1-ton screw block—which is electrically regulated. From the foot of each furnace runs a track, upon which the material is trucked away, the whole being within the radius of a large hydraulic crane, upon which the pigs or the full tanks of carbide may be swung. The carbide pigs having been brought out of the furnace, are allowed to cool off, and are then broken up in lumps about the size of furnace coal, these lumps looking like chunks of iron ore, and being, roughly speaking, about the same weight. The carbide, having been thus broken up, is put into the tanks or drums, which hold 1,000 lbs. each and are fitted with a screw stopper, so that when filled and the stopper screwed down, the drum becomes air-tight.



Photograph by J. T. Groves, of the St. Catharines Camera Club.

WILLSON CARBIDE AND ACETYLENE WORKS—VIEW OF ELECTRICAL FURNACE ROOM.

This is done in order to prevent the erosion of the carbide that would result if it were exposed to the air, and the saturation of the carbide with petroleum is a further preventative of this erosion, which is caused by the moisture always present in a greater or less degree in the air.

The chemical character of calcium carbide, the details of the construction of the furnace in which it is produced, and the various compounds which can be built up from it, together with an account of acetylene gas, were given in THE CANADIAN ENGINEER for Jan., 1896, and need not be repeated here. We may simply say that acetylene gas is evolved from the carbide by bringing it in contact with water, and the proper regulation of this contact is the only practical problem in the manufacture of acetylene. Several Canadians are at the present time working on methods for generating the gas, and the apparatus invented by three of these was shown to the writer, and all have been proven to be at least fairly efficient. These generators can be made for a small isolated plant—say 10 to 20 lights—at prices varying from $25 to $100; but a little further experimenting will not only cheapen but simplify these generators, and make an installation quite a simple matter. Even as it is now, the generators can be attached to ordinary gas pipes, and the only change required in a house is to put on a new set of burners. We hope in an early issue to describe the most approved styles of acetylene gas generators, but in the meantime may say that the principle of most of them consists in introducing a jet of water into a tank or cylinder containing the carbide. When the water touches the carbide, the gas is given off and stored in a holder, connected with the carbide tank. When a sufficient quantity of gas is produced, or the pressure in the holder has risen to a certain point, the water is shut off, and the further production of gas ceases till the pressure is reduced. A plan which is just now being worked out by an ingenious French-Canadian, reverses this process, and instead of introducing the water to the carbide, he introduces the carbide to the water. This is accomplished by a comparatively simple device, which will be described in an early number of this paper.

As the nature and properties of carbide and acetylene are becoming more generally understood, the supposed dangers incidental to their use are vanishing. It will not be long before it will be generally admitted that there will be less danger in acetylene than in any of the gases now used as illuminants. These bugbears were raised when electricity was being introduced for lighting, and it must be accepted as a matter of course that every new discovery or invention meets with its detractors. The only practical question now to dispose of is the cost of the carbide. Mr. Willson is now selling it for export at $70 to $80 a ton, and while he cannot supply one-tenth of the demand at that price, he would naturally see no occasion to sell it cheaper. Each pound of calcium carbide, according to Mr. Willson's experiments, produces a quantity of acetylene equalling 75 feet of coal gas in illuminating power. At $80 a ton, the cost of a pound of carbide is 4 cents; therefore at this price acetylene gas is equal to coal gas at, say, 54 cents per 1,000 feet. But, as a matter of fact, Mr.

Willson can manufacture carbide at a profit at $20 per ton, which would be equal to coal gas at 14 cents per 1,000 feet. With improved appliances it could even be produced cheaper than this, but it requires but little intuition to realize what a vast field is opened up to the sciences and arts by carbide at $20 or even $40 a ton. As an illuminant alone it will revolutionize present methods, for it makes a light that is as much superior to gas light as the latter is brighter than a tallow candle light. There is absolutely no flickering to an acetylene gas jet, even when used naked, while as to its purity the success with which it is already used for photographic and engraving purposes is a sufficient evidence. The machine room of the Riordon paper mills at Merritton has been lighted with it for some time past, and the experienced man who tests the shades of paper says it is a more perfect light than any he ever used, excepting alone the magnesium tape light, which gives off disagreeable fumes, and for other reasons is not in question as an ordinary illuminant. Again, it gives off less heat—some say less by 75 per cent.—than coal gas light, which is an important consideration in domestic lighting. Readers of our former article will remember that from calcium carbide can be produced all the other hydro-carbons, as for instance, benzol, naphthalene, ethylene, and ethane. From benzol we get the anilines, etc., while alcohol is made from the ethylene treated with sulphuric acid. From these we can branch off to the production of so many substances that, to quote the words of Prof. Lewes, 'acetylene can without exaggeration be looked upon as one of the great keystones of the organic edifice, and given a cheap and easy means of preparing it, it is hardly possible to foresee the results which will be ultimately produced."

It is impossible at present to estimate the value of the industries that will be created by the introduction of carbide and acetylene into the realm of commerce, and it is of the utmost importance that Canadians should be in the van in this development. The discovery was made by a Canadian, and Canada is better situated than any other country for the economical manufacture of the carbide, by reason of our enormous water powers and the abundance of lime and carbon (in the form of charcoal) to be had in the vicinity of most of these large water powers. As showing the manufacturing outlook created by Mr. Willson's own works at Merritton—which may be termed an infant industry, or rather an embryo one—it may be mentioned that he has already spent $90,000, and when his new premises are in operation will have spent $120,000. He will require in the next two years 60,000 iron drums for the shipment of carbide, and this one item of supplies will keep a small foundry and machine shop running. This is only one out of many items of supply required, and when we consider the various new industries that will come into operation having carbide and acetylene as their raw material, the belief expressed by Mr. Willson that the exports of Canada could be increased to $100,000,000 annually by these means, does not seem by any means beyond the possible. He could sell even now 300 tons a day at present prices, if all his orders could be filled. If a patriotic government gave Mr. Willson's company a share of the power of the Canadian side of Niagara Falls, his works, with the industries consequential on the evolution of the carbide manufacture, would make the whole Niagara peninsula one vast centre of industrial activity, and instead of workshops and workmen moving across the Niagara River as they are now doing, they would be coming to this side.

We give herewith the latest photograph of Mr. Willson, in whose clean shaven face the reader will observe a strong resemblance to Sir John Macdonald. Unfortunately the photographer, in "toning up" the picture, took out those peculiar lines about the face and mouth which make the resemblance so striking. Were it not that Sir John was old and Mr. Willson young, we fancy many an old politician would stand aghast at beholding again the face of the deceased grand old man so vividly restored to life in Mr. Willson's mobile features.

CALCIUM CARBIDE AND ACETYLENE NOTES.

Acetylene gas is now used by the camera club of St Catharines, Ont., for photographing at night.

The Riordon Paper Mills at Merritton have had the acetylene light in use for two months, and speak in the highest terms of its steadiness, purity and close resemblance to sunlight. They have 32 lights per night, each light being 37½ candle power.

At Sault Ste. Marie the Chicago Gas Co. have leased electric power from one of the paper mills, generated, we understand, on the Canadian side, and have made a start in acetylene lighting. They have made a contract to light a number of cars with acetylene.

The skating rink at Thorold has been lighted by acetylene gas, and photographic and other establishments in that vicinity are putting it in as soon as they can get generators.

The British Aluminum Co., which owns the power of the Falls of Foyers and other water powers of Great Britain, has made arrangements with the Acetylene Illuminating Co., 63 Queen Victoria St., London, to manufacture calcium carbide, having now 700 horse power at the Falls of Foyers devoted to this work. It is proposed by the company to devote, in the near future, 7,000 horse power to the production of carbide.

In laying out a plant for acetylene lighting, smaller pipes can be used than for coal gas. At the Riordon paper mills, for instance, 32 lights are run on a ¾-inch main, but the same pipe is large enough to carry gas for 100 lights at 37½ c.p.

A few days ago, the county council of Lincoln, after their meeting, adjourned in a body to visit the Willson Carbide and Acetylene Works, at Merritton. The members were surprised at the developments that had been brought about by Mr. Willson's enterprise. After complimenting him on his striking facial resemblance to Sir John Macdonald, they gave three rousing cheers for Mr. Willson on leaving.

Hermann Jurenz, 17 Kurfurstenstrasse, Berlin, Germany, in the course of a letter to THE CANADIAN ENGINEER, says: "On the occasion of the recent demonstration at Bari, in honor of the Prince of Naples, and the Princess Helena, of Montenegro, the Board of Trade had their headquarters illuminated by acetylene, which was the first time that gas was used for such a purpose. The Prussian state railway has bought 70,000 kgs. of calcium carbide for lighting their trains by acetylene gas. The demand for calcic carbide here in Germany is so great that the few works which produce this material cannot fill their orders, and therefore, the price of it is maintained at 20 cents per kg." [A kilogramme is 2¼ lbs].

The following theory of the natural origin of acetylene and calcium carbide has been sent us by a correspondent: "It is of interest to note that the synthetic method of producing carbide is only imitating on an insignificant scale the methods which, according to geologists, were employed by the great Creator in forming many of the most valued elements of this earth. By the enormous heat which accompanied the consolidation of the globe, portions of its crust became carbide, as carbon was then combined with all the metals. When the earth began to cool the vapors that had been driven off began to come down, and these vapors, acting just as water or moisture now does on the dry calcic carbide, decomposed them into hydrocarbon gases and the oxides of the metals. This accounts for the oxides, which are found in connection with all the commoner metals, and the metallic oxides, absorbing carbonic acid gas, became carbonates. The immense body of hydrocarbon gas was then turned into carbonic acid gas and watery vapors, and this vast atmosphere of carbonic acid gas, under the influence of heat and moisture on the surface of the earth, brought on the colossal vegetation which ushered in the coal age. Petroleum was probably the result of water getting down into the carbides that had already sunk so far under the surface of the earth that the gas would be decomposed under pressure of heat."

CANADIAN SOCIETY OF CIVIL ENGINEERS.

The annual meeting of the Canadian Society of Civil Engineers opened on January 12, at the society's rooms, Mansfield st , Montreal Prof McLeod read the minutes of the last annual meeting, after which the president, Herbert Wallis, read communications from the Earl of Derby and Sir Casimir Gzowski, K.C.M.G., expressing congratulations, The meeting was then called upon to appoint scrutineers for the election of officers and Council.

In the afternoon the members drove out to view the works of the Lachine Rapids Hydraulic and Land Co., and partook of a repast provided by the contractors, W. Davis & Sons After lunch E P. Hannaford, as past president of the C.S C.E., congratulated the contractors on the success of their splendid undertaking. W. H. Davis replied for the contractors. Loud calls for Mr Burland afforded him an opportunity to praise the closeness with which the engineers had estimated the cost of this great scheme, for now that the work was almost complete the estimate of Mr. Walbank had not been exceeded to the extent of even $50. He continued: "You gentlemen of the engineering profession, and especially those of you who may be young in the business, I would recommend this to you, that you manage in your estimates to do without extras. (Applause.) It will give you a good standing and reputation." Mr. Walbank then gave a lucid account of the progress of the work from the time the plans were drawn up, and of the many difficulties which had been overcome. After the inspection of the works the civil engineers returned to town and in the evening had dinner at the Windsor Hotel.

On Wednesday morning the first business was the reading of the report of the council. It appears that the present membership stands as follows: Honorary members, 8; members, 271; associate members, 145; associates, 42; students, 125; total, 591. Fifteen ordinary meetings have been held during the year, when papers were read, most of which have appeared in substance in THE CANADIAN ENGINEER.

In accordance with instructions issued at the last annual meeting, the council appointed a general committee to further consider the incorporation of the society, and also named committees in the several provinces of the Dominion The council also appointed a sub-committee, which on two occasions visited Ottawa in order to ascertain if the time were favorable for the introduction of the proposed amendment to the Dominion Act. It has, however, been considered inadvisable to introduce the bill during the past year. In the Province of Manitoba the Provincial Committee acted so energetically, that an act of incorporation, resembling very closely that proposed by Mr Creelman, was assented to on March 19th, and became law on July 1st, 1896. It was unfortunately found, owing to the absence of some members of the Central Committee and to the illness of others, that it was impracticable for this committee to perform the work for which it was appointed. The council, therefore, in order to carry out the wishes of the annual meeting, appointed a special sub-committee of its members to take charge of matters relating to the incorporation of the society. The committee has been actively engaged in the work, especially in connection with the Act for the Province of Quebec, since its appointment in November. The committee in the Province of Nova Scotia, under date November 2nd last, reported that the Act in that Province would be introduced as a public act at the next ensuing session of Parliament. The Nova Scotia legislature is summoned to meet on the 27th inst. In the Province of Quebec an Act was before the legislature at its last session. Unfortunately it was introduced somewhat late in the session, and was not passed before legislature was prorogued. No action has yet been taken in any of the other provinces. In connection with the passage of the Manitoba Act it became necessary to hold a meeting of council in Winnipeg, and in order to economize in travelling expenses, St. Geo. Boswell, W. B. Dawson and J. D. Barnett, members of the council, very generously volunteered their resignations, in order to admit of members resident in Winnipeg or its neighborhood being elected to replace them, thus making it possible to obtain the necessary quorum there. H. N. Ruttan, H. F. Forrest and G. H. Webster were appointed to fill the vacancies in the council, and at the Winnipeg meeting there were present H. Irwin, H. N. Ruttan, D. A Stewart, H. F. Forrest and G. H. Webster. Mr. Stewart acted as chairman and Mr. Irwin as secretary of the meeting.

ABSTRACT OF RECEIPTS AND EXPENDITURES FOR THE YEAR ENDING DECEMBER 31ST, 1896

Balance from 31st December, 1895		$7,217 77
General Receipts.		
Subscriptions:—		
Arrears	$ 714 00	
Current	2,218 00	
Advance	582 00	
Extra on cheques	1 55	
	$3.515 55	
Transactions sold	43 95	
Donation to Library	6 00	
Interest to December 31st, 1896	226 27	
		3.791 77
Building Fund.		
Balance from December 31st, 1895	$3.729 42	
Interest to December 31st, 1896	129 85	
		3.859 27
		$14.868 81
General Expenditures.		
Transactions published and printed	$ 1,161 95	
Advance proofs, etc.	44 75	
Printing and stationery	206 80	
List of members, charters and by-laws	83 70	
Postage	167 92	
Messengers	22 45	
Cabs	7 50	
Secretary's salary	300 00	
Asst. do. do.	480 00	
Janitor's wages	120 00	
Janitor, for washing towels	6 00	
Office furniture	15 60	
Rent of rooms for one year	550 00	
Telephone service	30 00	
Bank commission on cheques	8 40	
Water rate	25 22	
Electric lighting	36 15	
Bookbinding	34 90	
Books and magazines	33 35	
Telegrams	10 92	
Address to Lord Kelvin	26 03	
Expenses *re* Close Corporation	160 58	
Insurance for three years	14 40	
Express charges	68	
Prof. Carus Wilson's lecture (being cost of arrangements of apparatus, etc.)	16 87	
		$ 3.564 17
Balances.		
General Fund Treasurer	$7 445 37	
Building Fund Treasurer	3.859 27	
		$11.304 64
		$14.868 81

Examined with books and vouchers, and found correct.

K. W. BLACKWELL, E. P. HANNAFORD, } Auditors.
Treasurer. W. J. SPROULE, }

A very earnest discussion then followed on the subject of the close corporation, engaged in by Herbert Wallis, Percival St. George, J. St. George Boswell, C. H. Rust, H. Irwin, P. A. Peterson, W. J. Sproule and W. T. Jennings.

THE QUESTION OF INCORPORATION.

Mr. Wallis drew attention to the references with regard to the status of members of the profession At the last session of the Quebec Legislature, a bill which aimed to make the society a close corporation was introduced. He thought that this measure could be made to fit the requirements of the measure if the new council was given authority to push the matter, and it might then be once more presented at Quebec, and also in the Legislative Assemblies of the other provinces. By the terms of this proposed bill, it is intended to prohibit from practice those who are not corporate members of the society, or who are entitled to practice by some act of the Dominion or Provincial Parliament, unless such persons who are not at present members shall become members within a term of twelve months. It also provides for the formation of a Board of Examiners, who shall meet every six months to grant certificates to those wishing to be permitted to study, and those who have in due course rendered themselves fit to commence practice. It was held by one or two members that the bill was defeated because of the opposition of one of their own members. Upon this Mr. St. George observed that if there was a member of the society opposed to the bill he should resign and come out in the open like a man. He should not shield himself behind the society. Mr. Irwin took similar ground, and held that but for the action of this member, who was not present, and who had written the Attorney-General in opposition to the bill, it would have been passed by the Government. A great deal of discussion followed, many little difficulties being shown. One of these was the question of reciprocity between the recognized professional men of different provinces who might wish to practice in cities or towns outside their own province.

Mr. Rust drew attention to the fact that the Ontario Government permitted the secretary of the Provincial Board of Health, who was a medical man, to pass judgment upon plans submitted by engineers on behalf of municipalities in the province. He did not think this was altogether right, and proposed that a committee from the society be appointed to wait upon the Ontario Government. A committee was named, which included Mr. Rust and Mr. Jennings, the proposer and seconder of the resolution. Mr. Peterson did not like the clause in the bill which compelled English or American engineers to pass an examination before they could practise in this country. It was a mistake to insert such a clause. The president, however, reminded him that this law prevailed with respect to law and medicine in this country. Lord Russell, if he desired to undertake the practice of law in this province, would have to pass an examination. Mr. Peterson had other objections. There was, or there had been, a clause which was tantamount to preventing a plumber from opening a drain or an electrician from hanging a bell in a house unless such became members of their society. He objected to this. They did not want plumbers or electricians in their society. That was to say, his idea was not so much to exclude them as to have such amendments in the bill as would render it unnecessary for such tradesmen to join the society. The president said that in any case eacn person would have to pass the examination. If the plumber desired to apply and passed he did not see any objection. Mr. Peterson reminded the meeting that the member who had been alluded to as opposing the bill objected to it on the grounds he had mentioned. In any case, the bill had not passed. The question now was, what should be done in future? The Manitoba bill would have to be modified. The object was to have a bill passed in all the local legislatures almost identical in terms and principle, which would have at once a unifying and protective effect. The question of interprovincial reciprocity came up for a moment, on the suggestion of Mr. Sproule that it should be an instruction to the new council to insert a clause in the bill looking to interprovincial reciprocity. This, however, was not pressed; but as the council had undertaken this work of pushing the bill before the Quebec Legislature, the question was, should the former body be sustained and authorized to proceed and get the local legislatures to act. The president reminded the meeting that this work was not done for nothing. He did not know how much it would cost before they were through; but it would be well for the society to know what it was doing. Mr. Peterson thought that very little had been done, a position which the president and others warmly controverted, while Mr. St. George said that the council and the president had done splendidly and should be sustained. The older members had obtained their status, but it behooved the society to work for the rising generation. Several motions were made on the subject, besides that of Mr. St. George, looking to the continuance of the work on the part of the new council, with a view to having the bill passed by the several local legislatures, with such amendments as might meet the views of the land surveyors and others who were rather opposed to the Act, and were, at the same time, satisfactory to the council. On the motion of Mr. Percival St. George, seconded by Mr. St. George Boswell, it was finally resolved that the Council be given the necessary authority to act as it might see fit.

It was then announced that the Gzowski medal had been awarded to E. Mohun, for the paper on "The Sewerage of Victoria, British Columbia," which appeared in THE CANADIAN ENGINEER of August, 1896.

THOS. C. KEEFER, PRESIDENT C.S.C.E.

Before the business concluded, the following elections took place:—

Province of Quebec—Messrs. H. Irwin and G. H. Duggan.

Ontario—Messrs. J. Galbraith, C. Macdougall and C. H. Rust.

Maritime Provinces—P. S Archibald.

North-West Territories—E. A. Stewart.

Newfoundland—J. M. Shanly.

The election of officers for the ensuing year resulted as under:

President—Thomas C. Keefer, C.M.G., Ottawa.

Vice-presidents—Messrs. Henry T. Bovey, Montreal; W. T. Jennings, Toronto; W. G. Thompson, St. Catharines.

Treasurer—K. W. Blackwell, Montreal.

Secretary—C. H. McLeod, Montreal.

Librarian—W. McNab, Montreal.

Council—Messrs. St George Boswell, Quebec; M. J. Butler, Napance; G. C. Cunningham, Montreal; C. E. W. Dodwell, Halifax; G. H. Duggan, Montreal; H. Irwin, Montreal; E. H. Keating, Toronto; G. A. Keefer, Victoria; D. H. Keeley, Ottawa; D. MacPherson, Montreal; A. Macdougall, Toronto; E. Marceau, Montreal; M. Murphy, Halifax; H. Peters, St. John, N.B.; H. N. Ruttan, Winnipeg.

The newly elected president then took the chair, and the retiring president, Mr. Wallis, read an address on "Efficiency of Coal Consumption in Railway Practice." This brought the proceedings to a close.

The most of those honored by election to office in the Canadian Society of Civil Engineers have held office before, and have been the subject of biographical note and the engraver's art in THE CANADIAN ENGINEER. We introduce some new faces in the following columns:

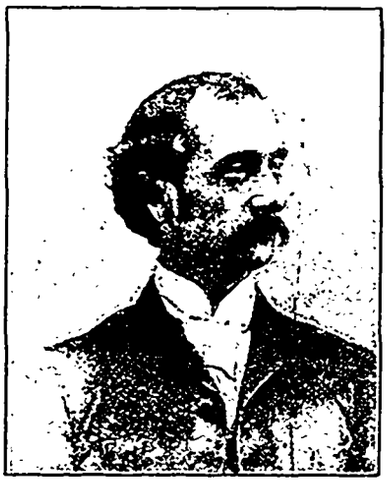
Duncan MacPherson is of U. E. Loyalist parentage, and was born at Bath, Ont., in 1858. He graduated with honors from the Royal Military College, Kingston, Ont., June, 1880, standing at the head of his class of Civil Engineering, and winning Lord Lorne's silver medal for general proficiency. He had the choice of an Imperial commission in Royal Engineers, Royal artillery, cavalry or infantry, but declined to accept any.

He joined the construction staff of the Canadian Pacific Railway in 1880, and has been continuously in the employment of that company ever since; first as assistant-engineer on construction, then as assistant-engineer on maintenance of track and bridges;

afterwards Mr. MacPherson was division engineer in charge of a division of 1,200 miles from Quebec to Sault Ste. Marie, including branches He has taken out patents in Canada, the United States and Great Britain, on a railway switch and frog, which has been thoroughly tested and is now in use on the C.P.R., and the St. Lawrence and Adirondack Division of the New York Central Rail-

DUNCAN MACPHERSON.

way, and is attracting favorable attention from leading railway men. He passed examination for Ontario land surveyor and Dominion land surveyor He joined the Canadian Society of Civil Engineers as a member at its inception in 1887. Joined the English Institution of Civil Engineers as associate member in 1884, and full member in 1891.



ERNEST MARCEAU.

Ernest Marceau was born at Danville, Que., 1852 He went through a classical course at the College de Montreal (1866-74), and took the course of Engineering at the Ecole Polytechnique de Montreal (1874-77): in Aug., 1877, appointed assistant engineer Grenville Canal enlargement; May, 1880, assistant to the superintending engineer of the Ottawa River canals; April, 1890, took charge of the Ottawa River canals upon the retirement of the late David Stark; May, 1893, in charge of the Quebec canals as acting superintending engineer; Oct., 1894, appointed superintending engineer of the Quebec canals.

C. E. W. Dodwell was born in England in 1853; his father was the late Rev. G. B. Dodwell, M.A. In 1862 he came to Canada and was educated at Bishops' College School, Lennoxville, and King's College, Windsor, N.S., at which latter place he took a full engineering course, and in '73 the degree of B.A., with high honors in mathematics and natural sciences. From 1873 to 1877 Mr. Dodwell was assistant-engineer on "Western Counties," "Nova Scotia Central" and "Eastern Extension", 1877 to 1881, assistant Provincial engineer to Nova Scotia Government; 1881 to 1889, Canadian Pacific Ry., first work being preliminary surveys and estimates for St. Lawrence Bridge, in company with G H. Massy, M.C.S C.E.; next on Ontario and Quebec branch, in charge of section, and of construction office in Toronto. Next resident engineer in charge of C. P. Ry., Montreal to Vaudreuil (24 miles), comprising heavy work, viz. Large stone viaduct entering Montreal, and bridges, 33 spans of steel, over Ottawa River at St Anne's and Vaudreuil (described in a paper in proceedings Canadian Society of Civil Engineers, Vol. II., Part I) He resigned in 1889 and set up the firm Dodwell & Hogg, in Montreal (A. L. Hogg, M. Inst. C.E.) built waterworks of Amherst, N.S., and waterworks and sewage of Dartmouth, N.S. In 1891, accepted appointment as resident engineer Public Works Department of Federal Government at Halifax, and still occupies position He was elected an associate member

C. E. W. DODWELL.

Institute of Civil Engineers (England), in 1881; member in 1891. Took active part in formation of Canadian Society of Civil Engineers, being one of the first Montreal Committee, member of council 1890, 1891, 1892 and 1897. Mr. Dodwell is also interested in higher education to the extent of being a member of the Board of Governors of King's College, Windsor, N.S., and lecturer in Hydraulic Engineering, Dalhousie College, Halifax.

DR. MARTIN MURPHY.

Dr. M. Murphy, C.E., Halifax, N.S., second son of Thos. Murphy, contractor, was born at Ballindaggin, near Enniscarthy, Wexford, Ireland, 1832. He was educated for the profession of civil engineering, and has been employed, without intermission, as a civil engineer and contractor from 1852 to the present time. When 19 years of age, he joined the engineering staff of the late Wm. Dargan, and continued in the same employment for eleven years. During this period his practice extended over the various public works of the time, constructed by Mr. Dargan in Ireland. At the age of twenty-four he was engineer and manager of railway construction, and at thirty was resident engineer of the lines of railway operated by the Dublin, Wicklow and Wexford Railway Company, in which position he continued until he came to Canada in 1868. During 1869 and 1870 he was engineer for the extension of new streets and sewerage in the city of Halifax; then for the next two years he was employed by the Provincial Government of Nova Scotia in making surveys for the extension of railways in Nova Scotia; 1872 to 1875, contractor for the construction of the coffer dams and masonry of the Restigouche bridge, Intercolonial Railway. In 1876 he was appointed Provincial Government Engineer for the Province of Nova Scotia, a position which he still holds. He has been consulted by the Colonial Government of Newfoundland, by the Provincial Government of New Brunswick, and has made a hydrographic survey for the Colonial Government of Bermuda. He is a Doctor of Science, an ex-president of Nova Scotia Institute

of Science, lecturer in the class of Pure and Applied Science, Dalhousie College, and has acted as examiner of graduates in engineering for King's College, Windsor. Doctor Murphy is the author of several papers on engineering subjects.

D. H. KEELEY.

D. H. Keeley was born in 1858, at Kingston, Ont. He began his career with the old Dominion Telegraph Company, at Kingston, in 1872, and six years later was transferred to Ottawa as chief operator. He was there identified with the introduction of the telephone, and was placed in charge of the original central office or exchange in 1879. In 1880 he occupied the position of chief operator at St. John, N.B.; and was manager of the Dominion Company's office, at Montreal, just before the amalgamation with the Great North-Western Telegraph Company in 1881. For a short time thereafter, he was chief operator of the joint office at London, and subsequently returned to Montreal as local manager for the Canada Mutual Telegraph Company; and in March, 1882, joined the late F. N. Gisborne, as assistant superintendent of the Government Telegraph Service, at Ottawa, which position he continued to fill up to the time of Mr. Gisborne's death in August, 1892, when the affairs of the service were left in Mr. Keeley's charge, and his appointment as general superintendent was made in 1895. Since 1885 Mr. Keeley has performed all the electrical work incidental to the repairs and maintenance of the Dominion Government's submarine cables, and has been granted several patents for improvements in quadruplex and multiplex telegraphy, and in telephone apparatus. He is a member of the Institution of Electrical Engineers (London, Eng.); associate member of the Canadian Society of Civil Engineers, and a member of the Canadian Electrical Association. Several papers on original work contributed by him have appeared in the *Transactions* of these two latter bodies, and in 1892 the Gzowski medal of the Canadian Society of Civil Engineers was awarded to him.

OTTAWA POWER.

Editor CANADIAN ENGINEER:

SIR,—Your correspondent. G. H. Fawcett, in his article on Ottawa water-power in your January issue, states the population of this city to be 45,000. The population for 1896 is 51,540. Yours truly,

AHEARN & SOPER.

Ottawa, January 16th, 1897.

YACHT BUILDING PROBLEM.

Editor CANADIAN ENGINEER.

SIR,—The information descriptive of the steam yacht, for which your correspondent W. A. B. requests the depth of submersion or mean draft of water, is somewhat meagre, but as it is I may reply as follows:

The draft of water of your yacht of from 4½ to 5 tons weight, will depend largely on her form (at and) below the load water line. Suppose we take ten feet off the over all length for rake of bow and overhang of counter; that would leave 30 feet as her length on load water line; then take six inches off the gunwale breadth each side to ascertain the extreme breadth on water line. Her principal dimensions then become 30 feet by 7 feet by 3½ feet. Such a yacht could be made to float at a mean draft of one foot or two feet according to the degree of fineness desired. The formula used is

$$\frac{D}{L \times B \times C} = M.D.$$

Where D=Displacement in cubic feet and is found by multiplying the tons displacement by 32.

L=Length on load water line.

B=Breadth at load water line.

C=Coefficient of fineness of plane of flotation, which we will here roughly estimate (being unable to get more complete data) at .4.

M.D.=Mean draft in feet.

Taking a mean weight for displacement (say 4.72 tons) and applying this rule to the figures given, we have:

$$\frac{4.72 \times 32}{30 \times 7 \times .4} = \frac{151.04}{84} = 1.8 \text{ feet nearly.}$$

Of course the above is merely a rough estimate, as the coefficient of fineness (.4) depends on the form of the longitudinal horizontal section of the vessel at the load water line (and the immersed volume). In a very fine yacht it would be less, and in a full one it might be considerably more than the above.

This formula was first used, I believe, by Professor Rankine, and it will give as accurate a result as can be obtained from such meagre details. I may here remark that the draft (of water) is usually one of the first dimensions fixed upon, and the displacement, as a general thing, is the factor to be calculated.

G. ASHTON OLDHAM.

Cleveland, O., Jan. 23rd, 1897.

FREE MILLING AND REFRACTORY ORE.

Editor CANADIAN ENGINEER.

SIR, -Can you give me in a few words the characteristic difference between free milling and refractory gold ores?

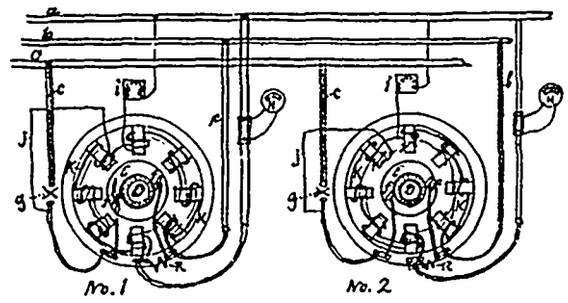
GOLD FEVER.

Toronto, January 25th, 1897.

[A free milling ore is one from which the gold can be extracted by amalgamation. That this may take place it is necessary that the particles of gold be brought in direct contact with the mercury covered plates. When gold-bearing quartz is crushed fine, the gold particles are set free, and are then in a condition to be amalgamated. It might be thought that as gold is always supposed to occur uncombined, that the same would be the case when the gold occurs in pyrites or any other sulphide; but it is not so. The particles of the sulphide cling so close around the minute particles of gold, as to prevent their amalgamation. This has led people to believe that the gold may occur in combination.

Such ores must be smelted or treated by the more complicated processes, and are hence called refractory. It is not to be understood that because an ore contains sulphides, it is therefore necessarily unfit for amalgamation. For instance, we might have a quartz ore containing a considerable percentage of iron and copper pyrites, but in which all the gold was carried in the quartz. Such an ore would be free milling, whereas if part of the gold were in the pyrites, it would then become refractory.—EDITOR.]

PROBLEM IN ELECTRICITY.



a. Positive bus bar. *b*. Equallzing bar. *c*. Negative bar. *d*. Commutators. *e*. Armatures. *f*. Brushes. *g*. Circuit breaker. *h*. Ammeter. *i*. Rheostat. *j*. Shunt field. *k*. Series field. *r*. German silver resistance.

Editor CANADIAN ENGINEER:

SIR,—In talking with a gentleman who was sending you in a reply to my Problem in Electricity, I find that he misunderstood the second half of question, that is, how is it that by moving the rheostat and altering the resistance in the shunt field, the quantity registered on meter will vary? He understood the question applied to any machine, whereas he should have read the balance of the question, which states that the negative side of machine is open and there is no connection whatever to bus bar on that side of machine. I make this explanation as others may have read the question the same way.

E. J. PHILIP.

Toronto, Feb. 2nd, 1897.

Editor CANADIAN ENGINEER

SIR,—I would suggest that "Problem," on page 256 in your January number, is very easy of solution, if indeed it be worth calling a problem The installation is imperfect, as *h* is located in a wire forming one side of the equalizing circuit, and is accurate as an indicator only under conditions when no equalizing current is passing; *h* should be located in the wire between *g* and *c*. As it is, when *g* operates, and the load current is thrown off that dynamo, its *k* coils and *r* are a derived circuit on the *k* and *r* of the working dynamo, including *h* in such circuit. Another circuit also exists on the idle dynamo including *h*, as follows: *a* to *i* of idle dynamo, to *j*, to *f*, to *d*, to *c*, to *d*, to *f*; the second, to *k* and *r* multiple, to *h*, to *a*, completing the circuit through *h*, as specified. As operating *i* of idle dynamo varies the resistance of this circuit, and the voltage also of idle dynamo, the amount of current passing through *h* is varied thereby. Under conditions specified, the indications on *h* of idle dynamo should be over one-half of that of *h* on the working

dynamo, if equalizer circuit is fairly well installed; if ample in capacity and low in resistance to a perfect degree, the indications may be nearly or quite equal The sum of the two indications would be the full load actually carried by the working dynamo This freak accentuates the importance of proper installations

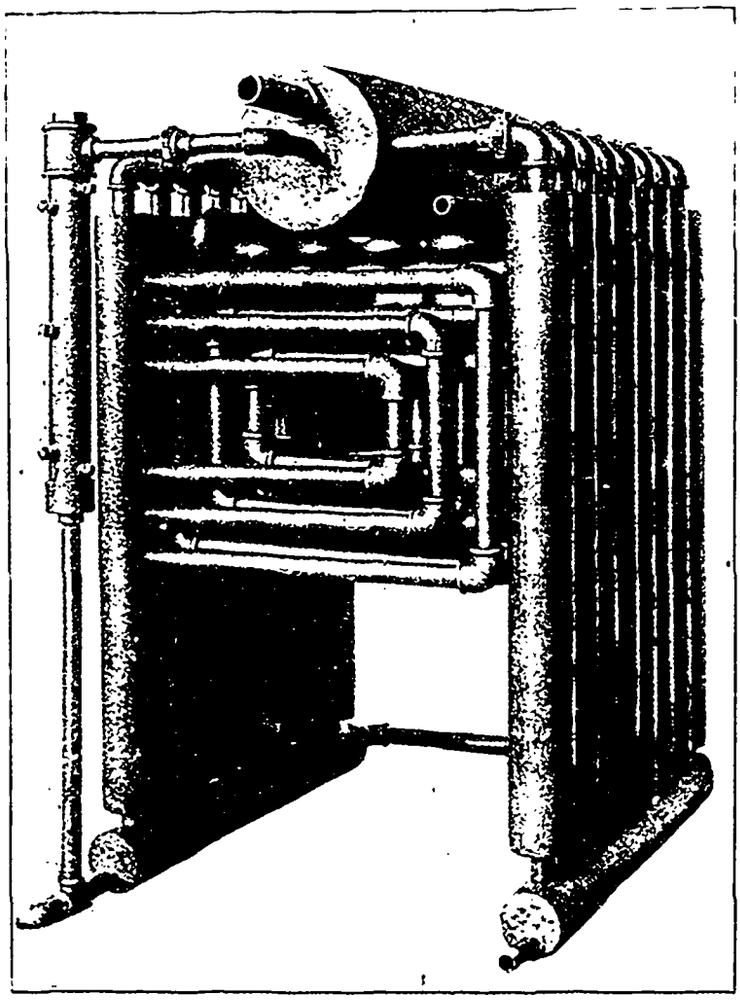
Yours truly,

JAMES W EASTON, E E.,
Stevens Mfg Co., London, Ont.
January 22nd, 1897.

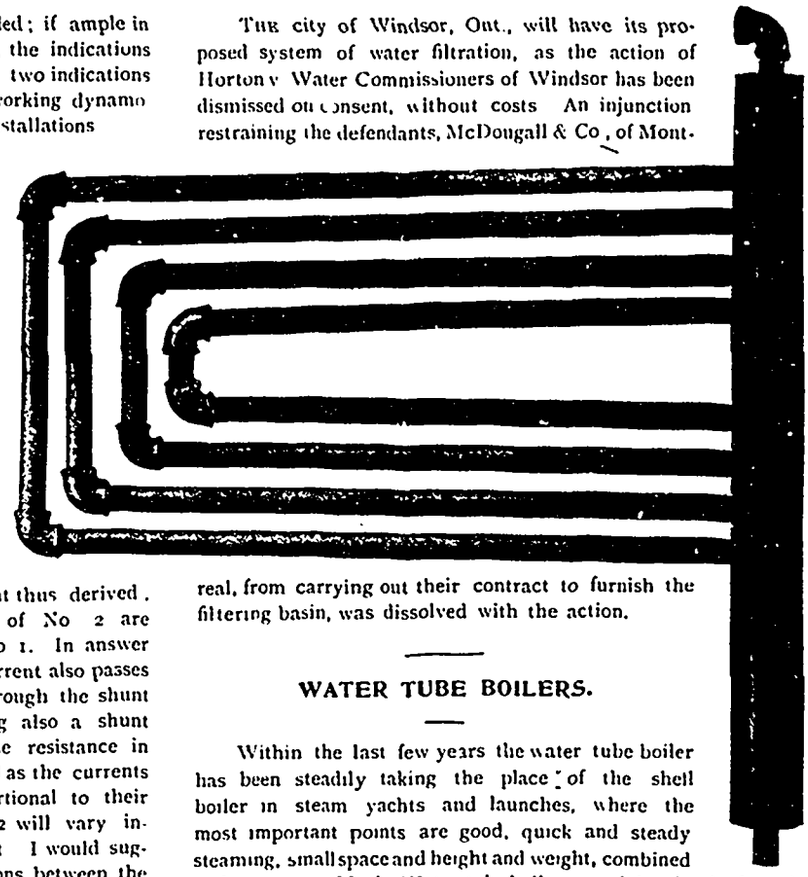
Editor CANADIAN ENGINEER

SIR,—I wish to give you what is to my mind the solution to the "Problem in Electricity" sent you by a correspondent in your January number. I take for granted that the diagram of the connections, as published, is the correct one. In answer to the first question, if we suppose the circuit breaker to go off on one machine, say No 2, the current generated by No 1 machine passing through the series coil will go through the equalizing bar into the series coil of machine No. 2, and from hence through the ammeter of the same machine, making this instrument read the amount of current thus derived. in other words, the series coils and ammeters of No 2 are nothing more or less than a shunt on ammeter No 1. In answer to the second part of the question, this derived current also passes through the armature of the No 2 machine through the shunt field and rheostat in the shunt field, this being also a shunt on the above circuit mentioned, so that if the resistance in the saunt field on No. 2 machine is varied, and as the currents passing in shunt circuits are inversely proportional to their resistances, the current in the ammeter No. 2 will vary inversely as the resistance of the shunt field circuit I would suggest to your correspondent to alter his connections between the equalizing bus bar and dynamos It is the positive poles of the machine which are to be connected to the equalizing bar, leaving the series coils in the main circuit, and not in the equalizing circuit I hope this will answer the problem stated Yours truly,

L A HERDT, E E
Electrical Department, McGill University,
Montreal, January 14th, 1897



THE city of Windsor, Ont., will have its proposed system of water filtration, as the action of Horton v Water Commissioners of Windsor has been dismissed on consent, without costs An injunction restraining the defendants, McDougall & Co., of Montreal, from carrying out their contract to furnish the filtering basin, was dissolved with the action.

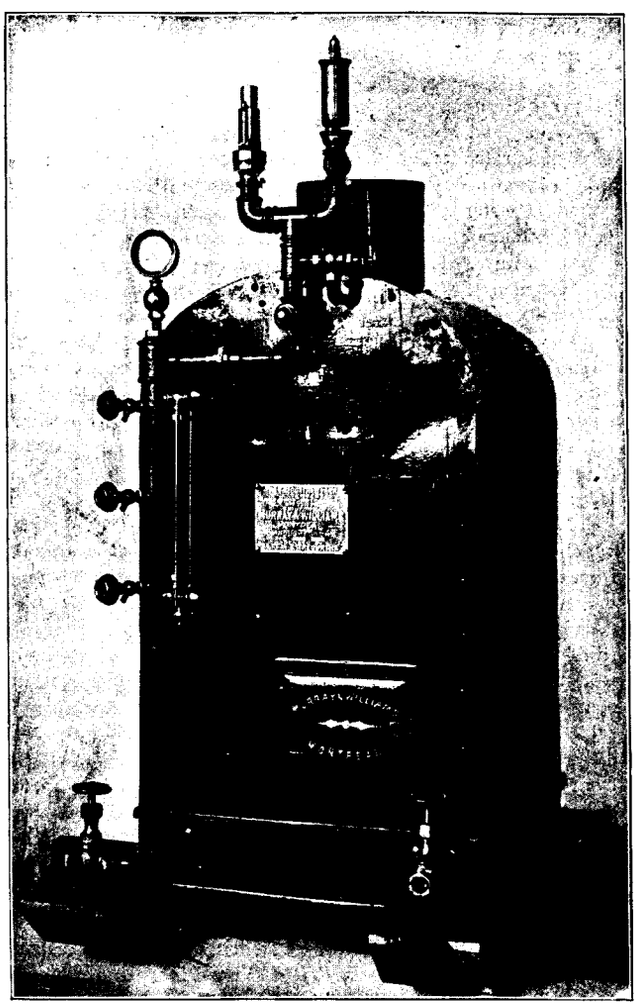


WATER TUBE BOILERS.

Within the last few years the water tube boiler has been steadily taking the place of the shell boiler in steam yachts and launches, where the most important points are good, quick and steady steaming, small space and height and weight, combined with economy of fuel. Water tube boilers are claimed to be far safer than shell boilers, an explosion being almost an impossibility. A tube may split and let steam escape into the fire-box, but upon reducing the pressure the boilers can always be run to the nearest point for repairs The Tregurtha boiler has been proved by eight years use to be one of the best and most reliable water tube boilers in the market. These boilers are made of the best quality iron and steel pipe, and all fittings used of the best quality malleable iron, each being carefully tested to ensure its being free from blow holes. This boiler is composed of two rows of wrought iron pipes of large diameter, one row on each side of the grate forming a water leg fire-box. These side pipes are placed close together, protecting the casing from the intense heat, also forming very effective heating surface, and dispensing with the heavy fire-brick necessary in many other boilers. Each side pipe has a series of circulating pipes extending from it over the fire (Fig 2). The circulation of water in this boiler is therefore very rapid and direct, there being only two bends in each pipe, and these are formed by elbows, which retard free circulation much less than return bends The circulation is short, and having a large body of water in each section to draw from, makes it very rapid. Each section is practically a complete boiler in itself, the water not having to travel through the whole boiler before separating from the steam. This also makes the boiler very easy to repair, should one of the circulating pipes split, the section can easily be removed without taking the boiler out of the boat, the split pipe taken out, and either replaced or the holes plugged until a convenient point for repairs be reached. The boiler is all heating surface, there being no cooling surface of outside pipes, most of the pipes being horizontal or slightly inclined, which is claimed to be far more effective than vertical pipes. The whole boiler is enclosed in a sheet steel casing on a light angle iron frame, and well lined with asbestos, presenting a very neat and compact appearance. The whole is then securely fastened into a water-tight cast iron ash pan The boiler, consequently, is very easy to set up in a boat; all that is necessary is to bolt the ash pan to the bed prepared for it.

While comparing a Tregurtha water tube boiler with a vertical shell boiler for a launch, the makers claim that a 26-inch Tregurtha boiler 46 inches high and weighing complete in the boat 1,000 lbs., wit

75 square feet heating surface, was placed in a launch 29 feet long, 6 feet beam, and supplied a 4-in. x 4-in. engine, turning a 22-inch, four-blade wheel, with steady steam at 150 lbs. pressure—natural draft being used most of the time, and they state that a shell boiler of the vertical direct tube type for the same work would need to be 28 inches diameter, without lagging, or 30 inches over all, 42 inches high, or with cone 56 inches, with 84 1¼-inch tubes and 60 square feet heating surface, the weight in the boat complete 1,200 lbs. Both these weights are without water ; the shell boiler would hold more than the water tube and consequently would weigh more when filled.



The water tube boiler will raise steam in fifteen minutes from cold water to 100 lbs. pressure, whilst the shell boiler would take at least half an hour. Murray & Williams, of Montreal, have secured the sole right of building these boilers for Canada, and are prepared to supply them in all sizes from 20-in. square, 2 h.p. upwards. These boilers are complete with stack and all fittings. Every pipe and fitting is carefully tested ; each section when put together is tested to 400 lbs. water pressure, and the whole boiler when finished is again tested to 400 lbs. For ordinary high pressure work the valves are set at 150 lbs., but the boiler is perfectiy safe for 200 lbs. steam pressure.

ONTARIO ASSOCIATION STATIONARY ENGINEERS.

Editor CANADIAN ENGINEER:

Since Nov. 1st, thirty-seven engineers have presented themselves for examination before the various members of the O.A.S.E. examining board. Thirty of this number were successful and have received certificates. The Hamilton city council has lately passed a resolution providing that every engineer in the employ of the city be required to hold at least a third-class O.A.S.E. certificate, and the Hamilton school board has also passed a similar resolution in regard to the caretakers of their schools where steam boilers are used for heating. The city council of St. Thomas is considering the advisability of passing a by-law to provide that all men in charge of steam boilers and engines in their city be required to pass examination and hold certificates of competency. Several manufacturing firms which have been requiring engineers of late, have refused to entertain the application of any engineers who could not produce certificates. As things are at present, any person may come along and proclaim himself an engineer, and we need not wonder at steam users giving the preference to engineers who hold certificates, as by so doing they engage a man who gives them some proof that he has a knowledge of engineering according to the grade of certificate which he holds, and that he has been sober and steady up to the time of his examination. A certificate is no guarantee of a man's future conduct, but it is a guarantee that he has certain knowledge of steam engineering, and that he has proved to the board that he has had certain experience as an engineer, and has been sober and steady in his habits. It is the intention of the O.A.S.E. and C.A.S.E. to introduce legislation at the coming session of Parliament to provide for the qualification of all engineers of stationary steam plants.

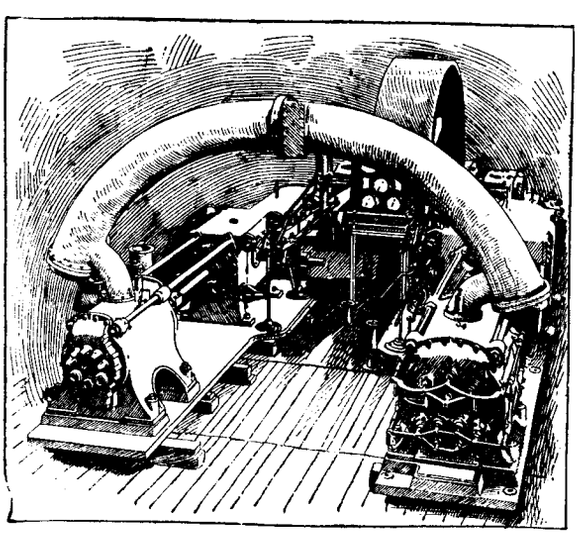
Any engineer desiring information regarding the examinations held under the present Act, will receive a copy of same and by-laws on receipt of a post-card giving name and address.

A. E. EDKINS,
Registrar, O.A.S.E.

Office, 88 Caroline street, Toronto.

MODERN MINING PLANT OF CANADIAN MANUFACTURE.

As an illustration of the fact that mining machinery of the latest and most economical types can be obtained in our own country may be held up the large Le Roi Compressor, which has this summer been built in the shops of the Canadian Rand Drill Co., in Sherbooke, and which has recently been shipped. On the steam end the engine is of the Corliss type, made in the form of a cross compound condensing machine. The high pressure cylinder is 22 inches in diameter by 48 inches stroke, taking steam through a pipe 6 inches in diameter. The low pressure cylinder on the opposite side of the machine is 40 inches in diameter by 48 inches stroke. As we said above, both cylinders are fitted with the Corliss liberating type valve with vacuum dash pot, and with a sensitive governor operating on the releasing gear of the steam valves, controlled by the air pressure, enabling the compressor to be operated automatically from six or eight revolutions to the maximum number of revolutions per minute. The main shaft is 14 inches in diameter by 13 feet long, weighing about 5,500 lbs. The shaft is fitted with cranks pressed on under immense pressure. The connecting rod forgings and piston rod forgings are carefully finished, and without flaw. The air end of the machine is fitted tandem with the steam cylinders, and is also compounded, the high pressure air cylinder being 22 inches in diameter by 48-inch stroke, the low pressure cylinder being 34 inches in diameter by 48-inch stroke. The valve motion insures the filling of the cylinder with air at atmospheric pressure, which fact largely affects the efficiency of the machine, for were the cylinder either not completely filled, or were the air hot and expanded, in just such a ratio would the efficiency be decreased. Between the high and low pressure cylinders is an intercooler of the latest type. Through this intercooler the air passes over a system of water circulating pipes, and is cooled in the process. This intercooler is, as is seen by the illustration, a very elaborate affair, being about 20 inches in diameter, and weighing about 8,000 lbs. On the main shaft is fitted



a fly-wheel 16 feet in diameter, 40 inches face, weighing about 28,000 lbs., which insures the steady running of the machine. The machine weighs about 240,000 lbs., and was shipped in six car loads to the Le Roi Mining Co., at Rossland. B.C.

HEAT AND BOILER EXPLOSIONS.*

BY CAPTAIN JAMES WRIGHT, HON. MEM. C.A.S.E.

The subject of the paper to be read before you is heat, and its action during the explosion of boilers.

I will first briefly outline the views held as to what heat is, by both ancient and modern philosophers. Following the modern ideas, the mechanical equivalent of heat will be considered. Then the behavior of water when subjected to heat, and under the usual atmospheric conditions; and further, when confined, as in a boiler, where, under ordinary conditions, the water may be subjected to a pressure greater than the atmospheric In preparing this paper I have endeavored to use only such facts that you can experimentally prove to be true. In calculations the simple rules of arithmetic are sufficient for our purpose, and technical terms will be avoided as much as possible. If I use the word "theory," it is in the sense of being a generalization of facts, and the word "energy" in its mechanical definition must be used; there is no equivalent for it in our language. Energy means "capacity for performing work," and according to this definition may be either at rest or in motion, or, as the books say, either potential or Kinetic, or, what is the same thing, either possible or actual.

As an illustration of how the term energy is used, and which must appear in this paper, especially when a boiler explosion comes in order. At noon you shut down your engine. The steam may then be 50 or 60 by gauge; notwithstanding this pressure the whole system is at rest—there is no visible motion. It cannot be denied that there is a capacity for performing work still in the boiler. It is possible, and is therefore called "potential" energy. Open the throttle valve; motion of the engine takes place, and a part of the potential energy stored in the boiler becomes Kinetic or actual, as stroke after stroke is made by the engine.

It is natural for the human mind to assign some cause for every effect observed. The common belief of the ancients was that heat was a material substance that permeated the small spaces between the minute particles or atoms of matter, and they called it caloric, a name retained at the present time, but with a somewhat changed meaning. There never was the least direct evidence to support this belief. It was one of the results of a pernicious fallacy then believed, that there was a double system of natural laws, one theoretical, the other practical. The philosopher made his theory, as he called it, and then twisted the facts to an agreement with it. Under such a system no scientific advance could be made.

This was the received opinion about heat for over 2,000 years. Yet during this time occasionally a writer appeared that doubted it, and considered heat to be simply a mood or condition of matter. But, true to the theoretical ideas of that time, no proofs were advanced. About one hundred years ago, Benjamin Thompson, afterwards known as Count Rumford, took the question in hand. He was a native of Concord, in Massachusetts, and for his loyalty to King George during the American revolutionary war, he was obliged to leave his country. After some years he turned up as superintendent of a military arsenal in Germany, where his attention was directed to the great amount of heat generated during the boring of brass cannon. He experimented and he measured. The question was in the hands of a master. The results were made public in a paper read before the Royal Society on January 25th, 1798. The scientific men in all countries have accepted his conclusions. It is said this was the most important paper ever read before this learned society. It established what is now called the mechanical theory of heat. Reasoning on his experiments, he came to conclusions that have been accepted as final, that heat is not an igneous fluid, but a form of atomic or molecular motion, and if a motion, there must be a mechanical equivalent in work.

We all know what a hot journal is, and at least some of the causes. We all know that heat is generated and the temper taken out of a chisel or drill if sharpened on a dry grindstone. Lay a small bar of iron on an anvil and strike it a smart blow with a sledge. Where impact took place it is found to be sensibly warmer than at any other part of the rod, and a second blow on the same place makes it warmer still; in fact it can easily be made red-hot. Those that have witnessed tests of armor-plates for warships tell us that when the projectile struck the plate there was a brilliant flash of light, and on examining the hole made in the plate it was found that some of the metal had been fused. To come down to a small matter, although there is no great or small in nature, when I was a boy going to school in Scotland, amongst the equipment of stocks and stores found in every boy's pouch, there was sure to be a good-sized brass button. Brass buttons were then fashionable on male attire, so they were easily got. By rubbing this button on a desk or form heat was generated, and, if then applied to the neck of the boy that sat next to him or in front of him, would give him a start Often the master's taws supplemented this affair, and I have seen battles fought on the play green to settle the little matter. In doing this trick, the boy was unconscious that he was illustrating one of Nature's great truths, the conservation of energy by the transformation of work into heat. But he was well aware that the longer he rubbed and the greater the pressure he put on the button the hotter it became.

Following the reading of Count Rumford's paper, it became an important problem to establish the correct relationship between heat and mechanical work. During the early part of the present century many tried but failed. At last, about the year 1840, the question was independently taken up by Joule, an Englishman, and Mayer, a German, of whom it has been said Joule worked the theory out, and Mayer thought it out, and both gave it the solidity of demonstrated truth. This great question took this form: What weight lifted one foot high is equivalent to the warming of one pound of water 1° F.? As it was then and is now, the unit of heat is the amount required to raise one pound of water one degree in temperature. Joule worked or experimented for seven years in the basement of a storehouse in Manchester that was noted for the uniformity of its temperature throughout the year. At first his results were widely different, but as his experience increased, they became closer. At last, in 1849, after applying all the precautions suggested by seven years' experience, the result of 110 experiments made on water, mercury and cast iron, was that the mechanical equivalent of the unit of heat was the lifting of 772 pounds one foot high, or what is the same thing, the lifting of one pound 772 feet high.

Mayer adopted an entirely different course. The data from which he calculated the mechanical equivalent of heat was obtained from the increased amount of combustible consumed in heating air which expanded against the atmosphere and did work above that consumed in heating the same weight of air to the same temperature in a closed vessel which resisted expansion, and no mechanical work done. Mayer perceived that the difference in the combustible consumed, or more properly the heat utilized in producing the same thermal effect on equal weights of air, and under the above different conditions, was the heat equivalent of the work done; and from this he calculated that the mechanical equivalent of the heat that would raise the temperature of one pound of water one degree F., was the lifting of 771.4 pounds one foot high, or about 10 ounces less than Joule's equivalent. This extraordinary coincidence removes any doubt of its accuracy; and it is rightly considered the greatest scientific discovery of the century.

It is an acknowledged truth in modern science, and confirmed by all experience, that energy or the capacity for performing work cannot be annihilated. The amount in the universe, possible and actual, remains the same under every change which may arise. But it changes its form of action. Under certain conditions it appears as heat or light; under others as mechanical, electrical or chemical energy, besides many other forms. Still conservation is the law which binds the whole together. We have a good example of this in the street railway system in this city. There is a pile of coal and a supply of water at one end of the system; a hundred or more moving cars at the other, with a wire connection between. The method of doing this is foreign to the subject of this paper, the main purpose of which is to trace the causes which lead to a boiler explosion, and the destructive effects which accompany or follow it, without any hypothetical suppositions about unknown forces which cannot be proved to be present. In fact, it will be seen that when a boiler explodes it is simply obeying the usual laws under which it acts when supplying steam to an engine, or to heat a building.

Following up the lines laid down at the beginning of this paper the effect of heat upon water under the usual atmospheric conditions, now comes in order. In this country we are acquainted with water in the form of a solid, a liquid, and steam. It is generally said that water freezes at 32° and boils at 212°. The last figure is not quite correct at all times; it depends upon the atmospheric pressure, which varies from day to day. But it would be inconvenient to be talking in fractions all the time, or having to read a barometer before making an assertion. It has been agreed upon that under the ordinary atmospheric conditions these figures be accepted

On a day when the temperature is below 32°, put a thermometer in a pail of warm water, and set it outdoors in an exposed position; then observe its gradual fall in temperature. Repeat this as often as you please; vary the conditions; let the temperature of the atmosphere be zero, or 10, 20 or 30 degrees below. You will find

* A paper read before the Canadian Association of Stationary Engineers, Montreal No. 1.

that water in the liquid form never falls below 32°. At this point there is a halt, and only after becoming a solid, or ice, does the temperature fall below 32°. Again, put a thermometer into a quantity of water in a pot, and put it over a fire in a stove. Now observe what takes place The temperature rises until 212° is reached. Here again a halt takes place. The water boils, steam is formed Hold the thermometer in the steam, its temperature is also 212°; and as long as any liquid water remains in the pot, its temperature never rises above 212° It makes no difference what the temperature of your source of heat may be, the result is the same. From this it is evident that the range of temperature in which water can exist in the liquid form, while under the common atmospheric conditions, lies between 32° and 212°. It has been said by the highest authority that water is the most wonderful substance in nature.

So far our experiments have been made in a pail or pot, Unimportant as they may appear, yet in view of what follows in this paper, I beg leave to call your special attention, again and again, to the fact that the highest temperature at which water can exist in a liquid form while under atmospheric pressure is 212°. This fact astonished even James Watt, which shows the state of experimental knowledge at that time. One hundred and thirty years ago he was working as a mechanic in Glasgow College. In the course of events, a model of a Newcomen pumping engine was put into his hands for repair. As a common mechanic he did the work. Afterwards he tested it, and was amazed at the enormous quantity of steam it used. In his efforts to discover the cause of this he found that he could not raise the temperature of water in an open vessel above 212°. He was enlightened on this subject by Dr. Black, one of the professors, who had previously discovered the same thing, put it in a scientific form, and was then teaching the principles of latent heat to his classes, that all matter in passing from the solid to the liquid form, or from a liquid to a vapor, absorbed an amount of heat that was not sensible to a thermometer, and was hence called latent, but could be proved to exist by a reversal of the process. After this consultation Watt returned to his shop in the college and contrived a means of making special and quantitative experiments on latent heat. He decided that the latent heat of steam at a sensible temperature of 212° was 945. Or, in other words, that the latent heat set free by one pound of steam at atmospheric pressure, in passing to the state of water at 212° also, would raise the temperature of 945 pounds of water one degree. Considering the then imperfect means at Watt's disposal of solving this question, it is wonderfully close to the now accepted figure of 966. It is well known that Watt, in tracing the causes which led to the wastefulness of the little model, invented the separate condenser, the first of that brilliant series resulting in the steam engine, and effecting in a peaceable manner the greatest revolution that ever took place on earth. To sum up the above thermal results: Under atmospheric pressure, water in the liquid form can only exist between the temperatures 32° and 212°. In the solid form, or ice, the temperature can fall below 32°. In the form of steam, the temperature can be raised above 212°, in which case it is said to be superheated.

Next in order comes the thermal behavior of water, when subjected to a pressure greater than the atmospheric, as we see in a boiler. This part of the enquiry will lead us directly, and at once, to the origin of the mighty force at work during the explosion of a boiler. For clearness and precision of statement, in the line I propose to pursue, I have considered it best to select some boiler for reference. Any one would answer the purpose; but I happen to have in my possession the drawings of a common horizontal tubular boiler, with all the calculations required for our present purpose. This boiler is 66 inches in diameter and 14 feet long, with fifty-nine 3½ inch tubes. The calculations are based on a working pressure of 100 pounds by gauge, and at a time when there was 4½ inches of water over the top row of tubes. Under these conditions there is 181 cubic feet of water in the boiler, and 97 cubic feet of steam room. As was stated in the beginning of this paper, I will endeavor to use only those facts that you can experimentally prove. Take this boiler when empty and drill a hole in the water space and another in the steam space. Tap the holes and screw in boiler thermometers. These are nothing but common thermometers designed for this purpose. When in place the bulb is in the interior of the boiler, the stem and the graduation is outside, where it can be read. After this is done, put in a proper charge of water; put the safety valve in place, and hang the weight at a point where it will balance an internal pressure of 100 by gauge. Then start the fire. At first the two thermometers may not read alike, the conditions are different; but they soon read the same. It will now be observed that the temperature of the water gradually rises. As it approaches 200° there is a noise in the boiler. This is the same action as the singing of a tea kettle, only on a larger scale. Presently the water thermometer reads 212. The boiler is now comparatively quiet. In a short time the finger of the gauge reads 5. At this time the reading of both thermometers is 228°, or 16° above the highest possible temperature under atmospheric pressure alone. Now carefully note the pressure and corresponding temperature as steam is getting up. With gauge at 30, both thermometers read 274°; with gauge at 60, both thermometers read 307°; with gauge at 100, both thermometers read 338°. These are the boiling points or temperature of ebullition corresponding to the given pressure, and prove that as the pressure increases the boiling point rises. And also that under all circumstances, at least as long as the steam is in contact with the water from which it was generated, the temperature of the steam and the water is the same. These results are immutable. The water contained in the accumulator in the Board of Trade building, when subjected to an air pressure of 100 pounds per square inch, would not boil until a temperature of 338° was reached.

In following up the line of argument pursued in this paper, it is convenient to know what is fairly the weight of water, and what is the weight of steam contained in this boiler, under usual working conditions, when the water is 4½ inches above the upper row of tubes, and steam at 100 by gauge. We found the water space to be 181 cubic feet. This volume of water, at a temperature of 338°, weighs 10,140 pounds; and the 97 cubic feet of steam, that being the steam space in the boiler, weighs only 25½ pounds. In this case the weight of water in the boiler is 397 times the weight of the steam. Numerical results sometimes surprise us, but we must accept facts as we find them.

Preliminary and other preparations being made, we now confront the main question—the explosion of a boiler and how it is effected. If our selected boiler, with 10,140 pounds of water in it at a temperature of 338°, was suddenly relieved from a large amount of its internal pressure of 100 pounds per square inch, what would take place? The conditions under which water formerly existed as a liquid in the boiler are gone, and it will of necessity lower its temperature in conformity with the decrease in pressure. In falling to atmospheric conditions, as it must come to this in all explosions, each pound of water drops 126° in temperature, and in 10,140 pounds of water, 1,277,640 heat units would be liberated. Now, what becomes of this heat? Energy is indestructible. It may take other forms, but cannot be annihilated. This heat is utilized in the formation of steam. There is nothing hypothetical in this. It can experimentally be proved to be true, and we see it every day. When water comes from the try-cock of a boiler under pressure, as soon as it is subjected to atmospheric conditions it generates steam, and a large volume, too, compared with the small quantity of water. But the same thing is seen to better advantage, and can be studied at the out board end of a blow-off pipe during the operation of blowing off a boiler. Look at the great volume of steam formed after exposure to the atmosphere, when nothing but water under pressure came from the boiler. It is a fact that during the operation of blowing off a boiler, and an explosion, the same process is gone through, the difference in the effects being due to the difference in the time it was done.

The weight of steam made under the condition of a sudden fall in pressure can be computed between any named pressures or temperatures. In the present case I prefer to take it from the working to the atmospheric temperatures, or from 338° to 212°, and also using the former data.

Temperature of water previous to explosion....	338°
Temperature after explosion	212°
Heat rejected per pound of water.....	126 units
Total heat of steam at 212° .....1178°	
Original temperature of water	338°
Units of heat required to form one pound of steam	840 units

This amount of heat is furnished by 6⅔ pounds of water in falling from 338 to 212°, or one pound of steam is, under the circumstances, formed in every 7⅔ pounds of water. Dividing the 10,140 pounds of water in the boiler by 7⅔, we obtain 1,322 pounds of water converted into steam by the sudden loss of 100 pounds pressure per square inch in the boiler. This is astounding. We found only 25½ pounds of steam in the boiler when in working order, and now during an explosion 1,322 pounds is accounted for. Most of you must think that I am in error here. If so, I cannot detect it. On the principle of the conservation of energy, I tested it in this manner. Previous to the explosion there was 10,140 pounds of water in the boiler at a temperature of 338°; total units of heat in the water, 3,427,320. After explosion there was 8,818 pounds of water at a temperature of 212°, and 1,322 pounds of steam at a sensible temperature of 212°, but a total heat of 1,178°.

Units of heat in 8,818 pounds of water at a temperature of 212°	1,869,416
Units of heat in 1,322 pounds of steam under atmospheric conditions	1,557,316
Total	3,426,732

In working this out, I paid no attention to the fractions in the table. Yet the difference in the heat units before and after explosion is only 588 in these large amounts. The conservation of energy here holds good, and obtaining this result, I had no hesitation in laying it before you. I have intentionally omitted saying anything about the 25½ pounds of steam that was in the working boiler It's effect on the results is comparatively insignificant, and for simplicity, I said nothing about it. Also, I wish to observe that in making the last calculation, it was based alone on the actual transformation of heat energy, from the sensible to the latent form, which then took place in the boiler after a sudden loss of internal pressure.

This loss of internal pressure generally results from a failure of the boiler to resist the stress it was subjected to In other words it was not strong enough. A rent, rupture or collapse takes place. An opening is made. If small the boiler may peaceably discharge its contents; but if large enough to permit an immediate and material fall in the pressure, enormous forces are liberated, an explosion follows, and all in strict conformity with natural laws, which are observed every day in a boiler house.

It may be thought that my method of calculation is obscure, in finding that 1,322 pounds of water at a temperature of 338° would change its liquid form into steam at atmospheric pressure, when the boiler pressure of 100 pounds by gauge was lost. I will put it in another form. As already stated there is 10,140 pounds of water in the boiler at a temperature of 338°. In falling to a temperature of 212°, or atmospheric conditions, there is 1,277,640 of heat units liberated, which is taken up as latent heat by a part of the water becoming steam. The latent heat of one pound of steam at atmospheric pressure is 996 heat units. Dividing the total heat units liberated, viz., 1,277,640, by 966, *we again obtain the same number, 1,332, which is the pounds* of water evaporated from, and at 212° by 1,277,640 units of heat. All such questions admit of an approximate solution in a practical manner. The fireless locomotive is an example, where water, in falling from a temperature of 400 to 260°, furnishes steam to do the work for a limited time.

I must now come to a close. My purpose in writing this paper to be read before you, was to trace the origin of the forces at work during the explosion of a boiler, and go no further. We have seen the changes which must take place in the thermal conditions of the water in a boiler in following a sudden fall of pressure from 100 by gauge to atmospheric pressure. At the same time, the total units of heat remains the same, notwithstanding the change of form in energy. But this is not all. What would be the result when the pressure has fallen from 100 to 80? Over 160 pounds of water would be converted into steam, an amount more than six times the weight of steam in the boiler under working conditions. This seems to prove that an explosion may, under certain conditions, instantly follow a rupture or failure of the boiler, although there are authenticated cases where it did not, and several seconds intervened between the failure of the boiler and explosion, as witness that case in a Denver hotel the year before last.

The engineers of 60 or 80 years ago were much perplexed in accounting for explosions. They theorized, as it was then called, and talked nonsense about explosive gases, invisible lightning, and the miraculous ability of red hot plates to make steam. But in one thing they were correct. They observed that under the same pressure, the destructive effects of explosions was in proportion to the weight of water in the boiler.

MANUAL ON THE BLOW-PIPE.

Editor CANADIAN ENGINEER.

SIR,—While in Montreal, I called on your office there about a book mentioned in the November number of your paper, in an article on "Field Testing of Minerals," by W. Hamilton Merritt. They were unable to give me the exact title of the book or the publisher. I also inquired of several book dealers. Could you supply me with the desired information, viz., the correct title of the book?

HUGH C. BAKER.

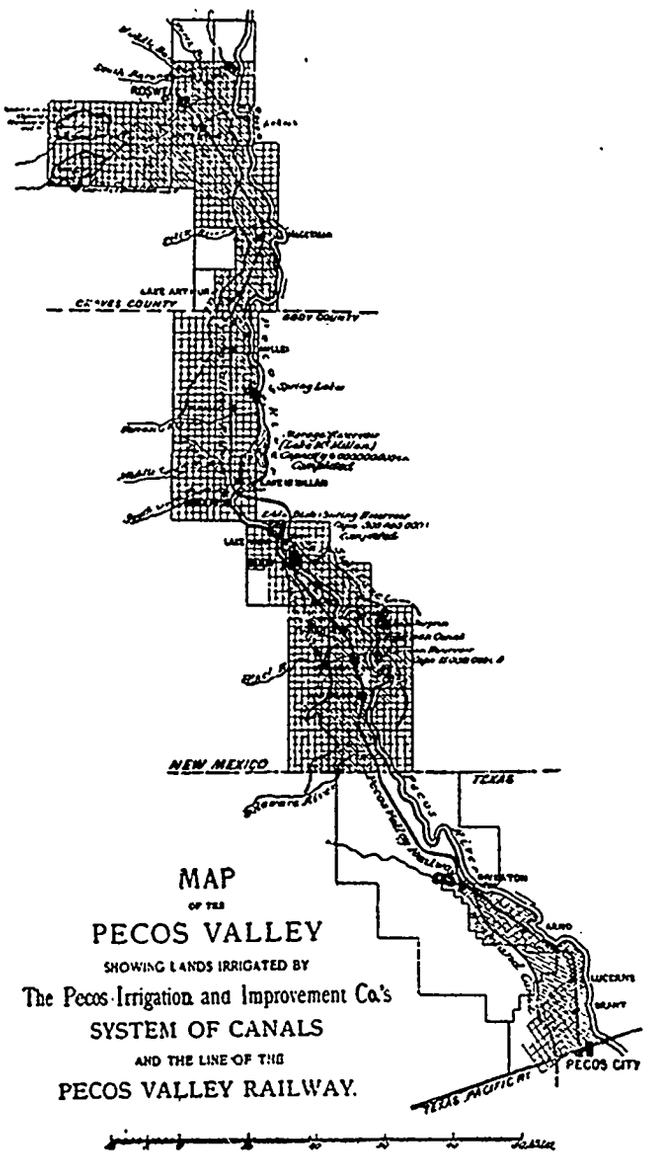
Blackburn Mines, Perkins Mills, Que.,
January 15th, 1897.

[Fletcher on the Blow Pipe, the book above referred to, is published by Wiley & Co., 53 W. Tenth st., New York, N.Y. —EDITOR.]

THE IRRIGATION WORKS OF THE PECOS VALLEY.*

BY ELWOOD MEAD, M.S., M. AM. SOC. C.E.

No single experience of a visit to the arid west is more startling or impressive than when wearied with the long stretches of unoccupied arid plain one witnesses for the first time the transforming power of water. The contrast between the loneliness, barrenness and monotony of the arid landscape and the habitations, fertility and exuberant vegetation of the irrigated field is so striking and attractive as to impress even the most casual observer. This is true wherever it occurs, but there are a few places where surrounding conditions add to the impressiveness of the experience, and among these must be numbered the Pecos Valley. The irrigated home of Wyoming, Utah or Colorado has always a mountain background with its forests of pines along the slopes and its summit of snow, but the irrigated lands of the Pecos are a veritable oasis in the desert. On every side stretch away into the dim and misty distance, under the unending sunshine of that region, the long, level expanse of red and yellow loam only partly hid by the stunted



growth of mesquite so apparently worthless and unproductive that to find it divided by only the narrow limits of an irrigation canal from scenes of production which rival the famed delta of the Nile, is a transformation so marvelous as to almost discredit the evidence of one's senses.

That the Llano Estacado, the treeless, grassless, waterless plain of the southwest, with its history filled with the tragic experience of its early explorers, should have its western limit marked by the greatest attempt at reclamation yet inaugurated on this continent, is one of the curious incidents connected with the conquest of this region. Already its orchards and vineyards, its homes, less than six years old, hidden by trees and surrounded by flowers and fruit, form an interesting subject for the sightseer, but to the engineer or the student of irrigation development it has a special interest. In the magnitude of its conception, in its cost

*A paper read before the Society of Civil Engineering, Perdue University, LaFayette, Ind., U.S.A.

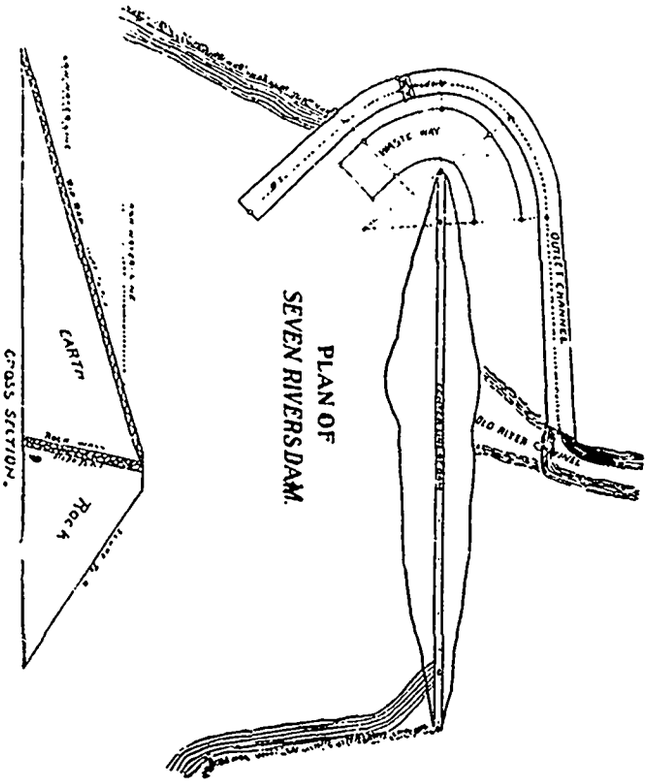
and in the results already secured, it is beyond question the greatest irrigation enterprise on this continent. A river hundreds of miles in length, with its waters unused and running to waste, the land along its banks uninhabited and worthless, with the whole available resources of the valley inadequate to furnish employment or support for half a hundred men, has, under a single management, been diverted, controlled and utilized, and an area brought under ditches in five years almost equaling that irrigated in Utah in 1890 after a half century of settlement. The ordinary haphazard location and construction of irrigation works, with its attendant waste of money in construction and waste of water and effort in operation, has been replaced by a systematic plan which aims at both the conservation of the water supply and the reclamation of the greatest area with the least expense. The controversies over water rights which usually mark the construction of rival canals depending on a common supply, is here avoided by the single ownership. In other words, it is the application to irrigation of the same methods which have created the trunk line in railways, the department store and the manufacturers' trust. That it is an example which will be followed elsewhere is probable, but there were certain considerations which made this comprehensive plan the only one which could succeed here.

In the first place, the water laws of New Mexico are wholly inadequate. There is no efficient or satisfactory means for determining conflicting claims to water, and the most economical and certain method is to prevent conflicts by a union of ownership. In the second place, it was an isolated, uninhabited region, with its possibilities undeveloped. Financial success could only be secured by an enterprise large enough to create a community in itself, to develop trade to attract railways, factories, and business, all of the interests which go to make up the industrial life of a prosperous community. The engineering problems made large canals a necessity, as the principal obstacle is the diversion and control of the river. The summer floods have worn deep its channel after it enters the plain where its waters are used. This renders its diversion expensive and difficult. It is not a stream having a perennial flow. When swollen by the floods due to summer rains its discharge fills and overflows its banks, reaching at the maximum 15,000 cubic feet per second, and even exceeding this for brief periods. But from January to June is a season almost destitute of rainfall, in which the flow of the river is largely dependent upon the springs which are found throughout its entire length. It is at this period that the needs of irrigation are greatest, and if restricted by the natural flow of the stream, and the summer floods lost, the area reclaimed would be limited not by the extent of its greatest but that of its least discharge. This made it necessary to unite with the diversion of the ordinary flow of the stream some provision for the storage of its floods.

Work on this enterprise was begun six years ago. Since that time the valley for a distance of nearly 170 miles has been placed in a condition to be irrigated; 250,000 acres of land are already susceptible of reclamation and a water supply is being rapidly provided for 150,000 acres additional; 75,000 acres have been settled upon; one town of 2,500 people has been brought into existence; 121 miles of main canal, 273 miles of main laterals and 900 miles of sub-laterals have been constructed.

Two masonry dams have been constructed across the Pecos River, one 50 and one 52 feet high, with the attendant works necessary for the regulation and control of its volume at the period of greatest floods. The largest artificial lake on this continent has been created, having sufficient storage capacity to supply all the canals below for an entire year, if not a single drop of water was supplied from the river during this period. It is these reservoirs which furnish the most interesting features to engineers, since, aside from their extent, the canals differ little from those found elsewhere.

Six miles above the town of Eddy the river cuts through a range of low, rocky hills. At the first of these the gap cut by the channel has been closed by a dam extending from bluff to bluff, this hill forming the lower line of a basin extending several miles up the stream. The dam is a combination of earth and loose rock, and has the following dimensions: Length on top, 1,686 feet, greatest width at base, 306 feet; width on top, 20 feet; greatest height, 52 feet; submerged area, 8,100 acres; total capacity, 6,000,000,000 cubic feet. In preparing the foundation for this dam all of the surface material was removed, and the loose rock portion rests on a foundation of solid rock. The foundation for the earth front was prepared by removing the surface soil, leaving the remainder in place. The loose rock backing of the dam has a lower slope of 1 to 1, and the upper slope of ½ to 1, the upper surface being placed with some care in order to give it the necessary stability at this slope. This portion of the dam is only intended as a supporting material for the earth front, the earthen covering being relied upon to prevent the percolation of water. This covering has a width on top of 5 feet with a slope of 3½ to 1, giving it a width on the bottom of 150 feet. The discharge gates are situated in a rock cut at the north end of the dam, this cut being through a material composed of alternate layers of rock and shale. The gates are of wood, having a masonry foundation and masonry retaining walls set well within the banks on either side. They are six in number, each having a clear opening of 4x8 feet, and an aggregate discharge when the reservoir is filled of 5,000 cubic feet per second. The bottom of these gates is 20 feet above the bottom of the reservoir, no provision being made for drawing off the water below this point, it being thought that this section of the reservoir will in time be filled by the sediment deposited by the river. Two waste-ways have been provided. The discharge of one begins when the water reaches a depth of 16½ feet above the bottom of the gates or 15½ feet below the top of the dam. The second begins to discharge when the reservoir reaches a depth of 25 feet above the bottom of the gates or 7 feet below the top of the dam. As yet the water has never reached a sufficient height to cause it to waste over the second spillway. The first spillway is 400 feet in width and the greatest discharge of 1895 was 15,000 cubic feet per second. The second spillway is 750 feet in width, so that it is



scarcely possible that any flood will ever menace the integrity of the dam.

The reservoir at present only retains 16½ feet of water after the flood season, but provision is to be made this year by which regulating gates will permit of its height being held to that of the flood season, or about 25 feet against the gates. The dam has been tested for two seasons with satisfactory results. When examined last month, there was no evidence anywhere of any displacement, nor has there been since the reservoir was first filled any leakage whatever, either through the dam or under its foundations. It can, therefore, be taken as a satisfactory example of this type of dam.

The construction and methods of operating the gates is best shown on the accompanying drawings. Both are open to some criticism. The use of wood in a structure as important as this is objectionable, because of its rapid decay and of the danger of its early failure from this cause. The operation of wooden gates the size of these is also extremely difficult, it having been found by experience that it is very difficult to open them when subjected to the maximum pressure during floods. The extra cost of iron gates would have been more than compensated for by their safety, durability and ease of operation, and would have been more in keeping with the substantial masonry which encloses the present structure. Fortunately the present gates can be readily replaced whenever necessary, and this will, doubtless, be done in a few years.

The second reservoir is 7 miles below the first, in a somewhat similar location and with a dam of the same type. This reservoir

submerges an area of 1,032 acres and serves both as a storage and distributing reservoir, as its discharge gates empty into the main canal. It is also provided with two spillways. The principal spillway is 400 feet long, discharges over a solid rock ledge, and is so arranged that the water in the reservoir can be held at the maximum or flood height by means of a series of regulating gates. The present dam at this reservoir is the second to be constructed at this point, the first having been destroyed by a flood soon after its completion. Its destruction was not due to any weakness in itself, but to lack of capacity in the spillways, a cloudburst in that region causing the waters to rise and overflow the top of the dam. With the construction of a second dam an additional spillway was provided which has proved ample.

Both of these reservoirs are situated in the channel of the stream. A third is now being constructed to store the waters of one of tthe principal tributaries, the Hondo River. In this the waters are diverted by means of a canal, which empties into a natural basin outside of the stream's channel. This reservoir will cover about 2,000 acres and will have a storage capacity of 2,500,000,000 cubic feet. With these reservoirs filled the farmer can look forward to the season when rain ceases to fall with an assurance that no matter what the fluctuations of the stream may be, his needs are provided for, and as an illustration of what this means, it may be stated that during the past two years water has never ceased to flow winter or summer in the canals of this system. Four main canals have been constructed. The upper or northern canal is 35 miles long, 30 feet wide and 6 feet deep. It supplies water for 67,000 acres. The southern canal is the principal one. It starts from the second reservoir, is 40 miles long, 45 feet wide on the bottom and 7 feet deep, one branch crossing the river on a flume 468 feet long. The two other canals are smaller. The one lowest down stream begins about 65 miles below the head of the southern canal and has been completed 13 miles. It will ultimately have a length of 40 miles and irrigate 35,000 acres of land in Texas. The outlay made by the company in carrying out this project has thus far been about $4,000,000.

Industrial Notes.

THE waterworks at Owen Sound will be extended at a cost of $6,000.

J. C. HENDERSON is building a saw mill and grist mill at Cold stream, N.B.

IT is said that the C.P.R. will build a new central station at the head of Bank street, Ottawa.

THE Alvinston, Ont., Stave and Heading Co. has sold out to the Sutherland-Innes Co., Ltd.

THE Strathroy, Ont., Brewing and Malting Co applies for an Ontario charter; capital, $11,000.

THE Granby, Que., Last Mfg. Co. are exporting 1,000 pairs of lasts per week to the United States.

THE people of Pembroke, Ont., are agitating for a sewage system, to supplement their water supply

A COMMITTEE of the town council, Welland, Ont., is in charge of the proposed new iron bridge at that point.

THE people of Renfrew, Ont., have voted in favor of a water supply and sewage system, by a majority of 12.

THE Dominion Government is calling for tenders for a large quantity of steel rails for the Intercolonial Railway.

THE Conneaut Tinware Manufacturing Co., Conneaut, O., proposes to establish a branch in Port Dover, Ont

H. GUTHRIE, Guelph, has been appointed liquidator of the Laughlin-Hough Drawing Table Co., of Guelph, Ont.

A DEMAND of assignment has been made on the Mountain City Cycle Company, Montreal Liabilities are not large.

JOSEPH M. AND EUCLID MASSE, Granby, Que., will carry on business as founders under the style of Masse & Masse.

ROWLAND DENNIS, founder, London, Ont., has the contract for the iron work of the new town hall at Dutton, Ont.

SOUTHAMPTON, ONT., has carried a by-law voting $11,000 for the purchase of the Saugeen water-power and electric light plant.

THE contract for a wing to the Presentation Convent at Coaticook, has been awarded to Octave Blain and W. Welsh at $5,000.

THE mayor of Chatham, Ont., has formed a scheme for dam ming the river Thames at that point, and developing a water power.

APPLICATION for a winding-up order for the G. & J. Brown Manufacturing Co., agricultural implements, Belleville, has been made.

Two thousand tons of cast-iron pipe, besides special castings, will be required in the construction of the Springhill, N.S., waterworks.

THE municipality of Ascot are advertising for tenders for rebuilding the bridge near Capelton, Que., known as the "Wilson" bridge.

W. J. CAMPBELL, Ottawa, Ont., is supplying the three new boilers for the heating apparatus in the Parliament Buildings at Ottawa.

JUSTICE TAIT, Montreal, has granted an order winding up the Dominion Cold Storage Company. W. J. Common is appointed provisional liquidator.

THE addition to the North American Bent Chair Company's factory, Owen Sound, Ont., is nearly completed. About 100 more men will then be required.

WINNIPEG, MAN., city council proposes to spend $10,000 to bring engineering experts to decide on the best system of waterworks and source of supply.

THE contract for the new Cornwall, Ont., general hospital has been let by the executors of the estate of John Purcell, to J. C. Johnstone, Cornwall, at $18,000.

A. M. CALEDON, architect, Ottawa, Ont., has completed plans for the new building for the C. Ross Co., Ltd. Tenders for construction will shortly be called for.

A NEW waterworks by-law will be submitted to the ratepayers of Cowansville, Que., as that passed some time ago was set aside by the courts on technical grounds.

A. DRISCOLL, C.E., has prepared plans for a dyke on the Chilliwack River, at Chilliwack, B.C., which will reclaim a large area known as the Cocooppel Slough.

A COMPANY of Buffalo men have, it is said, decided to build pulp and paper mills at Petawawa, above Pembroke, Ont. The Petawawa section is rich in pulp wood.

THE swing bridge over the Don at Cherry street, Toronto, is now under construction. Electric garbage cars will carry the ashes, etc., from e city over this bridge into Ashbridge's marsh.

IT is reported that the Canada Stone Chinaware Company, of St. John's, Que., will forfeit the bonus of $20,000 voted by that town, as it is not satisfied with the conditions under which it was granted.

OWING to the death of A. C. Leslie, the firm of A. C. Leslie & Co., wholesale hardware, Montreal, has been dissolved. W. S. Leslie continues the business under the old name of A. C. Leslie & Co.

THERE are fifteen sawmills in and around St. John, N.B., mostly on the river some two or three miles above the head of the harbor. These mills cut in the vicinity of 150,000,000 feet of logs in a year.

THE Chatham, Ont., Dredging Co. has completed the Raleigh plains ditch. It is over 10 miles in length, 90 feet wide at the outlet, and tapering to 45 feet, and 9 feet deep. The contract price was $40,000.

THE appeal of the city of Toronto against a decision which made it liable for the damages to elevators resulting from the sand, etc., in the city water supply, has been dismissed by the Court of Common Pleas.

THE new additions to the plant of the Niagara Falls Metals Works are nearing completion. A large foundry building, a blast furnace and the annealing ovens are under way. These ovens have a capacity of 5,000 pounds.

THE Manitoba Government calls for tenders for a new bridge over the Assiniboine near De Clare, to be built in the spring. Plans may be seen at the office of Hon. C. J. Mickle, Birtle, or the Public Works Department, Winnipeg.

JNO. MACDOUGALL, A. J. MacDougall, W. Bailey, Montreal; E. A. Crawford and J. L. Ross, Toronto, are to be incorporated as the Ontario Water and Sewage Purification Co., Ltd.; capital $95,000; chief place of business, Toronto

THE town of Listowel, Ont., will not have the new system of waterworks and lighting. The by-law passed empowering the spending of $15,000 on such purposes has been quashed at Osgoode Hall, on motion of J. G. Hay, Listowel.

THE St. Mary's River Bridge Co. applies for a Dominion charter to bridge the St. Mary's River and the Canadian Ship Canal. Capital, $500,000. The incorporators are:—T. C. Search, F. S.

Lewis, H. A. Berwind, E. V. Douglas, Philadelphia, Penn , F. H. Clergue, New York, N.Y., H. C. Hamilton, Sault Ste. Marie, Ont.

G. S. WILSON, for many years partner and manager in J. C. Wilson & Co.'s Montreal, and G. A. Mace, for some years manager of the paper box department, have started business as Mace, Wilson & Co., paper box makers, De Bresoles street, Montreal.

THE twelfth annual meeting of the Illinois Society of Engineers and Surveyors was held in Springfield, Ill., January 27th-29th. A number of interesting papers were read, a large number of which referred to sewage problems and road construction.

THE Excelsior Bicycle Company of Hamilton, Limited, applies for an Ontario charter to manufacture bicycles in Hamilton, Ont.; capital, 20,000. The incorporators are D. Blackley, J. H. Tilden, J. E. Brown, W. J. McDonald, J. Morris, Hamilton.

M. BEATTY & SONS, Welland, Ont., shipped to Rat Portage, Dec. 30th, a fine hoisting engine and boiler, with wire rope and sheaves for the shaft head, for the Mikado Gold Mining Company, to be used on their mine, about forty miles from Rat Portage.

THE plans prepared by Saxe & Rodden, architects, Montreal, for the headquarters at Bisley of the Dominion Rifle Association, have been adopted. The plans are for a storey and a half cottage to be built entirely of Canadian woods. The cost is fixed at $7,500.

THE sheriff has been put in possession of the works of the Dominion Art Woodwork Company, of West Toronto Junction, at the instance of Molson's Bank, which is creditor of the firm to the extent of $50,000. Other indirect liabilities amount to $20,000. There is a claim for wages of $1,300.

THE mayors of Montreal, St. Henri, Ste. Cunegonde, Cote St. Paul, Verdun and Westmount, will interview the Minister of Railways and Canals to endeavor to have the Seigneurs street bridge over the Lachine Canal replaced: to have sidewalks for foot passengers added to Napoleon road bridge, and to build a bridge at Atwater avenue.

THE arbitration for the expropriation of the Cornwall, Ont., Waterworks Company's system and plant by the corporation of that town is resumed. The arbitrators are John Kennedy, harbor engineer, of Montreal, for the town, Judge Carman, of Cornwall, for the company, and Judge McDougall, of Toronto, appointed by the County Judge.

IN his inaugural address for the year, President Ferguson, of the Ontorio Canners' and Packers' Association, regretted the overcrowded condition of the canning industry in Canada, noting that since 1885, 25 failures, involving a loss of $300,000 capital, had occurred in this country, and that this state of affairs did not at all deter new canneries from starting up.

THE most important part of machinery is the bearing metal. Without good boxes there is never satisfaction. The Laurie Engine Co., of Montreal, are building for the Lachine Rapids Hydraulic and Land Co., the largest engine in Canada, and Spooner's Tough Copperine Box Metal is used throughout this great piece of machinery. This speaks volumes for Spooner and his Copperine.

THE Nichols Chemical Company of Canada applies for a Dominion charter to carry on the business of a United States company of the same name at Capelton, Que., to manufacture chemicals and fertilizers, and do a mining business. Capital, $25,000. The incorporators are W. H. Nichols, W. H Nichols, jr., J. H. Bagg, of New York; S. L. Spafford, A. W. Elkins, S. L. Clough, N. B. Prichard, Ascot, Que.

THE Bushnell Company, Ltd., has decided to withdraw from the solicitation of lubricating oil trade in the Province of Ontario, and has transferred its travelling salesmen to the Queen City Oil Company, Ltd., Toronto. The Queen City Oil Company will carry a full and complete stock of the same standard grades of lubricating oils and greases they have in the past, and will give careful attention to all orders placed with them, either directly or through their representatives.

THE explosion at the Berlin, Ont., gas works which resulted in the fatal injury of the manager of the works, E. Carl Breithaupt, the instant death of Wm. Aldrich, and the serious injury of another employee named Weller, seems to have been the result of opening a tank by the light of a lantern held by Mr. Breithaupt. It had been found necessary to put more oil into the tank, and the manager went to attend to it personally, thus causing the fearful explosion which ended his life and that of his employees.

THE proposed rebuilding of the Victoria Bridge at Montreal reflects great credit on C. M. Hays, the general manager of the Grand Trunk Railway. The changes mooted are to substitute a modern structure for the tubular one now in use, and provide not only double tracks for railway traffic, but space for foot passengers, vehicles and electric cars. The foundations of the present piers are ample to carry the new structure, and there is no doubt the change would be a profitable one. The Victoria Bridge is two miles long; number of piers, 24, number of iron tubes, 25, width, central span, 330 feet, width of side spans, 242 feet, width of piers, 18 feet; material of piers, blue limestone; quantity in each, 8,000 tons; height of tubes, 22 feet; width of tubes, 16 feet, total weight of tubes, 10,400 tons; height from water, 60 feet; cost of bridge, $7,000,000.

A DEMAND of assignment has been made on Albert Holden, doing business as A. Holden & Co, by the Positive Lock and Washer Co., Newark, N.J. Assets are limited and liabilities placed at $19,781 The largest creditors are the Bowling Iron Company, $511; the Phœnix Company, $1,798; Torrey & Sons, $510; the Positive Lock and Washer Company, $301; the Bushnell Company, Ltd., $2,051; Watson Heater Company, $200; Felix Sauvageau, $350; Mrs M. C Waddell, $10,000; Mrs. H. P Holden, $3,523

AMONG the acts passed by the Quebec Legislature at its last session, were acts to incorporate the North Shore Power Company, to authorize the trustees of the parish of St. Jerome to borrow an amount not exceeding $60,000 for the construction of a church, sacristy and dependencies; to incorporate the Montreal Cold Storage and Freezing Company; to incorporate the Coaticook Electric Light and Power Company; respecting "The Stadacona Water, Light & Power Company"; to incorporate "The Canada Stone Chinaware Company."

THERE is said to be a well established combine among the shovel manufacturers in Canada and the United States. Here is an extract from a letter which has appeared in the daily papers recently, dated January 11, written by an American spade and shovel manufacturer to a Canadian importer: "Replying to your favor of the 6th inst., at the last meeting of the Shovel Association in New York, the Canadian manufacturers made an arrangement with American makers not to interfere with Canadian trade. We are, therefore, not in a position to quote you prices."

THE Canadian Nail Manufacturers met in Toronto recently. The discounts have been advanced 10 per cent., which reduces the price of nails. The discounts in the various Provinces are now as follows: Ontario, 80 per cent., delivered in 10 keg lots or over. Quebec, 80, and 2½ per cent. f.o.b. Montreal. Maritime Provinces, 80 per cent., delivered in 10 keg lots or over. British Columbia, 80 and 2½ per cent. f.o.b. factory. Winnipeg, 75 and 5 per cent. f.o.b Winnipeg. No change was made in the price of galvanized and plain wire and cut nails. Horseshoe and horse nails were dealt with at a meeting held in Montreal later; cull horse nails are withdrawn and prices are unchanged.

W. H. WALKER, graphite miner, of Hull, Que., has assigned, liabilities $172,420. The largest creditor is H. C. Hammond, of Toronto, $73,000. Hon. R. W. Scott has sums aggregating $14,000, and his name appears with Senator Clemow's for a couple of thousand more. Senator Clemow has a claim of $7,000, a joint claim with the estate of C. T. Bate for $9,000, and another with Sir Adolphe Chapleau and A. Audet for $12,000. The estate of H. C. Pinhey claims $6,000, A. A. Audet, $10,850, John R. Tilley, of New York, $6,000, and Mrs. Laura Willard, of Prescott, $12,000. Other creditors are the Ontario Bank, $2,000; Seybold and Gibson, $1,500; Blaikie & Co., Toronto, $1,500; A. Masson, $1,000; C. A. Blanchet, $1,600, etc.

THE annual meeting of the National Association of Plumbers was held last month in Quebec. The president, Jos. Lamarche, Montreal, occupied the chair. The meeting was well attended by members from all parts of the Dominion. A special committee was appointed to confer with manufacturers of plumbers' and steamfitters' supplies. The Montreal resolutions, the chief of which was "That the National Plumbers' Association would deal only with those merchants who sold to no others but master plumbers," were endorsed by the meeting. A deputation of wholesale dealers was received, who, after a short conference, extended their congratulations to the association. The vice-presidents from the different provinces submitted reports.

JUSTICE BURBIDGE, in the Exchequer Court, gave judgment recently in the Goodwin case. George Goodwin, contractor of the Soulanges Canal, sued the Government for about $74,000 in connection with his contract. The case was before the Exchequer Court some time ago, when judgment was given for $57,000, but it was sent back by the present Government for decision on certain legal questions reserved. In his later judgment Justice Burbidge decides against Goodwin. Judge Burbidge points out that the engineer's certificate did not state that the work was done to the satisfaction of the engineer in charge. Evidence was produced to

show that the work was done to the engineer's satisfaction. In his own opinion, the judge said that the work was done to the satisfaction of the engineer. In the case of Murray v. the Queen, however, the Supreme Court expressed the opinion that a certificate was not valid, because it did not state that the work was done to the satisfaction of the engineer. The case, therefore, was not before him on its merits. Under section 33 of the contract it was provided that a dispute be referred to the Exchequer Court, and, therefore, it was referred to him under that clause. That being the case, he had to decide against the contractor. If it were before him on its merits, he would have decided that the contractor was liable to recover The decision reverses the judge's previous decision

THE Canadian Bridge and Iron Co has gone into liquidation, Jno. W. Ross being appointed permanent liquidator of the concern recently. The liabilities of the company are fully $100,000, while the assets are nominally the same, about one-half of them being unfinished contracts The following are among the principal creditors whose claims are all secured B & S. H. Thompson, A. Davis, Congregational Missionary Society; J. E Cave, Boston, Mass, Jas. Shearer & Co, P Amesse, E Rousseau Among the ordinary creditors are M E. Fitzgibbon, A R. Williams, Howden, Starke & Co., Frothingham, Workman & Co., Sadler & Haworth, W. A. Fleming, Miller Bros. & Toms, F E. Cave, J. H Nault, J. Bertram & Son, Pittsburg Forge Co, St John Bolt Co, etc.

Mining Matters.

THE B. C Smelting and Refining Co, Trail, are putting in a saw-mill plant

D. O'CONNOR, Sudbury, Ont., will place a steam tug on Lake Wahnapitae next season.

P D McKELLAR, of Chatham, Ont., is interested in the Bothwell oil fields, and struck a remarkably fine well recently.

THE Springhill, N.S., coal mines is again the scene of a strike, the reason this time being the dismissal of a union overseer.

ABOUT $50,000 worth of gold dust taken from the Saskatchewan was purchased by the banks in Edmonton, N W.T., during the past season.

P. GAUTIER, the Hudson Bay Company's agent at Long Lake, four days journey by snowshoes from Jackfish Bay, Ont., reports that there are plenty of veins to be found there that carry gold.

THE various Provincial Governments, and the Federal Government as well, are to be asked to aid a Mining Bureau about to be established in the McDonald building, Victoria square, Montreal.

THE Trilby and Prince of Wales, Kootenay, B.C., are to have a complete machinery plant at once. The order has been given to the Ingersoll-Sargeant Drill Company of Montreal. The plant will consist of a four-drill air compressor, pump, hoist and boiler.

NEAR Ashcroft, B.C., there is said to be a "water" copper mine; a stream bearing copper in solution to an extent which makes its recovery by electricity profitable. S. F Griffiths, Vancouver, and G M Brown, general western passenger agent C P R, are interested.

R. H. AHN, M.E., of Rat Portage, Ont., was recently in Montreal, and reported that he had sold the Golden Gate mine to London capitalists at a figure that gave them a profit of fifty per cent on the money the owners had paid less than twelve months ago, besides paying back the principal and all expenses

THE Wm. Hamilton Mfg. Co. of Peterboro, Ont., has recently shipped a ten-stamp mill to the Golden Cache Mines Co., Ltd., Lillooet, B C The mill included a Blake ore crusher, automatic ore feed, and the ten-stamp battery, and all the necessary amalgamation plates. With this was a steam plant and portable sawmill.

THE Saw Bill Gold Mines Co., chiefly owned in Hamilton, are preparing to put in a 10-stamp mill, and the machinery is now arriving at the mine The shaft is now down 150 feet and the north and south drifts driven 100 feet As work progresses the mine appears to increase in richness. The company were approached a few days ago with an offer from an English syndicate. The country around this mine is now being surveyed

IN the United States and Canada there are seventy mining companies, which last year paid an aggregate of $14,734,500 in dividends. The Calumet and Hecla, on Lake Superior, leads with $2,500,000, followed by the Anaconda with $2,225,000, the Boston and Montana, $1,500,000, and the Quincy, $1,000,000 These are the mines which have paid $1,000,000 and over. Two paid $500,000 and $600,000, respectively, the other sums ranging from $1,000 to $500,000

Marine News.

AT Oak Island, N.S, a sand pump is being used to search for hidden treasure, Captain Kidd's, it is said.

THE steel steamer "State of California" has been bought by the Allans for $250,000 from the Anchor Line

J. G MILLER, iron founder, Chatham, N B., is building a marine railway at his works for repairing vessels.

THE Montreal Transportation Company, Kingston, Ont., has called for tenders for the construction of a new steel vessel.

THE Public Works Department, Ottawa, is making preparations for the dredging and blasting of the channel at Kingston Mills

THE Department of Public Works, Ottawa, will receive tenders till Feb 19th, for the construction of a wharf at Lotbiniere, Lotbiniere county, Que

THE bondholders and shareholders of the Chignecto Marine Railway will make a determined effort to secure aid from the Government at the next session of Parliament.

DREDGING was stopped in St John, N.B, harbor recently by order of the Minister of Public Works, but was resumed shortly after on the representations of the local members.

EXTENSIVE repairs are being made to the propeller "Lake Michigan" on Muir's dock at Port Dalhousie The steamer "Ocean" will also receive necessary repairs later on.

THE Marine and Fisheries Department of the Dominion Government has accepted the offer of Job Bros., St. John's, Newfoundland, for a sealer suited for the Hudson Bay expedition.

THE depth of the water in the harbor has come to be an important question to Toronto. The average for the year shows 8¾ inches below zero; however, this is 3½ inches higher than in 1895.

ALTERATIONS will be made on the C.P.R. steamships at Owen Sound, Ont., the company having decided to put upon each what is called a "turtle back" bow, somewhat after the style adopted for the Dominion Government's fishery protection cruisers.

IF the Dominion Government decides on canal enlargement at the approaching session, the Richelieu & Ontario Navigation Company will add two large steamers to its fleet, plans for which are said to be already drawn

AT the annual meeting of the Frontier Steamboat Company, St. Stephen, N.B., the following officers were elected directors. James Murchie, president; Geo. A. Boardman, Chas L. Deming (treasurer), John D. Chipman, Geo. E. Eaton, Geo. F. Hill, W. A. Murchie.

THE report of Kivas Tully, C.E., on the Toronto harbor, shows that 26,148 cubic yards of dredging was done, and strongly urges the diversion of the Don into Ashbridge's Bay to save the dredging at the east of the harbor. The construction of the trunk sewer is also approved.

THE Canadian Pacific Railway has taken over the Columbia and Kootenay Steam Navigation Company's fleet, consisting of eight vessels and two in course of construction. The price paid is said to be $250,000. A daily service will be established from Revelstoke, Nelson and Rossland.

THE first iron vessel built at Levis, Que., is now being built at Davies' dock for the Compagnie Maritime et Industrielle of that town It is a steamer 140 feet in length and 25 feet in breadth, with a speed of fifteen knots an hour, to run the ferry between Quebec and St Thomas, Montmagny.

THE Marine Engineers recently held their annual elections, resulting as follows: O P St. John, honorary president; E. J. O'Dell, president; J. S Adam, 1st vice-president; F. Limpert, 2nd vice-president; councillors, R. Childs, Jas. Currie, R. McLaren, Ed. Abbey, W. B. Stevens; secretary, S. A. Mills; treasurer, D. L. Foley, guard, J. R. Young; auditors, J. H. Ellis, F. E. Smith. The auditors presented their report for the year 1896, and stated that the balance in hand amounted to $300. The annual ball, held in St. George's Hall, was a grand success.

THE steamer "Chicora," of the Niagara Navigation Company's line, will not be taken off the Toronto and Lewiston route next season and placed in service between Toronto and Port Dalhousie, as was reported some time ago. She will start on her usual run when the season opens, and later may be held in reserve for handling the heavy excursion business. The 'Chippewa and 'Corona will be placed in service when the increase of travel may require-

The small steamer "Ongiara" will do ferry service between Lewiston and Queenston, and is now on the dock receiving extensive alterations The larger vessels of the fleet now wintering at the docks in Toronto, will also undergo a careful overhauling during the winter.

A TORONTO firm has contracted to build, for M. Boyd & Co., of Bobcaygeon, Ont., a compound, inclined engine having cylinders 16 and 30 inches diameter, 40 inches stroke, to indicate about 150 horse-power with 100 lbs. of steam. The engine frame will be built up of rolled steel I beams with engine castings bolted on. The engine will be placed in a new hull 108 feet long by 19 feet beam, now being built at Bobcaygeon to replace the "Esturion," and is expected to attain a speed of 14 miles an hour. The engines are being built to specifications prepared by A P Rankin, consulting engineer, Toronto, and the work will be under his supervision.

THE members of the deep water-ways commission appointed by the President of the United States over a year ago, have handed in their report to Congress. They state that it is entirely feasible to construct such canals and develop such channels as will be adequate to any scale of navigation that may be desirable between the several great lakes, and to the seaboard, and that a channel having a navigable depth of not less than twenty feet should be provided for. Starting from the head of Lakes Michigan and Superior, the most eligible route is through the several great lakes and their connecting channels, to Lake Ontario. The Canadian seaboard may be reached from Lake Ontario by the St. Lawrence River, and the United States seaboard by the St. Lawrence River, Lake Champlain and Hudson River, or by the Oswego, Oneida-Mohawk Valley and Hudson River. The commission recommended that the ultimate development of the largest useful capacity should be kept in view, and that all work should be planned on t[illegible]is. The commission recommends that exhaustive survey and investigations, with measurements of the outflow of the several lakes and full investigations of collateral questions, costing not less than $600,000 and covering some years of time, should be made.

Railway Matters.

A LARGE part of the Intercolonial Railway is to be relaid.

A CHARTER will be asked from the Dominion Government for a steam or electric railway from Toronto to Parry Sound, Ont.

THE Dominion Government will bonus the Quebec and Lake St. John Railway, to enable it to maintain service during the winter months.

C. E. SHAW, C E., is making preliminary survey of the proposed Victoria, Vancouver and Eastern Railway, from Kootenay to the coast.

THE Niagara Central Railway proposes to put on an hourly service between Niagara Falls and St. Catharines. New rolling stock will be required and extensive repairs.

A PROJECTED railway to divert the trade of the Yukon country will seek incorporation during the 1897 session of the B C. legislature house. Its termini are Stickeen and Dease Lake, Cassiar.

THE Railway Committee of the Privy Council have approved of branch lines of the London and Port Stanley Railway to Ridgetown. The G.T.R. have applied for approval of a branch line at Merritton.

THE Fort Erie Railway and Ferry Company will apply at the next session of Parliament for an act to increase its capital stock to $250,000, and the privilege for extending the road to Chippewa, were it will connect with the Niagara Falls Park & River Electric Road. The Fort Erie road at present is run by steam power, but electricity will be used in future.

THE Trans-Canadian Railway Co. will apply to Parliament to change its name, for extension of time to build and power to construct a branch from a point near the north-east end of Lake Winnipeg and thence to York Factory, Hudson's Bay; also a branch from a point near where the proposed main line of the company will cross the St. Maurice River, in the Province of Quebec, and then southerly by way of Joliette to Montreal.

THE new parlor car invented by G. A. Denham, of Boston, Mass., is attracting the attention of car builders. With the chairs furnished on the new car, the traveller can face in any direction. At night there will be a good bed for the lower as well as for the upper, longer, wider, and with eight inches additional height over the old style. The height of each berth will be the same, and a window will be provided for the upper one.

THE Nova Scotia Southern Railway, now in course of construction, is to be completed November 1, next. The main line extends from New Germany to Shelburne, a distance of 76½ miles, with a branch from Indian Gardens to Liverpool, 19½ miles.

THE Rocky Mountain Railway and Coal Co. will apply to the Dominion Government for extension of time to build, and for power to extend the line from Calgary to Lethbridge and thence to the international boundary, and to build a branch from Lethbridge to McLeod.

AN auxiliary derrick was recently turned out from the Toronto shops of the G.T.R. It was ordered after the Breslau accident about a year ago, and is the largest piece of machinery of this kind in use on the Grand Trunk. It is mounted on a car 44 feet long, and the machine can lift an engine out of a ditch and place it on the rails.

IT is said that the C.P.R. and the Heinze railways in B.C., have made a joint traffic arrangement. The C.P.R., in return for being able to bring its freight to Rossland and Trail without breaking bulk, will bring ores from Slocan Lake to the Heinze smelter at Trail. Another feature of the agreement will be found to be in the bringing of coke from Nanaimo for use in the Heinze smelter. The Dunsmuirs are now putting in extensive coke ovens to supply coke to the smelters at Nelson and Trail.

DURING the season of 1896 the balance of the Ottawa, Arnprior and Parry Sound Railway, a distance of fifty miles, was constructed, making the total length of the line from Ottawa to Parry Sound a distance of 263.8 miles, which was opened for traffic on the 20th of December, 1896. The season's work was exceptionally heavy, many of the rock cuttings taking the full season from March to December, working day and night, to complete them. This heavy work was found to be necessary in order to keep the curvatures flat and the gradients light, which has been done throughout the line. The sub-structures of all the bridges are of first-class masonry, as also all box culverts under all heavy embankments, and the superstructure of bridges, viaducts, etc., are all steel. The road is laid with 72-lb. steel fastenings, angle bars, and thoroughly ballasted. The western terminus of the line is at Depot Harbor, Parry Sound, which has an ample depth of water and is nearly land-locked. The company has commenced the construction of docks and erection of elevators there. The road is supplied with a full complement of tanks (60,000 gallons capacity), substantially built stations, round houses and turn tables, all on solid masonry foundations, and is equipped with motive power and rolling stock of the most modern type. Geo A. Mountain, C.E., is chief engineer of the road.

Personal.

E. J. PHILIP, Toronto, has been appointed to the Toronto Technical School Board.

JAMES PEDDAR, C.E., well known in Berlin and Toronto, died at Doon, Ont., January 17th, from consumption.

MALCOLM MCFARLANE, C.E., Assistant State Engineer for Wyoming, recently visited his relatives in Almonte, Ont.

A. W. WRIGHT, Niagara, Ont., the well-known labor man, has been appointed to the editorship of the *American Artisan*, New York.

W. MCNAB, assistant engineer of the Grand Trunk Railway system, has been appointed a justice of the peace for the district of Montreal.

W J. OLIVER, of Carleton Place, Ont., has gone to Sault Ste. Marie to take charge of the building of the large pulp mill that is being erected there.

J. W. PYKE, of Jas. W. Pyke & Co., iron and steel merchants, Montreal, has been elected treasurer of the hardware section of the Montreal Board of Trade.

GEO. LAVERS, Montreal, who was a member of the Bisley team last year, has been appointed foreman of the blacksmith shop in the G.T.R. shops in London, Ont.

J GALBRAITH, principal School of Practical Science, Toronto, has been appointed a member of the Toronto Technical School Board by the city council, to replace Dr. Orr.

WM. TAYLOR, the engineer on the freight train which was wrecked a short time ago on the O A. & P.S.R., displayed rare heroism in making his way, in spite of fearful injuries, to flag an approaching express train.

MAJOR HENRY A. GRAY, M. Inst. C.E., the well-known Dominion Government engineer, was married at St. Michael's Cathedral, Toronto, last month, to Miss Norma Victoria Merrick, daughter of the late Sheriff Merrick, of Prescott and Russell, Ont.

GEO H. TAYLOR, of the Gurney Foundry Co., who has gone to England to manage the branch of the company's business there, was banqueted at Webb's by the members of the company and the travellers before leaving. A gold watch and an illuminated address were presented Mr. Taylor.

THE Chartered Institute of Patent Agents, England, is a close corporation, admission to which is obtained by examination. Two Canadian solicitors of patents, John G. Ridout and J. Edward Maybee, of the firm of Ridout & Maybee, Toronto, have recently been made foreign members of the Institute.

THE lumbermen of the northern district of Ontario recently, at Allandale, Ont., presented James Webster, for the past twelve years superintendent of the Northern and Midland Divisions of the Grand Trunk Railway, with a large open cabinet and a set of silver comprising 105 pieces, accompanied by an illuminated address

MINING CONVENTION AT MONTREAL.

As these pages go to press an inter-provincial conference of mining men is being held at the Windsor Hotel, Montreal, under the patronage of the Governor-General It is expected that the

EDWARD GURNEY.

attendance will range from 100 to 150, and the discussions will be of considerable interest. A report of the proceedings will appear in our next number.

The following is the programme of proceedings :—

Wednesday Morning, 3rd Feb.—Chair to be taken at 10.30 a.m Business Session :—Presentation of reports for the year. Election of chairman. A National Bureau of Mines. Amendments to Legislation, etc Only members in good standing in their respective organizations will be permitted to vote. *Afternoon.*—"The Economics of Joint Stock Mining Companies and the Laws Relating to their Incorporation," by Mr. J. Bawden, Kingston, Ont ; "The Responsibilities of the Mining Engineer," by Dr. H. B Porter, Professor of Mining Engineering, McGill University. "Initial Payments on Bonds and Options," by Howard West, A R.S.M., New Denver, B C ; "A New Use for Scrap Mica," by C H Mitchell, Toronto. *Evening*—Topic for discussion.—"Air Compressors." Introduced by Mr James F. Lewis, vice-president of the Rand Drill Co., Chicago; also a description of the Taylor Hydraulic System of Air Compression, by Mr. C. H. Taylor, M.E., the inventor. "Coal Washing Plant at the Drummond Colliery," by Mr. Charles Fergie, M.E., Westville, N.S.; "Louisbourg: Its Importance as an Imperial Coaling Station," by Mr. Wm. Blakemore, M.E., Glace Bay, C.B.; "Underground Photography Illustrated by Calcium Light," by Mr. G. R. Mickle, M.E., Sudbury, Ontario.

Thursday Morning, 4th Feb.—"Notes on the Western Ontario Gold Field," by Dr. A. P. Coleman, Toronto, and Mr. F. Hille, M E., Port Arthur, Ont.; "Gold Quartz Mining in Canada and Victoria, Australia," by Dr. A. R. C. Selwyn, C.M G., Ottawa; "The Gold Bearing Deposits of the Eastern Townships," by Mr. Robert Chalmers, Geological Survey, Ottawa; "The Gold Bearing Tailings of Nova Scotia," by F. H. Mason, F C.S., Halifax. *Afternoon.*—"Notes on Some Mining Districts in British Columbia," by Mr. John E. Hardman, S.B.M.E., Montreal; "The Gold Bearing Lodes of Cayoose Creek, B.C.," by G. F. Moncton, M.E., Vancouver, B.C.; "The Utilization of the Mill Refuse and Peat Mosses of the Ottawa," by Ernest A. Sjostedt, M.E., Bridgeville, N.S., "Notes on Moss Litter," by Mr. T. W. Gibson, Bureau of Mines, Toronto; "Mines and Mine Management," by Robert Archibald, C and M.E., Joggins, N.S. *Evening.*—First annual dinner of the Federated Canadian Mining Institute.

Friday Afternoon, 5th Feb.—"The Mechanics of Mining Engineering," by D. W. Robb, C. E., Amherst; "The Metalliferous Rocks of the Kingston District, Ont.," by Dr. W. L. Goodwin, School of Mining, Kingston, Ont., "On the Occurrence of Iron Ore in the Interior of Labrador," by A. P. Low, B.A.Sc., Ottawa. *Evening.*—Any papers unread at previous sessions, or adjourned discussions on papers presented, will be discussed at this session.

EDWARD GURNEY.

Edward Gurney, president of the Toronto Board of Trade, was born in Hamilton, Ont., in 1845. He received his early education at the Central School and Phillip's Academy. When his education was completed, Mr. Gurney entered his father's foundry, and there learned the business which he has since carried on with such great success. In 1869 Mr. Gurney removed to Toronto, where he conducted business under the style of E. & C. Gurney, on Yonge street, where the Musee now stands. At the present the business is known all over the world, and branches are carried on in Boston, New York, Chicago, and London, England. At present the Canadian firm is known as the Gurney Foundry Company, and occupies extensive buildings erected specially for it on King street, Toronto. Mr. Gurney became a member of the Board of Trade in 1882, and was elected to the council of that body in 1888. In 1896 he was first vice-president and chairman of the manufacturers' section, and was elected president in 1897.

LITERARY NOTES.

P. S. Gibson & Son, Willowdale, Ont., issue their annual report to the township of York, Ont., for which they are engineers, in a recent pamphlet.

The *Electrical World*, New York, is placing itself very prominently before the scientific readers of the continent as the exponent of the newest ideas in matters electrical. Its New Year's number contained 164 pages.

The *Electrical Engineer*, New York, celebrates its fifteenth year in January, 1897, and heads its special number "Crystal Anniversary." The *Engineer* is to be congratulated on its age and the fine growth it has attained. We wish it a golden anniversary in equal prosperity.

The *Hardware Trades Journal* began its 43rd volume in January under new auspices, its new publishers being Hazel, Watson & Viney, Ltd., Creed Lane, Ludgate Hill, London. Our contemporary also makes a change of editorship, the new incumbent being Thomas F G. Coates, for the past three years editor of *Ironmongery* and the *Machinery and Hardware Trades Journal*. Our interesting contemporary is increasing the number of its correspondents, and still further improving what was already a valuable hardware paper.

Rossland now boasts of a business directory. It is not a big volume, as the alphabetical list of business places occupies four pages, and the classified list of firms three pages; but we venture to say that the booklet will command a wider interest than any directory of the kind yet issued in Canada. It may soon become an interesting literary relic. It is published by the Kootenay Publishing Co., Rossland, B.C. Price, 50 cents.

The *Canadian Architect and Builder* issued a very handsome New Year's number, in a special cover of most artistic design. A number of very fine illustrations appear in this issue.

We have received a copy of Scaife's Chart of Canadian History, published by the Comparative Synoptical Chart Co., Victoria St., Toronto. It is a valuable idea and excellently worked out. In a chart 2x3 feet, the author compresses all the great epochs of Canadian history, from the discoveries of Columbus and Cabot down to the events of 1896 The history of each province is traced down to Confederation, beginning with its discovery and exploration, the founding of the chief cities being noted, with the periods of the wars affecting the provinces, and the relation of the Sovereigns of England and France to the contemporary events in Canadian history. This chart is a most effective instructor for the family or the school, and is put on the market at a very reasonable price.

In "Harrison Hall and its Associations" R. S. Woods, Q.C., Junior Judge of Kent county, Ont., has done for the county of Kent what Miss Lizars has for the Lake Huron region through "In the Days of the Canada Company." Harrison Hall, in Chatham, built to commemorate the name of Chief Justice Harrison, may also be regarded as a memorial of the Hon. Samuel B. Harrison. In this book, just issued from the Chatham *Planet* press, Judge Woods has thrown around this memorial quite a halo of history. Much that is instructive in the development of the municipal, judicial and educational institutions of the western peninsula of Ontario is here recorded in very attractive style, and in the references to the war of 1812—in which the proclamations of Gen. Hull and of Sir Isaac Brock are reproduced in full—the author gives a brief but comprehensive review of the causes of the war and its effect on the locality.

CALENDARS.

We have to acknowledge the receipt of a number of very handsome calendars from our friends at the beginning of the year. Among them are those of the Conger Coal Co., Toronto.; the Boiler Inspection and Insurance Co of Canada; the Mechanics Supply Co., of Quebec; the C. Turnbull Co., Galt, Ont.; the Acton, Ont., *Free Press;* the *Canadian Post*, Lindsay, Ont.; the St. John's, Que., *News;* the Bellhouse, Dillon & Co., Montreal, Toronto and New York; Morton, Phillips & Co., stationers, Montreal; R. N. Buchanan & Co., steam pumps and machinery dealers, Montreal; J. Christin & Co., aerated water manufacturers, Montreal.

We have received from the Galena Oil Works, Ltd., Toronto, a copy of "Sketches in Crude Oil," by John J. McLaurin. This is a volume of over 400 pages, which will be further noticed in another issue.

FIRES OF THE MONTH.

Dudley's saw-mills, Megantic, Que.. Loss, $29,000 ——Jan. 13th.—Hamilton, Ont. Industrial Works. Damages, $5,000.——Jan. 14th.—Crathern & Caverhill's hardware warehouse, Montreal. Loss, $240,000. —Jan. 19th.—Consolidated Milling Co., flour mill, Peterboro, Ont. Loss, $60,000; insurance, $50,000.——Jan. 21st.—Toronto Electric Light Co.'s plant partially destroyed. There were 75 dynamos in the building; the loss is nearly as follows: Building, $5,000; engines, boilers, etc., $24,000, and dynamos, $48,000, amounting in all to about $80,000.——Jan. 29th.—Wm. Lord's saw-mill, St. Jacques, Que. Loss, $3,000.

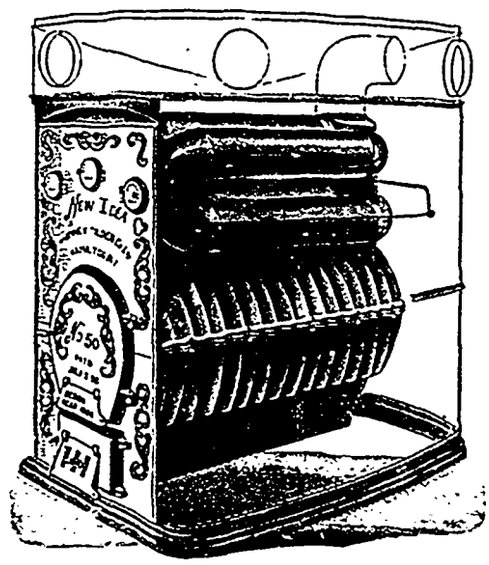
ONTARIO ASSOCIATION OF ARCHITECTS.

The annual meeting of the Ontario Association of Architects was held in Toronto, 12th and 13th ult., the president, H. B. Gordon, being in the chair. The treasurer's statement showed a balance on hand of $1,276.43. The legislation committee was instructed to introduce the association's bill again at the approaching session of the Ontario Legislature. The chief change desired is the substitution of Architect for the title Registered Architect as now in use. The formation of a Dominion association was discussed, but no action was taken. It was decided to organize chapters of the association in all towns where a sufficient number of members are resident. The president's address, and a paper on the possibility of a new style in architecture, by D. B. Dick, were read to the members.

The following are the officers of the association for 1897: President, Jos. W. Power, Kingston; 1st vice-president, E. J. Lennox, Toronto; 2nd vice-president, S. G. Curry, Toronto; treasurer, E. Burke, Toronto. Council—Andrew Bell, Almonte; Frank Darling, Toronto; D. B Dick, Toronto; J. M. Moore, London; W R. Strickland, Toronto. Registrar and librarian, W. A. Langton, Canada Life Building, Toronto.

THE NEW IDEA WOOD FURNACE.

The Gurney, Tilden Co., Ltd., of Hamilton, have placed on the market the new wood fuel furnace invented by R. W. Biggar and referred to in a former number of this journal. The following claims are made on behalf of this furnace, which is called the "New Idea." The ash-pit is deep and wide, and is nearly as long as the entire fire-box, which is very essential, as it allows the air to be distributed along the entire length of fire-box, and does not allow ashes and unburnt parts of wood to accumulate at the end of fire-box. It is fitted with a large door for easy removal of ashes; also with front lift draft for chain attachment. The fire-box is extra



THE NEW IDEA WOOD FURNACE.

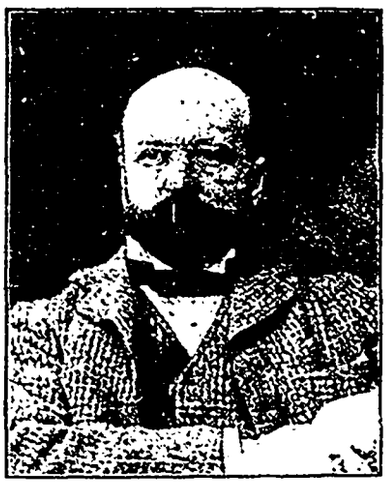
large and of the heavy corrugated pattern. It is fitted with a large feed door, through which any size wood can be taken. The fire-box joints are of the corrugated tongue and groove pattern, made absolutely air tight with asbestos cement and bolts. The inside of fire-box is fitted with heavy grate bars of improved pattern, which will stand severe firing, and can be put in or taken out without removing a bolt. The radiator is composed of a cast-iron crab, to which is attached from four to six heavy English steel plate tubes, according to size of furnace, with cast-iron elbows (made in one piece), allowing the products of the fire to travel from four to six times the length of the radiator, thus exposing a large heating surface to the action of the air. A direct and indirect draft damper is fitted in the middle part of cast-iron crab, and can be operated from the front of furnace. The cleaning of radiator is provided for with clean-out doors at the end of each elbow of radiator, where a brush can be inserted and all deposits swept into the fire-box. This can be accomplished when the furnace is in operation. The only joints on the radiator are where the steel plate tubes connect to the cast-iron crab and elbows, and they are bolted and cemented together with asbestos. Its low setting will also be appreciated by every furnace man, as it enables him to secure good elevation to all the hot-air pipes in a shallow cellar.

THE CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

On the first evening of last month Brockville C.A.S.E. was favored with a short visit from F. Donaldson, of the Boiler Inspection and Insurance Company of Canada, who gave a very interesting and encouraging address on the prosperity of the Order, and congratulated the members of C.A.S.E. No. 15 on the apparent lively interest they took in working out some difficult problems on the blackboard, etc. Some suitable remarks were also made by Past-President Chapman before the meeting closed.

F. L. WANKLYN.

By appointing Frederic L. Wanklyn, Montreal, to the general managership of the Toronto Street Railway, the company splendidly fills an office made necessary by the calls on President Mackenzie's time owing to his English investments. Mr. Wanklyn was born in Buenos Ayres not quite thirty-eight years ago, and educated at Marlborough College, England. He served a regular pupilage under the late Charles Sacre, M. Inst C.E., Chief Engineer of the Manchester, Sheffield & Lincolnshire Railway, at the Gorton Works, Manchester His first appointment was that of resident engineer of the Tramways and General Works Company on their lines in Lombardy, Italy. Subsequently he became general manager and engineer of the Lombardy Road Railways Com-



F. L. WANKLYN.

pany, with headquarters at Milan He was appointed by the late Sir Joseph Hickson, assistant mechanical superintendent of the Grand Trunk Railway, under Herbert Wallis, M. Inst. C.E., and later works manager at the Point St Charles Locomotive Works. He has been master mechanic in charge since the change in administration. Besides discharging the duties of these important positions, he acted as consulting mechanical engineer to the Montreal Street Railway during the construction of its power house. He is a member of the Canadian Society of Civil Engineers and an associate member of the Institute of Civil Engineers, England

METAL IMPORTS FROM GREAT BRITAIN.

The following are the values in sterling money of the metal imports from Great Britain for December, 1896, and the year ending December, 1895 and 1896

	December,		Year,	
	1895	1896.	1895.	1896.
Hardware and cutlery	£2,713	£3.557	£54.438	£62,454
Pig iron.....	463	60	33,520	27,996
Bar, etc.....	341	386	15,018	15,625
Railroad	5,479	36	144,248	174,470
Hoops, sheets, etc	2,332	2,473	61,248	49 194
Galvanized sheets	2,144	1,605	68,176	56,013
Tin plates.....	11 893	31,217	180,202	184,437
Cast, wrought, etc., iron ..	3,485	1,528	60,365	49,389
Steel	4,435	3,021	75,561	88,549
Lead	268	1,777	23,119	18,132
Tin, unwrought	313	1,152	25 065	21,360
Cement..	245	8	25,628	32,714

TIDAL MOTORS.

Editor CANADIAN ENGINEER.

SIR,—About two weeks ago I received the December copy of your paper, and having found so much of interest in it, I would like you to place my name on your subscribers' list, and herewith enclose you $1 to cover subscription for coming year. A good engineering paper is needed in this Dominion of ours, and if your December number is a fair sample, you have certainly made a great stride towards filling the bill, and with proper support should judge that you would accomplish the desired end in a very short time. Your article on "Power from the Tides" interested me very much. Much has been done on the Bay of Fundy coast in the way of getting power from the tides. Although, perhaps, many do not know it, in times past that method of obtaining power was very seriously thought of, and we have here record of several mills which were run by tidal motors. These mills were placed at the mouth of some creek or pond open to the bay This pond acted as a storage reservoir, the motor being operated when the tide was going out, and after it had risen to a certain point on coming in. On looking at Mr. Davies' drawings, the above system would correspond to his method of using one reservoir. However these mills were not used very much, or their adoption advocated to any great degree, the reason being that there were few natural reservoirs—small streams or basins—near the bay and at such localities as would be of value for a mill site, and the building of artificial reservoirs was, and is in most cases, out of the question, on account of primary cost and the expense of keeping up. Mr. Davies' method is very interesting, but the writer, while not wishing to detract from the glory which his ingenuity should give him, does not clearly understand where the claim for an invention comes in, unless it is for the use of a particular kind of motor under a new circumstance; but to prove a claim would apparently be rather difficult in this country. However, unless he can arrange automatic cut-offs, etc., to change from one head to the other, the method might not be as convenient or efficient as one might first suppose. The tides in the Bay of Fundy are very remarkable, and may be in time utilized more for power, but it will possibly not be with turbines as motors. Wishing you success with THE CANADIAN ENGINEER, and a prosperous and happy New Year, I remain, very truly yours,

HENRY R. LORDLY, C.E.

St John, N.B., January 2nd, 1897

EATON'S ELEVATOR PUMP.

Editor CANADIAN ENGINEER:

SIR,—In your article on the T. Eaton Co.'s plant, in your issue of January, a statement is made from which a wrong inference might be taken by a casual reader. It is stated that the 12 and 18½ x 12 x 12 pump was the first economical and well designed elevator pump in Canada. The fact is, there are very few pumps in Canada pumping water for elevators, and when a pump is being installed, the rule is to buy a good fire pump. Now a good fire pump is not necessarily a good elevator pump, from the fact that they work under very different conditions. This pump was built to run economically on elevator service, and was one of the first pumps built specially for that service. I call your attention to this matter, as no such explanation is made after reference to the 14 and 20 x 14 x 18 duplex pump, installed by the Northey Manufacturing Co last summer, which is as much superior to the Smith pump as it was to the old fire pump that had preceded it, both in design and workmanship

E. J. PHILIP,
Engineer, T. Eaton Co., Ltd.

Toronto, January 29th, 1897.

A QUESTIONABLE RULING.

Editor CANADIAN ENGINEER.

DEAR SIR,—In sending out our calendar this year, we took every reasonable precaution to ascertain if we were fully complying with the postal regulations, and found that the calendars went through without question from Vancouver to Halifax, except the city of Montreal, where they were tendered to our friends and four cents insufficient postage demanded. You will readily understand what annoyance we felt when we discovered this, and we would feel obliged if you would insert a notice in your paper explaining the matter, and apologizing to our friends who had this demand made upon them.

Yours truly,
THE B. GREENING WIRE CO LTD.

Hamilton, Ont., 23rd January, 1897.

A CIVIL ENGINEER'S OPINION.

Editor CANADIAN ENGINEER:

SIR,—Please find enclosed a post-office order for $1 00, which I enclose for THE CANADIAN ENGINEER for the year 1897. I am well pleased with the paper, and think that every young engineer should take it. Yours truly,

ANGUS SMITH.

Ridgetown, Ont., Jan 19, 1897.

Electric Flashes.

THE Owen Sound, Ont., Electric Light Company has completed the putting in of its incandescent light plant.

AN electric railway to encircle the Island of Grand Manan is proposed. It is thought such facilities would greatly increase the number of summer visitors.

THE Pontiac Telephone Co., Ltd., is applying to have its chief place of business changed from the village of Fort Coulonge to the village of Bryson, Que.

THE Park and Island Railway, Montreal, is surveying the extension of its line from Cartierville to Sault au Recollet, thus making a circuit of the Island of Montreal.

AN electric line from Rossland, B.C., to Spokane, Wash., is proposed, and application is being made to the Washington legislature for a charter for the United States end of the line.

THERE is a rate war in Hull, Que., between the Hull Electric Co. and the Ottawa Electric Light Company. The former company reduced the price of lights from 15½ to 12½ cents per light per week.

THE Valley Telephone Co., Annapolis, N.S., will run a line from Annapolis to Bridgetown, *via* Round Hill. It is also proposed to extend the line from Clementsport to Clementsvale, and thence to Bear River, N.S.

THE annual report for 1896 of the Ottawa Electric Railway Company shows the number of passengers carried in 1892, when the road was opened, was 1,520,405, with receipts of $71,698. In 1896 the number of passengers carried was 4,583,235, with receipts of $212,105.

THE contract for the complete rolling stock of the Quebec Electric Railway, including cars, motors, etc., has been awarded to an Ottawa firm The system at Quebec will be a duplicate of that at Ottawa The motors used will be of the Westinghouse make, and will be specially adapted for the grades which exist at Quebec.

THE Seine River, Foley & Fort Frances Telegraph and Telephone Company applies for an Ontario charter to build telegraph and telephone lines from Bonheur on the C.P.R. to Sawbill Lake, Hawke Bay, Lake Harold, Sturgeon Falls, Mine Centre, Foley and Fort Frances and other points, and also to develop and sell electricity for power and light.

THE water-power belonging to the Ontario Government at Sault Ste. Marie, situate between St. Mary's Island and the canal, was offered for sale at public auction by the Ontario Crown Lands Department recently. The highest offer being only $6,000, made by F. C. Clergue, president of the Sault Ste. Marie Pulp Co., the property was withdrawn.

THE Thompson Electric Company, whose factory at Waterford, Ont., was recently destroyed by fire, is moving to Hamilton, having leased a portion of the old Wanzer premises. Part of the plant is now in. They will manufacture dynamos, arc lamps, electric specialties, etc. This manufactory was established in Waterford in 1887. About ten Waterford families come here with the company.—*Hamilton Times.*

THE annual statement of the Toronto Street Railway shows a net profit of $282,026.47, as against $301,301 in 1895. Two dividends at the rate of 13¾ per cent. each have been declared, amounting to $210,000, leaving, after the deduction of an allowance for pavement charges amounting to $60,000, the sum of $12,026.47 to be carried forward. The operating expenses for the year were $17,845.55 greater than last year, chiefly due to improvements in apparatus. The number of passengers carried was 23,537,911 as against 23,355,228.

THE Sherbrooke Gas and Water Company, of Sherbrooke, Que., is remodelling its entire electric lighting plant and water power. It purchased from the Royal Electric Company one 180 K. W. and one 60 K. W. "S.K.C." generators. This, in addition to the 60 K.W. "S.K.C." generator purchased from the same company a year ago, will make up the electric equipment for both light and power. The intention is to use the smaller units for lighting purposes during the hours of light load, and the large machine for power purposes only, during the day time, but during the lap hours, that is, from five to seven o'clock in the afternoon, when the lights and power are both on, the three machines will be working together on the same circuit. It is also intended to change the entire transformer equipment, replacing it by one of a higher efficiency.

AT the annual meeting of the London, Ont., Street Railway, the statement showed great progress; 2,500,000 passengers were carried, and the operating expenses were 57½ per cent. of the gross receipts.

THE Montmorency Company of Quebec has ordered two 600-horse-power generators from the Canadian General Electric Company, which will be used to supply power to the Quebec District Railway.

A SPECIAL meeting of the Chatham, Ont., city council, recently approved the proposed city and suburban electric railway, and decided to submit a by-law to permit its construction at an early date.

THE Ingersoll Radial Electric Railway Company applies for an Ontario charter to build a line from Ingersoll, Ont., to St. Mary's through Thamesford and Kintore, and to Tilsonburg through Salford and Mt. Elgin, and to Brownsville through Verschoyle and Culloden.

IT is not true, as stated in some of the daily papers, that G. C. Cunningham, manager of the Montreal Street Railway, is going to England to manage the Birmingham Street Railway. It is true he is going; but on private business, and will be back in Montreal early in March.

THE Canada Western Telephone and Telegraph Company, Ltd., applies for a Dominion charter Chief place of business, Vancouver, B.C.; capital, $50,000. The incorporators are: O. Plunkett, R. G. Tatlow, Vancouver; J. C. Armstrong, G. E. Corbould, New Westminster.

THE Swansea Forging Co., Ltd., of Swansea, near Toronto, supplied the Metropolitan Street Railway Co. with the track supplies for the new railway running out of Toronto. The Swansea Forging Co. manufactures not only bolts, spikes, nuts, rivets, etc., for railway work; but also supplies for electric railways such as trolley hangers, etc.

THE city of Montreal has been enjoined from interfering with the laying of conduits by the Bell Telephone Company in the streets. The city had ordered the work stopped, on the ground that permission for the work had not been granted. The court held that the company's charter gave it the right to lay necessary conduits in the streets of the city.

THE Toronto Electric Light Company has since its absorption of the Incandescent Light Company been making improvements in its system. It is now in a position to supply a large number of house services, and has reduced the price to domestic consumers, and now gives a discount of 60 per cent. for prompt payment, instead of 40 per cent., as hitherto.

APPLICATION will be made by A. H. Edwards, Carleton Place; J. B. Riley, Plattsburg, N.Y.; T. Henry, Montreal, and J. Fowler, Arnprior, for the incorporation of the Lanark County Electric Railway Company, with power to construct a line of railway from Perth to Lanark, and to Oliver's Ferry and Smith's Falls on the south, and Almonte and Carleton Place on the north.

THE Montreal Cotton Co. has ordered from the Canadian General Electric Co., for their mills at Valleyfield, Que., a second 600-horse-power, three-phase generator and motors, making a total capacity of 1,200-horse-power in generators and over 1,000-horse-power in motors installed to date. The motors are largely of the inverted induction type, suspended from the ceiling and direct connected to the line shaft to be run.

AN isolated electric plant is being installed in the new Foresters' building, Richmond street west, Toronto. The W. A. Johnson Company have the contract for putting in three 50 k. w. direct current generators, made by the Walker Company of Cleveland. The generators will be direct connected to three "Ideal" engines of 75 h.p. each, made by the Goldie & McCulloch Co. of Galt. The plant will be fully installed in the course of a couple of months.

THE Montmorency Light and Power Company, of Quebec, is remodelling its arc light station. The old station is situated at Montmorency Falls in the power house, nine miles from the city of Quebec, and consists of 12 T.H. type arc dynamos. They each have a separate circuit from the power house to the city. It has been decided lately that it would be better to have larger units, and so the company has purchased two 220 K.W. "S.K.C." two-phase generators to be used as synchronous motors, and work in conjunction with the 600 K.W. "S.K.C." machine recently placed in the Montmorency station. To each end of the shaft on each one of these 220 K.W. synchronous motors will be rigidly coupled one 125 light dynamo purchased from the Brush Company, of Cleveland, Ohio.

THE Chateauguay & Northern Ry. Co., of Montreal, has ordered additional G. E. 1,000 equipments.

THE Canadian General Electric Co. has received an order from the Montreal Street Ry. Co. for 60 motors of the C.G.E. 1,000-type.

THE Peterboro', Ont., Power Company will shortly start up its three-phase plant for supplying power to the various manufacturers in that city.

THE Toronto Electric Light Company has ordered eight 125-light Brush arc machines of the latest type, to replace the apparatus destroyed in the recent fire.

THE Toronto Electric Light Company has ordered another 600 horse-power generator from the Canadian General Electric Co. This machine will be identical in type with that recently installed for them by the same company, being belt-driven, and running at 300 revolutions per minute.

AT the annual meeting of the Toronto Electric Light Co., the statement showed that the income for the year was $265,897 46, while the expenses were $172,134.69, leaving a balance of profit of $93,762.77, out of which have been paid four quarterly dividends at the rate of 7 per cent per annum, amounting to $75,119 94, leaving a balance of $18,642.83 to carry forward. The old board of directors was re appointed as follows. H. M. Pellatt, president, W. D. Matthews, vice-president; A. H. Campbell, S. F. McKinnon, Hugh Blain, W F. Murray, Hon. George A. Cox, Robert Jaffray, W. R. Brock, Samuel Trees, Thomas Walmsley, H. P. Dwight, Frederic Nicholls and Hugh Ryan.

THE Ontario Electric and Engineering Co., Limited, of Toronto, is the last venture which we welcome into the field of electrical manufacturing and contracting. This company starts operations under favorable auspices, and claims to be in a position to compete favorably with all comers. It is making a specialty of repair work. In carrying out this idea they will have the hearty support of all users of electrical machinery, to whom the advantages of having a well equipped factory, under the charge of competent engineers devoted to this branch, are apparent. In addition to repair work the company will manufacture a line of continuous current generators and motors up to 20 k.w. capacity These machines they will put on the market at the lowest price which is compatible with high efficiency and first-class workmanship The Ontario Electric Company also handles the continuous current machinery manufactured by the Eddy Electric Co., of Windsor, Conn., which has such a deservedly high reputation throughout the United States; and also the alternators of the Warren Electric Manufacturing Co., of Sandusky, Ohio. These alternators are of the inductor type, having no moving wires or contacts. The executive staff of the company consists of W. Heathcote, secretary-treasurer; Hazen Ritchie, A.I.E.E. (England), chief engineer, and J. J. Ashworth, general agent.

THE fiftieth annual report of the Montreal Telegraph Company announced the 130th dividend, amounting to $40,000, and the contingent account, a credit balance of $66,868.

NEGOTIATIONS are being made by the management of the Gorge Electric Road, Niagara Falls, N.Y., to have a direct route to Youngstown and Fort Niagara, by running over the Lewiston and Youngstown Road.

THE Sudbury, Ont., *Journal*, speaking of the new electric plant in that town, says. "The new electric light plant was purchased from the Royal Electric Co, of Montreal and Toronto. After the deal was closed, A. E. Payne, E.E., of the Royal Co.'s engineering and sales staff, arrived in Sudbury early in October last and took full charge of the construction."

(For other Electrical Items see also page XV.)