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The Canadian Engineer

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SANITARY NECESSITIES.

BY W. M. WATSON.

I have lately received a couple of clippings out of the Montreal "Witness," from a friend, together with a mild request that I should express my opinion on the facts they contained, publicly if I had the opportunity. Probably if I fully complied with the gentleman's wishes, I might place myself in a similar position to that of a plaintiff, who was addressed in the following words, by a late chief justice in England, when appealing the heavy damages that the jury had inflicted upon him for libel, viz.: "My experience in this court of such cases as yours is, that the law is too often used to punish the person who is unwise enough to speak the truth."

The clippings give the remarkably high death rate in Montreal, comparing the figures to the death rates of similar large cities, which are about one-half as heavy. If Dr. Reid, who prepared the statistics, would go a little farther and tell the public the actual death rate of the English-speaking citizens, and that of those who speak other languages, a little more light would be shown to an outside reader. Let Dr. Reid turn up a Montreal "Star," dated November 4th, 1885, and he will find that the statistics prove that the mortality for October in that year was 1,391; out of this number 1,286 were French-Canadians, 65 others belonged to the Catholic faith, and only 40 out of the whole number were English-speaking Protestants. That was the time when the preventable disease of smallpox was epidemic in Montreal. Between the fine houses of Montreal, among the wealthy, and those of the very poorest of the working-class is found a very unnatural gulf. The first-named class is allowed from 600 to 6,000 cubic feet each of enclosed air space to live in. They are heated in cold weather, by that healthy apparatus called low pressure, indirect, hot water heating, which gives them a splendid ventilation, as well as a warm, soothing temperature. They enjoy the best sanitary appliances, and take daily baths. They are surrounded with appointments that are pleasing to the eye, and are served at table by expert cooks. There is, within one mile, a large manufactory of white lead, etc., the men who do the work and benefit the general public live near the works, in houses built over swamp-holes; they have not a single thing within sight of their windows that has a pleasant effect, they possess no gardens or flowers. The rooms and rear yards are so small that in place of having the regulated amount of 600 cubic feet per head of interior living space, they cannot measure more than 200. In winter they crowd together in one room, with every crevice where the air can pass in and out of the room to change the sickening atmosphere pasted up with paper. Their heating is done by the air passing over the red-hot plates of an iron stove, which destroys the air that the inhabitants should be breathing, and the inmates are gradually destroying their own respiratory organs and poisoning their blood. The poison these workmen are liable to, when working, gives them but a short time to live, but this time might be largely extended, if the city authorities would do their duty. Why should the street opposite the doors of the poor dwellings be ankle deep in mud and festering garbage. The area around their houses should be considerably larger than at present, and the houses built on clean and wholesome foundations. Could not the City Council afford to give such working-men good swimming baths in each district, handy to get at, and provide for everyone to enjoy, at a small, but probably paying-price, a good wash. I know that many people will remain in a stifling room with apparent enjoyment, that other people would not tolerate one hour; and this is probably the reason why our French brothers suffered so badly in the year 1885 from smallpox, and are at present in a lesser degree doing the same each year. This is not the fault of themselves, or anything in their social or religious life, but of the shameful and openly corrupt city government. But while it pampers the class that is wealthy enough to pamper itself, it cares nothing for the poor, and still allows the barbaric system of earth cesspools to do duty for privies, to foul the soil the people live on, and to emit a united sickening odor into the air the unfortunate inhabitants are compelled to breathe.

The editor of the "Witness" tells us that the water supply is bad, that foul sediment is stored in the reservoir. Now the motto for all waterworks is to keep scrupulously clean the interior of all water pipes and tanks containing drinking water; I believe that there are no clean-out valves on the water mains of Montreal, therefore, the mains cannot have been properly cleaned since they were laid down. We are told that there is putrid matter or foul sediment in the bottom of their reservoirs; if so, then there is similar foul deposit in all the water mains. Why does not the "Witness" call for pipe cleaning as well as the reservoir cleaning? Simply because they cannot see inside the pipes, but can see inside the open reservoir. The pipes have been down a number of years, and the foul stuff in the bottom may be impregnated with disease germs, and will grow worse as time passes.

The end of a very long line of water pipes should be cut, and a full-sized valve placed on it, then a good drain made to receive the waste water; when this is done then leave the valve full open and open the turn-off valve at the intersection with the trunk water main quickly, so that it will cause a great commotion inside the water mains, with the air the mains will then contain, so that the dirt will fly before the body of rushing water to the wash-out valve, and by the time the body of water reaches that point, the interior of the pipes will be clean, and comparatively only a few gallons of water used. If the pipes of Montreal were laid on the circulating system, they should be divided at prominent places where they will be able to flush the longest length of main pipe at one time, in a similar way, as above described. The next question is, why should water, which contains such foul sediment as the "Witness" complains of, be allowed to enter the water mains, Montreal having the very best facilities to hand to filter the water, the cost of which need be no more than one cent per head to build and manage. I believe I can tell the "Witness" where to find the key to the whole trouble that causes the great sacrifice of human life in Montreal, and that is the disgraceful way in which public officers are appointed. It is no secret that positions are sometimes sold at good prices, that men are engaged who know nothing of the business they are appointed to fill, nor do some of the appointees care one cent for the general welfare of the public, who pays their wages. Montreal may have the best and the most expensive appliances put down to perform its public works, but they quickly deteriorate after their completion for the need of reasonable intelligence being displayed by some of its officers, in charge, who are void of skill. In October, 1898, this paper published my description of the Montreal incinerators, and it proves what poor mechanical assistance the city pays for. It is some years since I looked over the water-works, and cannot speak as to any present details, but the complaints named by the "Witness" could be easily and quickly corrected.

The York machinery Co., composed of W. H. Sumbling, J. G. Nicholson and J. D. Bird, has started business at 833 Yonge street, Toronto, as manufacturers of laundry machinery. The firm is now making power ironing machines of all kinds, hydro-extractors, etc., and will make special machines to order for other lines of trade. Mr. Sumbling, the manager, reports that his firm has been very busy ever since the shop was opened.

SOUTH AFRICA, ITS PEOPLE AND TRADE.

CAUSES OF THE BOER WAR.

ARTICLE II.

In our article last month, a brief sketch was given of the beginning and rise of the European communities in South Africa. The history was brought down to the annexation and retrocession of the Transvaal. As there exists a great deal of misconception about the causes of the present war, we shall endeavor to review the main facts.

What led to the annexation of the Transvaal? It was not lust of gold, for only small alluvial diggings had been found as yet, and the great gold reefs of Johannesburg were then as little dreamt of as the Klondyke of Canada. It was because the Republic was bankrupt, the Boers in many districts having refused to pay any more taxes, the country reduced to a state of anarchy by the incapacity of its administrators, by factions bitterly antagonistic to each other, and threatening civil war, and the failure of the Boer commandos to subjugate the native Chief Sekukuni, who was bringing other native tribes down upon the territory, the principal danger being threatened by the Zulus, under Cetywayo. This renowned Zulu King was anxious to pay off old scores with the Boers, who had constantly encroached on his territory, and frequently captured and enslaved his people and robbed them of their cattle and lands. The British Government might have allowed the Boer Republic to find its own way out of its financial difficulties, but when it came to their relations with the natives there was danger that once the Zulu King had overrun the Transvaal, with his 40,000 warriors, he could not restrain his army at that achievement, but it would then turn upon the British colony of Natal, which was neighbor to both, and which then had a white population of only 30,000, against a native population of 300,000. Under these circumstances, and considering that a petition for British intervention had already been signed by 3,000 out of 8,000 of the voters of the country, Sir Theophilus Shepstone, who had been authorized by the Home Government to act as he thought wise, annexed the country, without any force other than a personal escort of twenty-five mounted policemen. The British then took in hand the conquest of Sekukuni, which the Boers had failed to achieve, and then had to deal with Cetywayo, who, robbed of his revenge upon the Boers, now turned sullen towards the British. The next act in the drama was the great Zulu war, which was fought with no help from the Boers, except that given by a single family, Piet Uys, and his sons. These people, forgetting their rescue from certain destruction at the hands of the Zulus, no sooner found this dreadful menace removed, than they began to agitate against British rule. As stated before, they had one real grievance in the dilatoriness of the Imperial Government in granting them a local legislature; but this at last was being framed when rebellion was brought about through the enforcement of taxes, which the Boers refused more obstinately to the British than they had done to their own authorities.

*The Government £1 notes or "blue backs" then sold at a shilling, or say five cents on the dollar, while the salaries of the civil servants were three months in arrears.

[These papers have been issued in pamphlet form, containing a glossary of Cape Dutch and Kafir words and phrases in common use. Bigger, Samuel & Co., 62 Church Street, Toronto. Forty pages. 10 cents.]

In this rebellion they were led by a man, who, when the history of that land comes to be written, will be set down as the evil genius of the Dutch race in South Africa—Paul Kruger. This man, who was born a British subject in the Cape Colony, first came into prominence among his countrymen as a hunter and fighter—a fighter first against the Kafirs and then against his own people, as well as the English, whom he hates as cordially as the British sailor of Nelson's day did the French and Spaniards. It seems curious that a man of Kruger's pretenses to piety should be so tenacious of liberty and natural rights for himself and his fellow-Boers, and yet refuse the most elementary rights to British people in his country; and that he should see nothing but iniquity in Dr. Jameson's quixotic dash to rescue the Outlanders from misgovernment, and yet see no wrong in his own invasion of a friendly State with no better motive than a lust of power. Some forty years ago, at a time when the Transvaal and the Orange Free State (a neighboring Republic, composed of his own fellow-countrymen), were at peace, Paul Kruger formed a plot with M. W. Pretorius, another Boer leader, to overthrow the government of the Free State. While Kruger invaded the country, at the head of a commando, inciting the Free State Boers to rise, as he proceeded, Pretorius was set to instigate the Free State natives to revolt. The Free State forces were, however, brought together in much quicker time than he anticipated, and when Kruger saw himself confronted with double the number of cannon his own force had, he discreetly withdrew.

That Kruger's intrigues during the days of the first Republic were a cause of the country's troubles is shown by the statement of the last President, Thomas Burgers,* who, referring to the events that led up to the annexation, said: "Fruitlessly did I press upon him (Kruger), the fact that by showing how our danger lay in want of unity, the British Government would have cause to step in, on the ground of humanity, to avert civil war, and to present a general rising of the natives. * * He would not hear of retiring. Had I not endured in silence, had I not borne patiently all the vile accusations, but out of selfishness or fear, told the plain truth of the case, the Transvaal would never have had the consideration it has now received from the British Government. However unjust the annexation was, my self-justification would have exposed the Boers to such an extent, and the state of the country in such a way, that it would have been deprived both of the sympathy of the world, and the consideration of English politicians."

After the annexation, he was appointed field cornet (a position corresponding to our sheriff, but including also the duties of tax collector and other functions), of his district, at a salary of £200, which in those days was a good income. By false representations, however, he drew £300, or what came to the same thing, withheld tax moneys to that amount over his salary. The administration called upon him to make good the amount, but he did not do so then, or since. He only met the Government's request by demanding an increase of salary! The correspondence in the case is on record. How much the consciousness of this fraud had to do with the intrigues he engaged in against the British Government, it is hard to say. At all events, while holding an office under the British Government, he was engaged in agitations against it, and became the leader in the armed rebellion that followed. After the British defeats in the skirmishes at Laing's Nek, Majuba Hill and Ingogo, and while British reinforcements, to the number of 10,000 men, were gathered, the Gladstone Government stayed the sword-arm that was ready to strike back, and an armistice was arranged, followed by the convention of 1881, by which the Republic was restored, subject to the suzerainty of the Queen. By this instrument, the right of internal self-government was given to "the inhabitants" of the Transvaal, without prejudice as to nationality, and in the discussions by which the intent of its provisions was explained, Mr. Kruger distinctly declared that all would be put on an equality, as regarded the franchise and other rights. These discussions were taken down at the time, and form part of the records in the colonial office. At that time the Boers were in a large majority, and it is possible Kruger might have kept faith had the population remained thus, but Englishmen began to come to the country in greater numbers, and in 1886 the discovery of the now celebrated Witwatersrand gold fields brought people from all quarters of the globe, until the alien or outlander population, which of course included Englishmen, outnumbered the Boers. Kruger had from the first aimed to keep all power in the hands of the Dutch, and hence began the evasions and trickery by which the plain intentions of the negotiators of the original convention were to be thwarted. His ambition did not stop here. He purposed the formation of a great military state, which would centralize the Dutch influence in South Africa, and establish a Dutch republic extending from the Cape to the Zambesi, with Pretoria as the capital For a long time this ambition, though steadily pursued, was concealed, and even now there are many well-informed public men in England and America who have either not grasped the situation or refused to believe the designs so steadily pursued by this cunning trickster. The people of the Orange Free State, under the misguiding influence of their present head, President Steyn—a third-rate attorney, possessed of none of the commonsense statesmanship of the late Sir John Brand, who so wisely guided the little State for twenty-five years previously—were easily led into these designs, and in the Cape Colony, the widespread ramifications of the Afrikander Bond—a sort of granger organization, having for its motto. "Africa for the Afrikanders"—afforded good ground to work upon, as its membership was almost exclusively Dutch. The plan, as regarded Cape Colony, was to overturn British authority gradually, allowing Britain to retain the

* In the course of his last address to his Volksraad, President Burgers said: "I would rather be a policeman under a strong government than the President of such a state * * You have ill treated the natives, you have shot them down, you have sold them into slavery, and now you have to pay the penalty. * * The fourth point which we have to take into account affects our relations with our English neighbors. It is asked, what have they to do with our position? I tell you as much as we have to do with that of our Kafir neighbors. As little as we can allow barbarities among the Kafirs on our borders, as little can they allow that in a state on their borders anarchy and rebellion should prevail * * To-day a bill for £1,100 was laid before me for signature, but I would sooner have cut off my right hand than sign that paper, for I have not the slightest ground to expect that when that bill becomes due there will be a penny to pay it with." President Burgers—who left the Transvaal broken hearted, not because of the annexation, but because of the intriguing which brought about the condition of things rendering that step inevitable—just before he died left a statement of the case for the benefit of posterity, in which he shows how Kruger plotted with the annexation faction in order to oust Burgers and get the presidency for himself. Kruger overdid his part, but though his ambition was balked for the time by the annexation which he did not count upon, he continued his intrigues against the British with the result which history tells.

naval station at Simon's Bay, and a certain "suzerainty," which could be strained to the breaking-point as time went on. Steyn, the Free State president, with his usual lack of diplomacy, gave a plain statement of these designs in a speech just a year ago, and anyone who studies the wording of most of Kruger's recent despatches and his replies to the enquiries of American and other newspapers, will see how he claims to act as champion of the whole of South Africa, though the difficulty is supposed to be with the Transvaal only. It was made plain to the British element in South Africa, and to the Home Government, that Britain must either make good her claim of paramountcy or give over the rule of South Africa to the Boers. As one of the Boers put it, there could not be two "bosses" in South Africa, and it became a question, which was it to be, Boer or Briton?

In pursuance of his policy of Napoleonizing South Africa, President Kruger, at the head of a delegation of three, went to London in 1884 to attempt to get a release from all semblance of British control, and to get a formal confirmation of the encroachments he had been making on independent native tribes since the convention of 1881. He represented to Lord Derby, the Secretary of State for the colonies, that his burghers were discontented under the existing convention, which they felt implied interference with their internal affairs. The deputation drew up a draft of a new convention, in which the name of the Transvaal was changed to the "South African Republic," and in which the British suzerainty was expressly abolished. In discussing this draft, Lord Derby politely, but firmly, informed the deputation that "neither in form nor in substance was it such as Her Majesty's Government could agree to;" but that as the paramountcy of Great Britain was an obvious fact, and did not require a document to establish it, he had no objection to satisfying the susceptibilities of the Boers by accepting the change of name, and by omitting any specific use of the word "suzerainty," which Kruger had said was offensive to them. And so, clinging to the letter of this change, Kruger built up his claim that the Transvaal was now a "Sovereign International State," though the new convention of 1884 distinctly prevents the Transvaal from making any treaty with a foreign power without the consent of Great Britain. Without trying to define the term "suzerainty," plain men will question the "sovereign independence" of a country whose autonomy was given as an act of grace, and which could not make its own treaties. But even if there were no suzerainty, the conduct of the Boer Government had rendered it liable to be called to account in a dozen ways under common international law.

Some people ask, was not the Boer Government justified in its recent policy, by the Jameson raid? The answer to that question is that the Jameson raid was the result of Boer tyranny and misrule, and not the cause of it. Had Kruger treated the Uitlanders as white men with natural rights, and had he not laid on burden after burden, and taken away right after right, with studied hostility towards British subjects in particular, there would have been no Jameson raid. The educational restrictions, the arming and fort building,

SCENE—MARKET SQUARE, JOHANNESBURG.

the prohibition of public meetings, and the iniquitous press law, and other grievances, all preceded the Jameson raid. The people of Johannesburg and other Uitlander centres began to despair of any action from the British Government, and yet, while agitating persistently for their rights, the majority of the members of the "National Union," formed at the time to obtain redress for the people's grievances, publicly and privately assured the President that they had no desire to upset the republican form of government. And there is complete evidence that these sentiments were genuine with the Uitlanders at that time. Dr. Jameson's brave, but quixotic raid, as it was carried out, put the people of Johannesburg in a false position, and they have been unjustly charged with cowardice. It is not denied by the National Union leaders that an agreement was made with him to come to their aid. But after smuggling in 3,000 rifles, the leaders found that more had to be done to make the rising a success—for it was intended to seize Pretoria, whose forts, then under repair, were exposed and ill-garrisoned—and so they sent word to Jameson to wait on the Bechuanaland border till they notified him. Their object was not merely to

become better equipped for the struggle, but to declare to the world that the struggle was their own, and not brought about through an invasion. They proposed to have a new flag, so that there should be no question of the independence of the movement. Dr. Jameson, however, became impatient, and appears to have disregarded either the requests of the committee or the warnings of the Imperial Government, who wired him as soon as they heard of his intention. The reader will remember how his force of 400 or 500 men were caught by a Boer force of three times his number before he reached Johannesburg, and compelled to surrender, the leaders in the movement at Johannesburg being unaware of his approach till too late to do anything. These leaders were arrested, and, as we know, heavily fined, the fines aggregating over a million pounds, and were bound over for three years not to take any part in the politics of the Transvaal. Their tongues were, therefore, tied, and hence the false impression that has been current regarding this affair. With his characteristic cunning, Kruger sent, as mediators, three men in whom the Johannesburgers had faith, and by promises of reform, made on his behalf through them, but which he had no intention of keeping, the people were induced to lay down their arms, hoping for redress at last. The President saw that the reformers had lost the sympathy of the outside world, through Dr. Jameson's mistake, and he took the fullest advantage of the fact. He at first pleaded for delay in the execution of the reforms till the excitement of his burghers should be allayed, and when this plea was somewhat worn by time, he repudiated the promises made to the mediators. An ever-increasing revenue, squeezed from the gold fields, enabled him to add to his forts and armaments, and the Jameson raid furnished the excuse that had been wanting before. In the case of Pretoria, the capital and centre of Dutch influence, the guns were mounted pointing outward; in the case of Johannesburg, the Uitlander city, they were placed so as to bear upon the town itself. Taking advantage of the sympathy naturally aroused in the Orange Free State, he drew that republic into a formal alliance by which it bound itself to join the Transvaal in any war that might arise. Before the Jameson raid, official Boerdom was insolent enough in its dealings with aliens, but after the raid, matters grew worse.

ENTER THE STANDARD OIL COMPANY.

Many of our good friends in Petrolia seem to have taken our reference to the Standard Oil Co.'s doings in Petrolia as a reflection upon the policy of the town authorities. This is shown by the letter from Petrolia in another column. Nothing could be farther from the writer's intention. We understand that the first deal by which the great oil monopolists obtained possession of Rogers, Fairbanks & Co.'s refinery was accomplished before the people of Petrolia were aware of it, and even if they had been they could not have prevented it. When the Imperial Oil Co. of Petrolia at first declined to sell out, the Standard Oil Co. took indirect, but none the less effectual means of getting their grip on the Canadian oil trade. They not only obtained from the Canadian railways a discrimination in freight rates against Canadian producers, but induced the Dominion Government to permit the importation of oil in ship tanks and cars. Before this, petroleum and its by-products had to be imported in cans or cases of not more than fifty gallons, and duty was charged on the cases. Inspection was also required which so restricted the imports as to give the Canadian refiner at least a fighting chance. When the Standard Oil Co. sought to break down these barriers deputation after deputation from Petrolia and other oil centres went to Ottawa, showing that such a change would ruin the Canadian oil trade as an independent industry, and would sooner or later deliver the business into the hands of the American monopolists. Their appeals were unavailing, but the prophecies were speedily fulfilled; for when the Imperial Oil Co. found itself in the ditch it sold out to the Standard, and the other small refineries had to follow.

The discrimination made by the railways in favor of the American corporation has been gratefully rewarded by the withdrawal of as much of the oil transportation business as it can divert to its own vessels. Once having become possessed of the Canadian oil business the Standard Co. could not be blamed for piping its crude oil from Petrolia to Sarnia, because with the facilities of shipping in tanks which the Government has given it a great saving could be effected by having its works along the water front at the Detroit River. As to the increased price which the Standard Co. is paying for crude oil, the fact will not be lost sight of that the price the company now charges for refined oil, gasoline, benzine, etc., has been advanced about ten times the proportion of the advance in crude oil. However, it is assuring to know that the enterprise of Petrolia's citizens is carrying the town ahead in spite of fate.

AMERICAN STEAM WAGONS.

Aside from the Serpollet system of flash boiler steam engines for light vehicles, which is successfully used in European countries, steam power was used exclusively for freight wagons and heavy constructions of other descriptions until a number of New England men, mostly engaged in other forms of machinery manufacture, evolved designs of boiler and engine which have made steam available for the lightest class of road wagons. By the success of their experiments they created a new type of light vehicle, which is characteristic for this country, and is already commanding intense interest in Europe. George E. Whitney, of Boston; A. T. Cross, of Providence; William B. Mason, of Milton; The American Waltham Manufacturing Co., and the Waltham Manufacturing Co., both of Waltham, and the Stanley Brothers of Newton, were the pioneers in these improvements of steam engines, closely followed by others, who are all indebted to the early experiments of S. H. Roper, who commenced his experiments with light steam engines over twenty years ago, and continued them until his death in 1896. To this common origin in ideas, says The Cycle Age and Trade Review, may be traced a certain sameness in construction of the engine part of the various wagons produced, but notwithstanding this partial similarity, each of the patterns has a pronounced individuality due to the great variation in running gear and details which are of the greatest practical importance for the management and operation of the vehicle.

Whitney in his experiments with yacht boilers found that the single vertical tubular boiler, with flues 26 diameters in length, produce more steam per pound of boiler than any other form of steam generator with which he experimented, and he has adopted as standard this ratio of dimensions. The dimensions of the boiler are: Total height, 20 inches, with a body diameter of 16 inches. Whitney uses copper tubes ½-inch in diameter, and about 300 in number. The boiler shell and fire-box are of steel, about 1-10-inch in thickness, and the completed boiler, which weighs about 85 pounds only, is tested to 500 pounds hydraulic pressure. The steam pressure used is not high, only about 125 pounds commonly.

In Mason's wagon the same style of boiler is used as in the Stanley and American Waltham wagons, the design being

Stanley's and the work Mason's. It is in most respects similar to Whitney's, but does not have the cylinder within the steam space of the boiler as has the latter. The Mason frame consists of a girder of steel tubing at each end, supporting the axles and connected underneath by two lattice braces, each formed of two crossed rods secured at their ends to the front and rear girders, and fastened together at the crossing. The upper corners of the two girders are joined by two composite side-bars, the wagon body being secured to these side bars by clips. The general scheme of the motive part of the Mason wagon is to locate the vertical boiler under the seat, and to pivot to the front side of the boiler a frame carrying a pair of piston valve, link motion, simple, steam engines, cylinders 2-inch bore by 3-inch stroke, working downward on cranks at 90 degrees. Mason uses a 12 pound flywheel on his engine shaft, with a view to equalization of torque when cutting off very early. Besides the flywheel the crank shaft carries an 8-tooth sprocket, from whence a Baldwin separable cycle chain leads to a 32-tooth sprocket on the compensating gear case on the rear axle. The rear axle is not divided, a sleeve being used to transmit power to one of the rear wheels. To secure a ready chain adjustment, a right and left threaded strut is pivoted to the compensating gear yoke, which forms a part of the rear axle support, and reaches forward to the engine frame. As the engine and boiler are carried on the wagon body springs, this screw strut requires a universal jointing to accommodate the variations in the relative positions of the engine crank shaft and the rear axle. The engine frame is pivoted on a steam admission located a short distance to the rear of the mid-point of the piston travel, hence the entire fabric of the engine frame and the engine has a free pendulum movement on the tri-union, enabling the driving chain to be very easily adjusted to a nicety The firing of the Mason boiler is controlled by the use of a regulator acting on a diaphragm actuating the fuel admission valve. The gasoline is carried in a copper tank under 20 or 25 lbs. air pressure, maintained with a hand operated air pump This air pressure drives the fluid gasoline into a horizontal vaporizing tube, reaching entirely across the fire-box, close to the top of the burner. There is no valve between the gasoline tank and the vaporizing tube, and the fuel supply regulating valve is placed between the vaporizer and the burner, and acts on the gasoline vapor, not on the fluid before vaporizing. When the pre-determined boiler pressure is reached the regulator closes the fuel admission valve completely; to avoid the total extinguishment of the fire, a very small by-pass opening is provided around the fuel valve, this by-pass admitting vapor enough to the burner to keep the burner lighted and to keep the vaporizing tube hot, so that as soon as the boiler pressure falls the fire will be automatically increased without any attention on the part of the driver. When the regulator reduces the fuel supply it also opens a large area of cold air supply to the fire-box of the boiler, and thus instantly checks the generation of steam, so that the safety valve never opens to discharge any steam into the open air, which is of very great importance, as this avoids an emission of visible steam, and also avoids a waste of boiler feed water, both very desirable points. The gasoline is carried in a cylindrical tank, located well forward, under the foot-board. The water tank is in the rear of the boiler. The boiler is clothed first with sheet asbestos, ¼-inch thick, then with hair felt ⅝ or ¾ inches thick. The tanks are of sheet copper. The smoke bonnet leads horizontally to the rear, and has an upwardly directed rectangular opening or smokestack, not more than an inch high, projecting a very little above the rear body cover. This smoke discharge is supposed to be of use when the wagon is standing still and the fire is burning. The smoke-stack is also carried downward and to the right side, and terminates in a downwardly opening, cylindrical nickel-plated smoke-stack, extending about 10 or 12 inches below the bottom of the wagon body. There is no damper in this smoke duct. The exhaust pipe is carried across the top of the boiler inside the smoke bonnet, and terminates in a nozzle directed downward into the cylindrical smoke-stack mentioned; and when the engines are running there is a very perceptible down-draught through the rectangular uptake at the rear of the smoke-bonnet.

The Legislation Committee of the Trades and Labor Council, Toronto, waited on Hon. John Dryden recently, to ask that certain clauses in the Ontario Factories Act be rigorously enforced They want a blower attached to all dry emery wheels.

EXCESSIVE HEATING IN A CORLISS ENGINE.

Editor CANADIAN ENGINEER:

What is the correct lead to give valves of a cross compound Corliss engine, driving air compressors direct connected to the piston rods? What would be the pressure on crank pins when thus connected, and would this pressure on crank pins be sufficient to cause excessive heating?

Toronto, October 15th, 1899. ENGINEER.

THE DIESEL HEAT MOTOR.*

The Diesel motor has attracted more or less attention for the last two years, but the principles upon which it operates, and which are so widely different from other motors, have not been generally understood. Hirn's work at Mulhouse, Professor Lanza's work in Boston, and Isherwood's practical experiments, roused mechanical engineers to the importance of considering the utilization and conservation of heat in the steam engine as the fundamental question of design. Even Ericsson, one of the pioneers of the steam engine, had previously turned to the hot-air engine to escape from those losses inseparable from the employment of steam. Naturally enough, then, many scientists and inventors turned again to the internal combustion engine, which had been previously experimentally developed by Barnett in England, Drake in America, LeNoir in France, improved by Brayton, Barsanti, and others, ably discussed and advocated by Dr. Siemens, and finally developed into a practical working machine by Otto in 1876. Otto's master patent, though at first vehemently attacked, became the foundation on which Priestman, Crossley, Atkinson, Capitaine, Clerk, and others, built up a number of types with a gradual and satisfactory increase in economy. But they all worked in the beaten path of mixing a charge of gas and air, carefully compressing it, and igniting it for explosive action by various igniting devices. Not one attempted a vital change in the cycle itself until Rudolph Diesel, in 1893, proclaimed his method and attempted the development of a practical working engine on the ideal of Carnot.

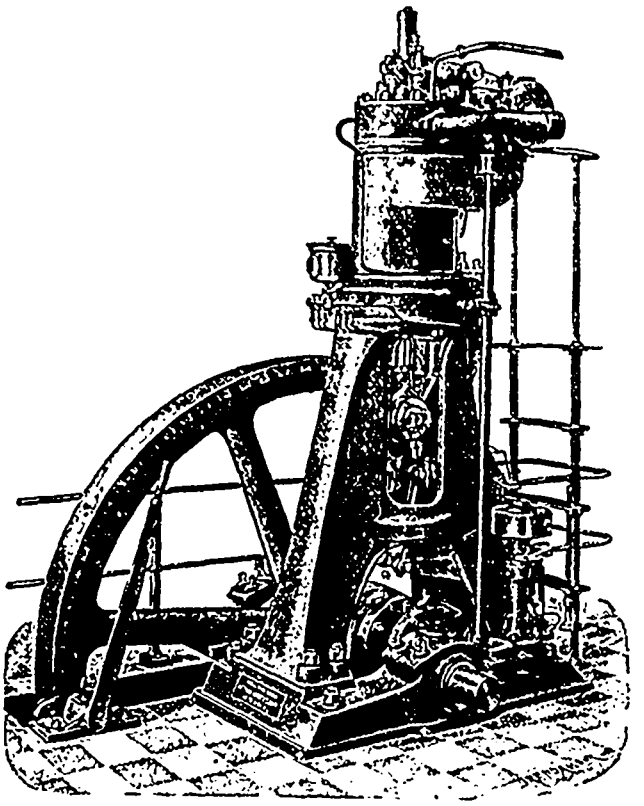
After experimenting with various vapors more permanent than steam, and at first attempting both to add and withdraw the heat from the working fluid from without, he reached the conclusion that the atmosphere about us would furnish a cheap, endless supply of permanent gas, available not only as the vehicle of heat, but as the means of evolving it from the fuel employed.

Rudolph Diesel is a Bavarian, 40 years old. He received his early education in Paris, where his parents then resided, until they were forced to emigrate in 1870 by the decree of the empire. He is a man of studious habits, a good mathematician and thoroughly versed in the science of thermo-dynamics, which he has made his life study. As a student at Munich he was a pupil of the celebrated Professor Linde, now well known as the inventor and builder of the ice machine which bears his name. Since the publication of his lecture of June 16, 1897, he has been fairly overwhelmed with praise and congratulations by the leading professionals of Europe. For the past fifteen years Mr. Diesel has devoted himself almost entirely to this work. He even built a small experimental motor in Paris many years ago, the working of which enabled him to modify his first theories considerably. He, however, took the precaution to have the parts of this motor made in different shops to prevent his ideas and processes from becoming known. In 1892 he made his applications for his first patents in different countries. On the 16th of June, 1897, he delivered a lecture before the National Society of German Engineers at Cassel, in which he not only developed his theories, but exhibited in drawings the actual construction of his motor, and gave some data in regard to the practical results obtained at Augsburg. Professor M. Schroeter followed Diesel in further development of the theory of the motor, and gave in detail the results of tests made by him on the first experimental motor, and stated his conviction that the motor was now ready for commercial work.

Diesel's idea was to follow Carnot's cycle strictly, obtaining the lower isothermal and adiabatic curves by compression, and the upper lines by combustion and expansion. For a long time he experimented with various vapors, which, under normal con-

*Extracts from a paper read before the Massachusetts Institute of Technology by E. D. Meier, C.E., M.E.

ditions, are far above their points of condensation. Ammonia vapors, especially, seem to have the properties best suited to the theoretical process. But great difficulties in handling them were encountered in practice. In the endeavor to replace them he was naturally lead to experiment with air. Up to this time he had necessarily applied his heat from without, and was subjected to the losses and limitations due to the metal walls



20 H. P. Diesel Motor—German Type.

through which it had to pass. He was then subject to the same losses which had defeated Ericsson, and was compelled to make the step which made his motor an internal combustion engine. Starting out, then, with the intention of improving the caloric process of the steam engine, he reached, in a round-about way, means similar to those employed in gas and oil engines. But this similarity is strictly limited to the fact of internal combustion, the method of combustion being radically different. Further, finding that to begin his compression isothermally led him into pressure which must, in our present practice, be considered excessive, he abandoned that part of the Carnot cycle, and made his compression adiabatic throughout, thus reducing the necessary pressures from over 100 atmospheres to between 30 and 40. When, as in the history of the steam engine, these higher pressures become practically feasible, a return to the original complete process may become advisable. Diesel's fundamental invention is then really a process of converting heat into work; this of course has been supplemented by other inventions naturally growing out of the persistent and logical development of a practical machine to operate on this process. It was Diesel's first intention to build a motor with three cylinders, embodying compound compression and compound expansion, and one of this type has been built at Augsburg, and is to be thoroughly tested on producer gas. But the development of the single cylinder type has been so satisfactory, and the demand for them has become so great, that at present the German shops are busy to their fullest extent, building their simpler form. As this form has reached an absolute efficiency of 30 per cent., and is in every way a simple and practical machine, there is at present no reason for developing the compound motor. The cut here given represents the first of these 20 h.p. motors, built by the Nuremberg Machine Works. This motor was exhibited at the Electrical Exposition in New York city, held in May, 1898. In appearance it resembles a vertical marine engine. A strong base plate supports the main journals of the crank shaft, outboard bearings being provided for the shaft extensions which carry the fly-wheel and pulley. Bolted to the base plate is a stout A. frame, containing the guides. In the rear leg of this frame a small air pump is supported. On the top of the frame is placed a cylinder open at the bottom. Its top is closed by a head cast in one piece, in which are contained one suction valve for air, one discharge valve for spent gases, and a needle valve for the fuel. The admission to the casing of this fuel valve is controlled by a stop valve, which can be instantly closed to shut off the supply of fuel. Besides this, there is a starting valve used only in starting the engine. Cylinder and air pumps are water jacketed. This water jacket was not used in the earlier experimental engines, but is found advantageous in keeping the temperature of the working parts uniform. As the temperature of combustion is so much lower than that of the explosion type of engines, a much smaller amount of water suffices for this. In the earlier German engines the main shaft and crank are bored for water cooling. This, however, grew out of the practice of Krupp's Steel Works of boring all small shafts produced. The practice has been discarded in England and in America as unnecessary. The air pump is driven by a set of levers attached to the main cross-head. Conveniently placed to one side is an air vessel known as the starting tank, connected by copper pipe to the air pump, and to the fuel valve casing.

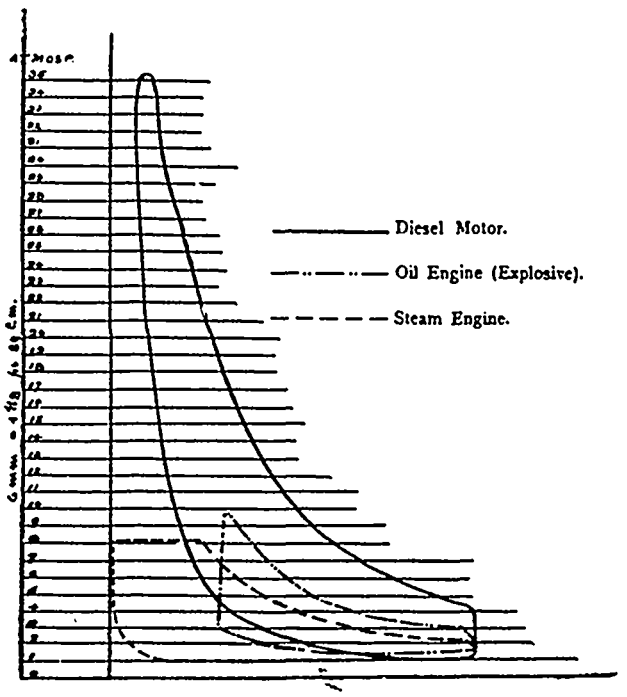
The operation is as follows: On one down stroke the main cylinder is completely filled with pure air; the next up stroke compresses this to about 35 atmospheres, creating a temperature more than sufficient to ignite the fuel. At the beginning of the next down stroke the fuel valve opens, and the petroleum atomized by passing through a spool of fine netting (wire), is injected during a predetermined part of the stroke into this red-hot air, resulting in combustion controlled as to pressure and temperature. This injection is made possible by the air in the starting tank, which is kept by the small air pump at a pressure some 5 to 10 atmospheres greater than that in the main cylinder. A small quantity of the air enters with the fuel charge, which it atomizes as described. When the motor is running at full load a very small quantity of injected air suffices, and the pressure in the air tank steadily rises. At half-load, with less fuel injected, more air passes in. For this reason, the starting tank is made large enough to equalize these differences, and a small safety valve is provided on the air pump. The petroleum is pumped into the fuel valve casing by a small oil pump, bolted to the base plate. This pump is arranged to pump a fixed maximum quantity of petroleum. A by-pass is provided so that this whole quantity, or any portion of it, can be returned to the supply tank. The governor controls the action of this by-pass valve, closing it just long enough to compel the exact quantity of the fuel required to pass into the fuel valve casing. As this requires only the movement of a small light wedge, the regulation is accomplished with great exactness. In this regulation resides a great advantage for the Diesel motor. The full charge of air being always supplied for complete combustion, it matters not whether the governor permits one or fifty drops of petroleum to enter the working cylinder at each motor stroke; the combustion is always complete. Thus variations in excess of air over that theoretically necessary, from 26 to 116 per cent., have been measured, and the analysis of the spent gases shows no trace of unburnt carbon or hydrogen. It is hard to conceive a more perfect combustion than that which takes place when fuel is sprayed, finely powdered or atomized into red-hot air, just beginning to expand. To stop the motor it is only necessary to close the valve which admits the petroleum into the fuel valve casing. The valve gear consists of a series of cams placed on a shaft and journaled on brackets cast on the cylinder.

In starting the motor a hand lever is pulled to one side, throwing all these cams, except the exhaust valve cam, out of gear, and throwing a special cam into gear with the starting valve. A few strokes of the petroleum pump by a hand lever inject a small quantity of petroleum into the fuel valve casing. The fly-wheel is thrown over by a lever a trifle beyond the upper dead point. The fuel throttle valve is opened, and by a turn of the hand wheel communication is established between the air tank and the starting valve. A single charge of highly compressed cold air enters the cylinder, sufficient to give two revolutions of the fly-wheel at moderate speed. At the close of the first revolution the starting valve cam is automatically thrown out of, and the other cams into, gear, and thus on the second revolution a full charge of air is drawn in and compressed, and in less than thirty seconds the motor is running at full speed.

Mr. Diesel makes a sharp distinction between the tempera-

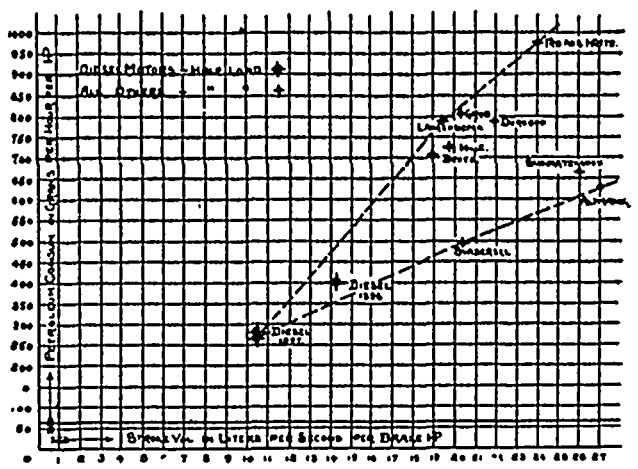
ture of ignition and the temperature of combustion; the first is a constant value at each pressure, and dependent only on the physical qualities of the fuel, the higher the pressure the lower the temperature of ignition. The temperature of combustion on the other hand is variable, depends on many conditions, and especially on the quality of the air by which the combustion is maintained, but it is always higher than the temperature of ignition. Diesel's radical departure from all previous practice is in generating a combustion temperature by mechanical compression of pure air, utilizing this temperature to ignite the fuel, and by so introducing the fuel that the heat lost by expansion is practically balanced by the heat added by combustion.

Before the completion of this perfect engine, certain critics of Diesel's theories contended that the dimensions of the cylinder, and all other working parts would become so great as to make it impracticable to build such engines. But in Diesel's engines the increase and the decrease in pressures are so gradual that there is no shock. The change from one to the other is always accomplished at a dead point. In all motors relying on explosion for their moving force, and even in the steam engine, there is a direct blow at the moment of ignition or admission. I present here a drawing on which indicator diagrams of a high pressure steam engine, of an explosion type motor, and of a Diesel motor have been drawn, based on the same piston displacement.

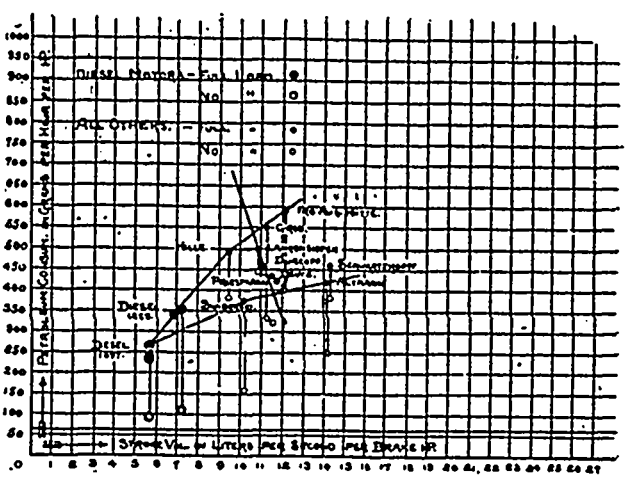


COMPARATIVE DIAGRAMS—DIESEL MOTOR OIL ENGINE AND STEAM ENGINE.

Diesel's and the explosion motor diagrams can be directly compared, since both work on the four-stroke cycle. The steam engine diagram should be quadrupled. This disposes of the objections just referred to. These second and third diagrams are graphic comparisons of the Diesel motor, with a number of the best petroleum motors as to economy in fuel and volume swept by the piston per second. They are given on the authority of Professor Hartmann, well known as a careful and conscientious observer in the field. The abscissae represent piston displacement in liters per second, the ordinates petroleum consumption in grams per hour, both figured on the effective or B.H.P. The full lines embrace the results for full loads, the dotted lines those for half loads. The comparison is between engines which burn ordinary safe lamp petroleum and kerosene; results obtained on benzine or naphtha are not considered, since motors depending on such dangerous fuels can never be generally adopted for industrial purposes. The calorific value of these highly inflammable and explosive liquids is no greater than that of safe kerosene or of fuel oil. You will notice that we find the Diesel results in both cases near the apex of the angle; or plainly put, both at rated capacity and at half load the Diesel motor shows the smallest cylinder dimensions and the least expenditure of fuel. Remember that the others represent the best results from engines carefully developed and improved in all mechanical details, while the Diesel motor is but the third one ever built, and that in its construction the practical realization of the theoretical cycle was the primal consideration, mechanical improvement being left for the future commercial exploitation of the machine. Broadly speaking, the absolute



COMPARATIVE CHART—FUEL CONSUMPTION AND STROKE VOLUME, HALF LOAD.



COMPARATIVE CHART—FUEL CONSUMPTION AND STROKE VOLUME, FULL LOAD.

efficiencies of the best known heat engines of to-day range about as follows, taking into account actual calorific values of the fuel and effective or brake horse-power:

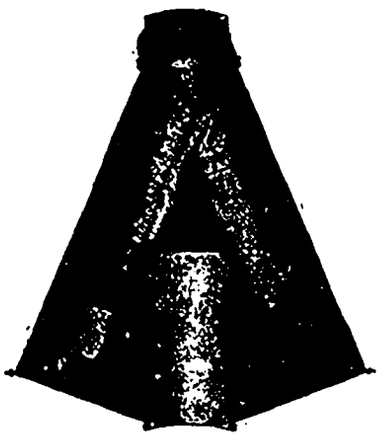
	Per cent.
Small auxiliary steam engines, pumps, etc.	6-10 to 1
Plain slide valve engines in good condition	3 to 5
Single cylinder Corliss engines	6
Compound condensing engines	8
Reheating compound or triple expansion steam engines	12
Best oil engines (explosion type)	16
Best gas engines (explosion type)	19
Diesel motor	28 to 30

All these are compared when running steadily at full load or rating at point of best economy. But in a large majority of the applications of all these prime movers, the exigencies of the service require them to be run frequently at three-quarters and half load for a large part of their daily service. It is conceded that in most engines the internal frictions or mechanical losses are a fixed amount, so that a loss of 15 per cent. at full load becomes 30 per cent. at half load. And thermal losses increase even more rapidly, for instance, in steam engines by cylinder condensation. In gas and oil engines the absolute efficiencies have in some cases shown a measured loss of nearly 60 per cent. In the Diesel motor the thermal efficiency is shown to increase with decreasing loads, thus counteracting in a marked degree the loss in mechanical efficiency which it shares with other machines. From a number of carefully checked tests I found the average drop in absolute efficiency from full to half load to be only 15 to 16 per cent. in the Diesel motor. So promptly and easily does it respond to a change of load that a sudden addition of 80 per cent. to the electrical load on the

Diesel motor at the Electrical Exposition at New York, by the throw of a switch, was not noticed by observers of the engines or the lights, though promptly registered by the ammeter. For variable load, then, the Diesel motor will show in practice a much greater superiority over all rivals than that apparent from the tabular figures just given.

A NEW FORM OF EXHAUST HEAD.

One of the important features of a modern steam plant is an exhaust steam pipe head. To be effective it must thoroughly separate the water from the steam, and thereby prevent the constant spraying of roofs and walls with consequent deterioration and expensive repairs. In the form of exhaust head built by the B. F. Sturtevant Co., Boston, Mass., and illustrated herewith, the principle of centrifugal force is utilized to secure perfect separation. Dry exhaust steam weighs only .038 lbs. per cubic foot, while water of the same temperature weighs 59.36



pounds per cubic foot. It is therefore evident that inasmuch as centrifugal force is proportional to the weights of the bodies in motion, the water will be thrown outward with $\frac{59.36}{.038}$, equals 1,562 times the force exerted upon the steam. In the Sturtevant exhaust head the steam passes up the interior pipes, is discharged tangentially close to the shell, and is thereby given a vigorous whirling motion. The entrained water—likewise the oil—flies outward, strikes the cool side and trickles down to the outlet at the bottom. The steam now perfectly dry, finds ready escape through the central opening above. The action is claimed to be so positive and absolute that perfect separation must be the result. These heads are built in sizes to fit pipes from 1 inch to 20 inches. All sizes above 10 inches are flanged instead of tapped.

THE LATE PROFESSOR BUNSEN.

Prof. Robert W. Bunsen died recently at Heidelberg, Germany. The age of the great scientist was 88, and he formed a most interesting link between the German scientific men of the past and those of to-day. As the obituary notice in the London Times says, Prof. Bunsen passed away full of years and of honors. He was born in 1810 at Gottingen, and graduated in the university of that town. The greater portion of his scientific researches were carried out at Heidelberg, where he held the chair of experimental chemistry from 1852 until his retirement in 1889. To enumerate Prof. Bunsen's discoveries in almost every branch of chemistry would fill a treatise. Suffice it here to enumerate those which have made Bunsen's name a household word. First came Bunsen voltaic battery, which, supplanting the more expensive form bearing the name of our countryman Grove, was generally used as the cheapest and most effective mode of generating electricity until the dynamo displaced all forms of chemical batteries. Next came the Bunsen gas burner, which, it is not too much to say, is now not only a necessity in the laboratory, but in every household and every manufactory where a clean flame is wanted. About his discovery of this simple and effective apparatus an interesting tale could be told. No one before Bunsen had thought it possible that a mixture of coal-gas and air could be made to burn without explosion from a simple tube burner. His clear conception of the laws which apply to the inflammation of such a mixture showed him that it was possible to arrange the dimensions in such a way that a steady, smokeless, and highly combustible mixture could be obtained, but a long series of delicate experiments was needed before the perfect burner which now bears his name resulted. Prof. Bunsen's work in spectrum analysis was most valuable, and his papers on this and on the many other subjects in experimental chemistry have been valued most highly by the world of science They also resulted in honors from foreign scientific societies being conferred on their author, which were most richly deserved and were highly valued by their recipient.

REPORT OF THE CITY ENGINEER OF TORONTO.

The annual report of the city engineer of Toronto, Ont., C. H Rust, for 1898, has been issued. It contains a great mass of information concerning matters dealt with by the engineer's department during the year. Statistics of the city show: Area, 17.17 square miles; 257.93 miles of streets, of which 179 are paved and 78 are unpaved; 82¼ miles of lanes; 230 miles of sewers, 430 miles of sidewalks, 255 miles of water mains, 230 miles of gas mains, 130 miles of underground electric conduit, 4.300 miles of overhead electric wire, 80 miles of steam railway track, 84½ miles of single street railway tracks, 7,000,000,000 gallons of water supplied annually. During the year there were 24.64 miles of new pavements and roadways constructed, as follows: Asphalt, 3.408 miles; brick, on concrete, 6.079; brick, on gravel, .352; brick, on concrete (track allowance), .413; cedar block and brick, on concrete, (track allowance), .280; cedar block, on concrete, .084; cedar block, on gravel, 4.831; macadam, 2.089; gravel, 4.756; concrete, .057. Reconstruction of track allowances—' :k, 3.341; scoria, 2.986.

The engineer, ref .ing to the increasing demand for improved roadways, says that the ratepayers are, owing to better times, beginning to realize the advantage of having a good pavement in front of their property. He mentions his disapproval of gravel roadways, as unsuitable for city streets, and he advocates discouragement of their construction. It is noted that a great many of the ratepayers have, Mr. Rust thinks, unjustly condemned cedar block pavements. The difficulty has been in the past that too long a time was given for the payment of the cost of cedar block pavements. Instead of ten years the time for payment is now five years. A cedar block pavement is cheap, easily laid and repaired, noiseless, and, dependent upon the extent of traffic, will remain in good repair for from six to eight years, and at the end of that period it can be renewed at a cost of from 45 to 50 cents per square yard, making it the cheapest pavement that can be laid, and much to be preferred to a gravel roadway, which costs about 10 per cent. more.

A large folder map is inserted in the report, which shows all the streets in the city, and they are colored to show the various pavements. Those which are in immediate need of repavement are also indicated.

Respecting pole , wires and conduits on streets, it is said that the time has arrived when strong efforts should be made to get rid of a number of poles and overhead wires, especially in the central portion of the city; and we should try and arrive at an agreement with the different electrical companies in the matter of the construction of underground conduits, which should be constructed by the city, and a yearly rental charged the different companies for the use of them. During the preceding year this department made several attempts to bring the companies together, so as to avoid the duplication of pole lines, but those efforts did not result in any satisfactory arrangement.

Mr. Rust urges improvements to the water works system, to place that branch of the city service absolutely beyond failure and guarantee an adequate supply of water for domestic and fire requirements for some years to come. Mr. Rust states most emphatically that a new conduit is necessary between the Island shore crib and the pumping station; at present the supply is endangered with low water. A large expenditure for mains, conduits and pumps, in order to place the water works in a satisfactory condition is recommended. He also recommends the installation of another 10,000,000 gallon high duty engine at the main pumping station, as an economical expenditure. A new 36-inch main is said to be required from the corner of Bathurst

street and College street to the reservoir, so as to provide a full supply for the high level district, and also to enable the reservoir to be filled in three or four instead of sixteen or twenty days, as at present; and also to enable a fire pressure to be maintained on the low level or main district at times when it may be necessary to shut down an engine for repairs at the main pumping station. He considers that a daily supply of from 14,000,000 to 15,000,000 gallons should be amply sufficient for all purposes. If the present waste of water could be prevented, there is no doubt that a further reduction in our water rates could be made.

THE METRIC SYSTEM.*

In a paper on the Metric System, published in The London Times in 1896, Herbert Spencer in opposing its introduction begins by declaring that the "advocates of the metric system allege that all opposition to it results from ignorant prejudice," which he very properly declares is far from true. What is far more dangerous as an obstacle to human progress, and often far more common, is what may be called "intelligent prejudice," meaning thereby an obstinate conservatism which makes people cling to what is or has been, merely because it is or has been. It will be convenient to consider the objections offered by Mr. Spencer in the order in which he has presented them in the four separate letters which go to make up his article. Mr. Spencer reproduced in quotation a considerable part of the well known argument of Sir John Herschel, written and widely published over thirty years ago, in which he claimed, first, that the metre was not exactly the ten-millionth of the terrestrial meridian passing through France, which was entirely correct, and that, therefore, it was not a good unit for international use, which does not at all follow. He further attempted to show that the polar radius of the earth, which could never be known except indirectly, was a better unit than the quadrant, a large part of which could be measured directly, and that this radius differed by only eighty-two yards from 500,500,000 English inches. He then proposed to increase the English standard by its one-thousandth part, so as to furnish what he declared would then be "a system of linear measurement the purest and most ideally perfect imaginable." It has always been a surprise that so able a mathematician and astronomer could have overlooked the inherent weakness in such an argument. The simple facts are that while in the beginning the metre was made to be as nearly as possible one ten-millionth of the meridian, no one imagined that it could be exactly so, or rather that we could ever know that it was exactly so. It is sufficiently near that value to be very convenient in calculations relating to terrestrial distances and areas, but it must always be considered as defined by a material standard, and no metrologist ever thinks of it in any other sense. Before beginning the exposition of his own views he ventures to quote another objector to the metric system in the person of Prof. H. A. Hazen, of the United States Weather Bureau, who some time ago argued that its adoption would necessarily include that of the centigrade thermometer scale, and that as, in his opinion, this was very bad, the metric system must be very bad.

Mr. Spencer objects to the metric system as, although it is a century old, it has not yet, even in France, entirely driven out some of the old denominations and units. In reply to this it may be said that little research is required to reveal innumerable examples of persistence in the use of words and things for more than a hundred years after their betters were available. The next objection is worthy of more serious consideration, and it has been given (for it has long been discussed) a good deal of weight by many thoughtful people. It refers to the alleged universal tendency to continual bisection, thus leading to the use of halves, quarters, eighths, sixteenths, thirty-seconds, sixty-fourths, and, sometimes in subdividing the inch, one-hundred-and twenty-eighths. To begin with, the existence of any such inherent tendency is quite open to discussion, but, without going into that, it is at least plain that it has never shown itself in the evolution of systems of weights and measures. In all, as well as in the English money units and denominations, there is no indication whatever of this "natural tendency" toward continual halving. It is a common practice, possibly growing out of a tendency in some degree natural, to continually bisect a single unit. What possible objection can there be to speaking of a half or a quarter or an eighth of a mile or rod or yard or inch, if one wishes to do so? And no more can there be to a half, quarter, eighth, or sixteenth of a kilometre, kilogramme, metre, gramme, centimetre, millimetre, etc., nor, again, to the use of such fractional parts as thirds, fifths, or sevenths, if they seem to be desirable. But to compare the two systems in this respect one should undertake such a problem as finding the value of a third, quarter, fifth, or eighth of a mile or a ton in rods, yards, feet, and inches, or hundredweight, pounds, ounces, drams, and grains, and then do the same thing in the metric system. The enormous superiority of the latter will at once be revealed. On the other hand, it cannot be denied that there is, and has been for many years, a strong tendency toward the decimal subdivision of single units, even among users of our own clumsy system of weights and measures. In weight, for instance, in the United States it has been long ago decided that a hundredweight shall be a hundred pounds, as its name implies, and not a hundred and twelve as in England, and our ton is almost universally two thousand pounds, although they still retain the traditional ton of twenty-two hundred and forty pounds in certain transactions; and as if to emphasize the utter absurdity of the thing, in some parts of New England a "long" or "gross" ton of coal weighs twenty-two hundred pounds. In many extensive calculations the avoirdupois pound is adopted as the only unit of weight, and fractional parts are expressed in tenths, hundredths, etc.; and this is found to reduce the labor of such calculations enormously. In length measure the tendency toward decimalization is still more marked. In land surveying and in engineering operations it is now the all but universal practice to use the foot as the unit and multiply and divide decimally.

In accurate machine-shop practice the use of decimal divisions is becoming almost universal. The unit is generally the inch, and it is subdivided into tenths, hundredths, thousandths, etc. "True to one hundredth, or one thousandth, or one ten-thousandth of an inch" is heard a hundred times oftener in every shop than "correct within a sixty-fourth or a hundred and twenty-eighth," etc., and it means not only greater convenience of expression and measurement, but an actually higher standard in precision of workmanship. To the objection, then, that the tendency of mankind is toward a binary rather than a decimal division of units, which is almost the only one offered by Mr. Spencer worthy of serious consideration, we may briefly reply by saying that even granting it to be a fact, it has no bearing whatever on the questions of ratios and relations of units, which is what distinguishes one system from another; that such a tendency may find expression in one system as well as another, and certainly with infinitely greater facility in the metric system than that now in use among English-speaking people; and, furthermore, that the estimation of fractional parts by tenths or hundredths is believed by many who habitually work that way to be both easier and more accurate than by halves, quarters, eighths, etc., and as a matter of fact the prevailing tendency is away from the latter and toward the former.

Mr. Spencer resorts to quotation, and brief reference should be made to the arguments set up by some of his authorities. The letter of Sir Frederick Bramwell contains some remarkable statements. His assertion that the new system will require "more figures to perform ordinary sums than on our present system, when rightly applied," is so grossly incorrect, as may be easily proved by a few examples, that no time need be spent in controverting it. The same might be said of his further assertion that it is more likely to lead to error, and, above all, to the common error in placing the decimal point. This last statement is frequently made, and it is worth while, therefore, to call attention to the fact that in all ordinary business transactions in which the decimal system is used, and in all calculations for that matter, the error of a misplaced decimal point is one of the rarest of all errors. This is because of the generally quick and certain detection of such a mistake. To misplace the decimal point by the smallest possible amount is to change the result tenfold, and usually so great an error is instantly detected by means of approximate knowledge or other checks. Take the United States' own money system, for example; it is perfectly safe to say that other mistakes are a million times more frequent than a persistent, undetected misplacing of the decimal point. Yet, curiously enough, considerable weight has been given to this

*Extracts from a paper by Prof. T. C. Mendenhall, President Worcester Polytechnic Institute, in Appleton's Popular Science Monthly.

objection to the metric system of weights and measures, which is, on the contrary, vastly less liable to errors of computation than that now in use. Sir Frederick also furnishes an extensive extract, giving the views of the first Napoleon on the subject of reform in weights and measures. Many of the stock arguments are repeated, and if they had not been thrashed over long ago it would be perfectly easy to take them up one by one and show their absurdity. An entire lack of any really accurate knowledge of the subject and an absence of any sort of conception of the simplest metrological principles are shown in a single quotation: "A toise, a foot, an inch, a line, a point, are fixed portions of extensions, which the imagination conceives independent of their relations one to another; if, then, we ask for the third of an inch, the mind goes into instant operation. The length called an inch is divided into three parts. By the new system, on the contrary, the mind has not to divide an inch into thirds, but a metre into a hundred and eleven parts." It is difficult to properly characterize such utter nonsense, but, fortunately, the French people, who are to-day the leaders in the world's metrology, were not obliged to take their science, as they were most other things, from the first consul. A group of the most distinguished Frenchmen of any period had perfected this system, even in the very midst of the bloody revolution which closed the last century, and when their final report was made in an address to the legislative chambers by the celebrated La Place, the event was described by Adams as a "spectacle at once so rare and so sublime . . . that not to pause for a moment, were it even from occupations not essentially connected with it, to enjoy the contemplation of a scene so honorable to the character and capacities of our species, would argue a want of sensibility to appreciate its worth. This scene formed an epoch in the history of man. It was an example and an admonition to the legislators of every nation and of all after times."

Mr. Spencer also quotes from an auditor who had to go over £20,000 of accounts, and who was "very thankful that it was not in francs." At first blush it seems entirely natural and creditable to him as an Englishman to rejoice that his twenty thousand is in pounds sterling rather than francs; but, after all, his remark is only a reflection of that not uncommon English sentiment that the imperial monetary system is more perfect than any other in the wide world. This sentiment is doubtless the outgrowth of national pride and intellectual inactivity; it is not entertained by the majority of the more thoughtful and scholarly Englishmen, and, furthermore, it is in every respect false. It is unnecessary to consume time in quoting the opinion of England's most distinguished scholars, to show this.

I must be content to stop without reference to a few other points raised by Mr. Spencer, for they are essentially all of a kind. There is a sentiment underlying much of his argument, to which I must briefly refer, however, because it has shown itself in other recent discussions of this subject. I refer to an anxiety lest the "poor man" be in some way injured by the proposed reform. It has come to be the fashion in all political or economical controversies to exhibit a consuming interest in the poor man's welfare; indeed one marvels that there should continue to be any poor, so universal and so intense appears to be this anxiety to shield them from all harm. Fortunately, the so-called "poor man" is not so blind to his own interests as some would have it appear, and he is quite alive to the fact that the proposed metrological reform is fully as important to him as to anybody.

Finally, it ought to be understood that the advocates of the metric system do not assume that it can come into use immediately or without considerable hardship. It took nearly a century to fairly establish the decimal money system in the United States, which no one would now think of giving up. During all this time old units and denominations continued to be used in a lessening degree, although not authorized by law. Something of the kind must occur in the transfer from our illogical, brain-destroying, time-consuming system of weights and measures for the more perfect system for which it is sure to make way. Furthermore, they heartily welcome and desire the presentation of all arguments against or objections to the metric system, believing that the more widely it is known and discussed the more supporters it will have. They expect to meet occasionally such "intelligent prejudice" as is exhibited by Mr. Herbert Spencer, whose contribution to the discussion of the subject is sure to be considered in the years to come as altogther the most remarkable to be found in any time or tongue.

THE PRACTICAL MAN.

Weights of square and round bars of wrought iron in pounds per lineal foot.—Kent.

Iron weighing 480 lbs. per cubic foot. For steel add 2 per cent

Thickness or Diameter in Inches.	Weight of Square Bar One Foot Long.	Weight of Round Bar One Foot Long.	Thickness or Diameter in Inches.	Weight of Square Bar One Foot Long.	Weight of Round Bar One Foot Long.
0			4	53.33	41.89
1-16	.013	.010	1-16	55.01	43.21
1-8	.052	.041	1-8	56.72	44.55
3-16	.117	.092	3-16	58.45	45.91
1-4	208	.164	1-4	60.21	47.29
5-16	326	.256	5-16	61.99	48.69
3-8	469	.368	3 8	63.80	50.11
7-16	.638	501	7-16	65.64	51.55
1-2	833	.654	1-2	67.50	53.01
9-16	1 055	828	9 16	69.39	54.50
5-8	1 302	1.023	5 8	71.30	56.00
11-16	1 576	1.237	11-16	73.24	57.52
3-4	1.875	1 473	3-4	75.21	59.07
13-16	2.201	1 728	13-16	77.20	60.63
7-8	2 552	2.004	7-8	79.22	62.22
15-16	2 930	2 301	15-16	81.26	63.82
1	3 333	2 618	5	83.33	65.45
1-16	3 763	2.955	1-16	85.43	67.10
1-8	4 219	3 313	1 8	87.55	68.76
3-16	4 701	3 692	3 16	89.70	70.45
1-4	5 208	4 091	1-4	91.88	72.16
5-16	5 742	4 510	5-16	94.08	73.89
3-8	6.302	4.950	3-8	96.30	75.64
7-16	6.888	5.410	7-16	98.55	77.40
1-2	7 500	5.890	1-2	100.8	79.19
9-16	8 138	6 392	9-16	103.1	81.00
5-8	8 802	6 913	5-8	105.5	82.83
11-16	9 492	7 455	11-16	107.8	84.69
3-4	10 21	8.018	3-4	110.2	86.56
13-16	10 95	8.601	13-16	112 6	88.45
7-8	11 72	9 204	7 8	115.1	90.36
15-16	12 51	9.828	15-16	117.5	92.29
2	13.33	10.47	6	120.0	94.25
1-16	14 18	11.14	1-8	125.1	98.22
1-8	15 05	11.82	1-4	130.2	102.3
3-16	15 95	12 53	3-8	135.5	106.4
1-4	16.88	13.25	1-2	140.8	110.6
5-16	17 83	14.00	5 8	146.3	114.9
3-8	18.80	14.77	3-4	151.9	119.3
7-16	19 80	15.55	7-8	157.6	123.7
1-2	20.83	16.36	7	163.3	128.3
9-16	21.89	17.19	1-8	169.2	132.9
5-8	22.97	18.04	1-4	175.2	137.6
11-16	24.08	18.91	3-8	181.3	142.4
3-4	25.21	19.80	1-2	187.5	147.3
13-16	26.37	20.71	5-8	193.8	152.2
7-8	27.55	21.64	3-4	200.2	157.2
15-16	28.76	22.59	7-8	206.7	162.4
3	30.00	23.56	8	213.3	167.6
1-16	31.26	24.55	1-4	226.9	178.2
1-8	32.55	25.57	1-2	240.8	189.2
3-16	33.87	26.60	3-4	255.2	200.4
1-4	35.21	27.65	9	270.0	212.1
5-16	36.58	28.73	1-4	285.2	224.0
3-8	37.97	29.82	1-2	300.8	236.3
7-16	39.39	30.94	3-4	316.9	248.9
1-2	40 83	32.07	10	333.3	261.8
9-16	42.30	33.23	1-4	350.2	275.1
5 8	43.80	34.40	1-2	367.5	288.6
11-16	45.33	35.60	3-4	385.2	302.5
3-4	46.88	36.82	11	403.3	316.8
13-16	48.45	38.05	1-4	421.9	331.3
7-8	50.05	39.31	1-2	440 8	346.2
15-16	51.68	40.59	3-4	460.2	361.4
			12	480.	377.

To compute the weight of sheet steel—Divide the thickness, expressed in thousandths, by 25; the result is the weight, in pounds, per square foot.

For weight of sheet brass, add 11 per cent.

For weight of sheet copper, add 10 per cent.

THE WATER CURTAIN.

For many years the water curtain has been in use in Canada as a means for fire protection. Some years ago when a building next door to the T. Eaton Co., Toronto, was burned down the value of this device was most apparent, since unshuttered windows within a few feet of the flames were not even cracked by the intense heat, because of the sheet of water which fell from the roof and from the tops of the windows where perforated pipes had been arranged for the purpose. That this is looked upon as a great novelty is evidenced from the following paragraph, quoted from a recent issue of The Engineering News, New York:

"Another form of protection against exposure fires which has recently been employed is the outside fire sprinkler system. This has been applied on an elaborate scale to the costly new public library building for the city of Chicago. As many of our readers doubtless recall, water curtains have been frequently suggested as a means of fire protection, but this is, we believe, the first instance, in America at least, in which such a device has actually been constructed."

GREEN'S ECONOMIZER.

Editor CANADIAN ENGINEER:

Referring to the article in your June issue, entitled "A Dismissed Engineer," it would appear that the utility of the economizer was not what it was guaranteed to be to the city of Toronto. The question of the utility of the economizer to the city of Toronto, and of the sufficiency of the tests made, is to be thoroughly sifted in an action brought by us, and now pending, and we are fully prepared to show when the proper time comes that the economizer has done everything that it was warranted to do. We consider it a little unfair on the part of your paper in the meantime to publish extracts from Judge MacDougall's report, which is based upon an investigation entirely ex parte as far as our company is concerned.

THE GREEN FUEL ECONOMIZER CO.

Matteawan, N.Y., August 15th, 1899.

NEW CATALOGUES.

Cranes—The Northern Engineering Works, of Detroit, Mich., U.S.A., have sent out their first catalogue, consisting of twenty pages, which illustrate three motor electric travelling cranes, compressed air travelling cranes, portable pendant winch, hand chains, jib cranes of the cantilever and single braced types, air hoists. Tumblers of different styles suitable for foundry use are also shown. It is sent free to enquirers. G. A. True is general manager; the engineer is Ed. S. Reid, late of the Whiting Foundry Equipment Co., Chicago.

The Gutta Percha Co.'s pocket catalogue for 1899-1900 to hand, and it illustrates the various styles of rubber footwear made by this well-known concern, under their famous trade mark, "Maltese Cross." Almost every conceivable style of footwear is shown from children's rubbers to lumbermen's, sporting and firemen's gum boots.

SEPTIC TANK SYSTEM OF SEWAGE TREATMENT.

A great deal of interest is being taken in Ontario in the Septic tank system of sewage treatment. C. H. Rust, C.E., city engineer of Toronto, has recommended the Septic tank system for adoption in that city. The following description of two plants on this system now in operation in the United States is taken from a recent issue of The Engineering News, New York:

The largest Septic tank for the treatment of sewage thus far built in the United States is located at Verona, N.J., seven or eight miles from Newark. It receives the sewage of a branch of the Essex County Lunatic Asylum, and was designed and built by Jas. Owen, M.Am.Soc.C.E. The tank and supplementary filter beds were put in operation about November, 1898, and now receive the sewage from a large building containing some 300 patients and attendants. Quite a large roof area is connected with the sewerage system, the connection having been made before it was decided to treat the sewage. The amount of sewage treated daily is placed by Mr. Owen at 40,000 gallons. The tank is of concrete, and is 18 x 50 ft. by 10 ft. deep, giving a capacity of about 65,000 gallons. It has a trapped inlet, from a small grit chamber 4 feet square. There is a man-hole at about the center of the top of the concrete roof of the tank, but the cover of this is sealed up with cement. The tank effluent passes out through a 16-inch pipe, beneath the surface on to four filter beds. Each bed is 14 feet square, with concrete walls and bottom. At the intersection of the division walls of the bed is a sheet iron distributing pan, 3 to 4 feet in diameter, with a bottom curved upwards, and a notch in one side to allow the sewage to flow on to the bed. The pan was provided with a device designed to cause it to revolve automatically through one-fourth of its circumference whenever the bed receiving sewage became filled, but the device has not proved successful, and the pan is now revolved by hand. The filtering material was originally composed of sand at the top, then coke, then gravel, resting on a layer of large-sized stone, making a total depth of about 5 feet. This choked up in about three months' of operation, which was in winter weather, making it difficult to do any cleaning. All the material, except the large stone, has been replaced by 3½ feet of coke, with 6 inches of coarse sand at the top. The walls of the bed extend about 16 inches above the top of the sand. The tank has not been cleaned since it was put in use. The amount of sludge which has accumulated is unknown, as the tank is sealed. To the eye the tank effluent, as it flows over the distributing pan, has a cloudy or slightly milky appearance, but it seems to be pretty free from suspended matters. On the bed, however, a depth of 9 to 12 inches has a brownish or yellowish look, like water standing in a muddy pool. A silver coin, held between the thumb and finger, could scarcely be distinguished at a depth of 5 or 6 inches. The tank effluent flowing from the pipe or dipped up in the hand from over the bed, had a strong sewage smell. One of the filter beds, which was in need of being raked, showed a thin skin of dark, almost black, sludge, which had curled up in small patches, on partially drying out. This, too, had a strong sewage smell. The effluent from the filter beds is discharged into a ditch leading into a small stream. This effluent at a point where it issued from the beds also had a pretty strong odor, less decided than that directly from the tank. As the four beds have a combined area of only 784 square feet, they work at an average rate of more than 2,000,000 gallons per acre, per day, assuming a total daily flow of 40,000 gallons. This is very high. With the present relation between daily flow and tank capacity the sewage remains in the tank about 40 hours, assuming proper distribution through the tank, and making no allowance for sludge accumulation. Perhaps a shorter stay in the tank or a more thorough aeration, or both, would enable the filter beds to do better work. As it is now, there is reason to believe that the sewage reaches the beds in such a state that little or no nitrification could be expected, except at a very low rate of filtration. It is realized that the beds are overworked, and a supplementary filtering area is proposed. The present plant cost about $2,600.

In March, 1898, after careful study into the more recent English method of bacterial purification of sewage had been made for the city of Columbus, Ohio, and their trial then recommended, beginning on a small scale, an opportunity was afforded Alvard & Shields, engineers, Chicago, to install a plant of this character for a large Golf and Polo Club house near Chicago. The soil of this vicinity being a very heavy clay, was not adapted to intermittent subsoil irrigation, which had already been ineffectually tried, and the expense of procuring sand, which had to be hauled from a great distance, debarred the consideration of artificial sand filters to any considerable extent. No dilution was afforded for the effluent, as the stream which passed through the grounds became entirely dry during the entire season when sewage purification would be needed. The only available location was necessarily within full view of the club house, and within 100 feet of a teeing ground; so that it was important that the method adopted should be such as to enable the plant to be concealed from view.

Under these circumstances, nitrification on prepared coke beds was decided upon, and a first installation, based upon a sewage flow of 2,000 gallons per day, was installed in a little more than two weeks. The plant consisted of a large flushing tank, with a capacity of 850 gallons, into which the sewage from the main building discharged; a basket screen of wire of 1-inch mesh, removing the large matters such as waste paper, rags,

lemon and orange peel and the like. After leaving this tank, the sewage, somewhat staled, was discharged periodically upon a single nitrification bed, in a brick chamber 12 feet in diameter, and 3 feet in depth, filled with coke, the particles of which were of chestnut size and smaller. Perforated drains led from beneath this bed to an automatically-controlled valve in a man-hole outside of the chamber, so arranged and operated by means of differentiated inlets and a float as to discharge the contents of the bed after it had remained in contact with the coke some 2½ hours. The effluent from the coke bed thence passed on to an artificial sand filter, 30 inches deep, carefully prepared of graded and suitable materials and well underdrained, and proportioned for a rate of flow of 250,000 gallons per acre per day. The object of this room arrangement was, that such an anaerobic action as might be possible would be set at work in the flush tank, which was made large for this reason; and that the partially broken-down organic matter would be the more readily acted upon in the nitrification bed. Subsequent experience led us to highly value this feature of the design and extend it. The sand filter was only added as a precautionary measure. The sewage from the very first was of high concentration owing to the insufficiency of the water supply—rough determinations showing free ammonia, 3.40 parts per 100,000; albumoid ammonia, 0.75; chlorine, 8.00. Notwithstanding this, bacterial activity was rapidly set up in the nitrification bed, and in two weeks was at its best, the effluent being bright and odorless, the sand filters evidently having little if any work to do. This condition was maintained all during the early part of the season. Among the minor practical difficulties which developed was the fact that the sewage would form a membrane over the top of the coke bed. No attention whatever was given to the plant by the attendant of the club, and if neglected for many weeks, this membrane would become water-tight. When this film was broken open the sewage would rush down violently into the coke bed, showing that it was filled with air beneath. So long as the sewage could be got to go down into the coke, it would purify itself readily; and during the entire summer no deposit was to be found at the bottom of the bed—a difficulty which had been feared at the outset. During the summer the particles of coke each became covered over with a thin film of nitrogenous matter, slightly reducing the liquid capacity of the bed; but evidently increasing bacterial activity. It is estimated that with the average flow of sewage for the summer, not less than 440 cubic yards of sludge of 90 per cent. moisture were entirely consumed in this little space of 340 cubic feet. The purification effected in the early work of the plant was over 95 per cent. of organic matter removed.

In the early part of September when some 4,000 gallons of very concentrated sewage were being purified daily, the bacterial efficiency of both coke and sand bed failed; and the results which followed brought into more prominent light its recent excellent efficiency. Where golfers had frequently passed over it and by it in scores every day without observing its proximity it became so odorous as to make its presence known for several hundred feet around. Steps were promptly taken to temporarily divert the sewage, and the filter was given a rest for about a week. The area of the secondary sand filter was slightly increased, and a new form of filling and emptying device for the coke bed was introduced; the original one having proved unreliable through corrosion. Otherwise no change was made in the plant, the coke not even being removed from its bed. At the end of the week it was in good condition, and sewage was again introduced in gradually increasing quantities. It was noticeable that the coke freed itself from impurities much more rapidly than the sand filter. The results of the season's experience having met the most sanguine expectations of the builders it was determined to increase the capacity of the plant, both to reduce the rate of flow and to meet new demands upon it from an additional building erected in the spring of this year. Accordingly it was remodelled entirely and enlarged so as to be fully capable of purifying 6,000 gallons per day. The new plant consisted of a septic tank capable of holding the maximum flow of 24 hours, built of brick, arched and sodded over. The original flush tank was dispensed with, and the sewage passed direct to the septic tank without intervening screen or grit chamber. The effluent from the septic tank passed to two square nitrification beds by means of an alternating device which has now worked successfully for six months. The nitrification beds were of brick, 12 feet square with an effective depth of three feet. One was filled with the coke used the previous year, which was found when removed from its old bed to be as clean and bright as when it had been deposited there the year before. The other bed was filled with fine cinder about pea size. The rate of flow through the nitrification beds was (intermittently) 500,000 gallons per acre per day, or about 2 cubic feet of coke to 1 cubic foot of sewage per day. The alternating device is so regulated that the beds fill in from five to six hours when running at the maximum rate. The beds have seemed to become effective after a film of nitrogenous matter forms upon the particles of coke. The effluent automatically and alternately discharged on to the sand bed used last year, which, however was not enlarged at the time the plant was remodelled. The new design seemed to be fully equal to the occasion, and most effective purification resulted even without the use of the sand bed.

A rather curious and singular disaster, however, befell it, which caused much trouble and no little study for the time being. After having operated many weeks in a most satisfactory manner it suddenly began to fall. The most noticable failure occurred in the effluent from the septic tank, which became opalescent, and the sewage in the nitrification beds rapidly filled with a large amount of black sooty filaments, denoting decomposition. It was evident that something was wrong, but for the moment just what could not be determined. A little later there began to appear on the surface of the nitrification beds a lime sludge, which ran over from the septic tanks. Investigation showed that this was nothing less than the calcium carbide ash from a large acetylene gas plant which has recently been installed, and which used 100 lbs. of carbide daily, the saturated residue of which had been daily deposited in the main sewer. It was the most convenient way for the attendant of the acetylene plant to get rid of his own troubles, but it made several weeks of exceeding trouble for others. The ash from the calcium carbide in such quantities has enough lime to completely destroy bacterial activity in the septic tank or nitrification bed, to say nothing of its being a material which is most disastrous to sewers themselves by choking and filling them with its deposit.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

Annual Dinner of Toronto No. 1.

The 13th annual dinner of Toronto No. 1 branch of the above association was held at Webb's restaurant on Thanksgiving eve, and was the most successful reunion yet held. The tables in the main hall were filled and an "overflow" table in the adjoining room well taken up, about 150 guests being present. The dinner was served in Harry Webb's best style, and was much enjoyed by all.

The chair was occupied by the president, Herbert Terry, and on his right sat Mayor Shaw, Ald. Hallam and Ald. R. C. Pettigrew of Hamilton, representing the Hamilton branch of the C.A.S.E. On the chairman's left sat A. M. Wickens and Ald. Frame. After welcoming the guests and mentioning the fact that of all the members of this association in Toronto only two were without full employment at the present time, the toast of the "Queen" was proposed and received with enthusiasm. John Alexander sang "Stand by the Old Flag," which was loudly cheered. The toast of "Canada Our Home" was coupled with the name of Ald. Hallam, who was warmly received. In responding he said that as an adopted son of Canada he always felt it impossible to do justice to the varied charms and the vast resources of this immense country, and he could only say that he loved it. There was no man who came to this Dominion willing to work that could not make a living and save something over. Thousands who came here poor are now wealthy. A country larger than the United States and only 300,000 square miles less than the whole of Europe had great possibilities. It was a land celebrated alike for its liberty and its loyalty to the Old Land (cheers), and he was glad that in the present South African crisis Canadians were ready to stand for the integrity of the Empire. We all revolted at the conduct of the Turks to the Armenians, but the conduct of the Boers towards the Uitlanders in the Transvaal was of the same tyrannical nature. The Boers were, in fact, the Turks of South Africa. He was glad to tell them that the city council had declared a half holiday on the occasion of the departure of the South African contingent, and

he hoped they would all turn out with flags. Referring to personal matters he felt justified in speaking of his long services in the city council, and to what he had done for the public library, and it was no secret that he would be a candidate for the mayor's chair for 1900. (Voices—"We'll elect you.") He was glad to feel that he had the support of so many of those present, and he should do all in his power to promote the prosperity of the city. Geo. W. Grant and John Alexander sang the duet, "The Standard on the Braes of Mar," and were enthusiastically encored. "Toronto Our City" was coupled with the names of Mayor Shaw and Ald. Frame, who were well received, and in their remarks referred to the great advantages and bright prospects of the Queen City. Wm. Prestwick then sang a comic song and received an encore. "The Manufacturers" was replied to by G. R. Baker, of Westman & Baker, who was glad to see so bright a silver lining to the cloud that had hung over manufacturers for some years. The good times were well indicated by the price of pig iron, which had gone up from $12 a ton to $24, and was likely to go up to $30. Steel was also up in proportion, and when these materials rose it was a barometer showing expanding trade. He was glad that this association was not a labor organization, and took no part as a body in strikes and agitations, but aimed only to improve the minds of its members. This was a hopeful sign. There was no trade in which there were so many botches as in the machinists' and mechanical trades. Speaking of the need of technical education, he was surprised how few men could read a mechanical drawing, and the technical school here should have its work extended. He hoped the machinists and mechanics would take pattern by the stationary engineers in the matter of study for self improvement, for he held that every mechanic ought to have an ambition above the bench. J. D. Powers then sang "Brown October Ale," and was recalled. John Mayne was also called on and said trade in his line was remarkably good, and he did not know a boiler maker in Canada who was out of a job. Competition, however, was still keen, but he was proud to say that Canada was now competing with the greatest countries in the world in the production of machinery and other manufactures. Many members of the C.A.S.E. had become convinced of the value of the association, as some of them would not now be in the positions they occupy had it not been for the connection. The engineer was now getting to be a man of responsibility and influence, and many a manufacturer looks to him for advice on questions of coal consumption, electricity, gas, compressed air and kindred questions. Ald. Hallam here said he might remind the members that the city council had not lost sight of the technical school matter, but had already voted $75,000, but he wanted $25,000 more for the extension of the work. The site for the new school had already been secured, and as soon as this additional grant is made the work could go ahead. The matter was now in the hands of Ald. Lamb, whom the members should stir up. He (Ald. Hallam) had done all he could to promote this work, which he felt had already borne fruit, as he knew an instance where a young man who got the rudiments of his training at this school was now filling an important place in New York at a salary of $5,000. Mr. Gray then gave a trombone solo which was well rendered. A telegram was then read from City Engineer Rust regretting that absence from the city prevented his being at the dinner, but wishing them a pleasant time. The toast of "The Executive" was responded to by Robt. C. Pettigrew, of Hamilton, the executive president, who said he was proud to have the honor of the presidency of this association, for he looked upon it as the greatest organization in existence. It was great because it was educational, and because its objects were solely the intellectual and technical improvement of its members. Bro. Wickens, the secretary, was preparing question papers to be sent out quarterly, and this will do much to help the associations in rural districts. Alluding to the progress of his city he humorously referred to Toronto as the northern suburbs of Greater Hamilton. He closed by commending the work of the Toronto Technical School. Mr Alexander then sang "Kings of the Road." Bro. Geo. C. Mooring, executive vice-president, followed, explaining briefly the relations of the general executive to the different branches, and said the Toronto branches were more flourishing than at any time in the history of the association, and its finances as well as membership were in better shape than ever. He urged the need of legislation, which would put the stationary engineer upon as good a footing as the marine engineer, and hoped something would be done at the next meeting of the Ontario Legislature. Bro. Charles Moseley, treasurer, also spoke, saying that all members interested would find in the September number of The Canadian Engineer the draft of the law which it was proposed to submit to the Legislature. There was some prejudice yet to overcome, but all could do something to remove this from the minds of members of Parliament. The association was prospering, new branches were being formed, and it was only a matter of time till our legislators would fall into line. There was now a permissive law in Ontario under which certificates of qualification were issued, but this did not fill the bill. There were numbers of second-hand steam plants in operation in this province, and there should be some sort of inspection enforced, which would prevent the use of such dangerous engines and boilers. Mr. Prestwick sang a comic song, "Old Clo'," which was encored. "The Sister Societies" was replied to by Robt. Mackie, of Hamilton branch, and Alex. McRae, of Toronto No. 2, who spoke briefly and to the point. The latter, speaking of the need of some standard of qualification for the steam engineer, mentioned a case where a boiler was taken out of an old tug, after being condemned, and sold to a man who erected it in a saw-mill. If this boiler was condemned in a tug, where it might have endangered the lives of three or four men, why should it not be condemned in a saw-mill, where it would endanger the lives of thirty or forty men? After a song by Messrs. Grant and Alexander, Bro. Pettigrew proposed "Toronto No. 1," coupling it with the names of Bros. Terry, Wickens and Huggett. The first named gentleman relegated his speech to Bro. Wickens, who expressed his strong desire to see the cause of technical education advanced more rapidly in Toronto. No business required to advance more rapidly than the engineering and mechanical trades. If a man embarking in some new line of manufacturing wanted some appliance never used before for a certain purpose it was to the mechanical man he would go to get the idea put into practice. A man who could work out practical ideas was worth something to his employer, and the more he improved the more valuable he became. There was nothing visionary in the value of technical knowledge. He saw young men before him who were living evidences of the advantages of study on practical lines, and especially of membership in this association. He believed in the idea of mutual help. There was no use in a man hiding his light under a bushel—in fact the man who did so generally had not much light to hide. As to legislation there was no reason why a stationary engineer should not be licensed. If it was necessary to license a marine engineer, who might have half a dozen lives in his care for four or five months in the year, it was surely necessary to license a stationary engineer who might have as many hundred lives in his hands the whole year round. It might be laid down as an axiom that there was no such thing as the explosion of a boiler by accident, so that skill in the handling of boilers and engines was all important. Bro. Huggett followed on the same lines, and in regard to the Technical School question claimed that the association ought to have a more direct and larger representation on the board than it was proposed to give. After the press had been responded to by representatives of The Canadian Engineer and Canadian Electrical News the gathering broke up about 1 a.m.

HAMILTON BRANCH, C.A.S.E.

A meeting of the Hamilton branch of the Canadian Association of Stationary Engineers was held October 17th, in their hall. The attendance was fairly large. The meeting marked the commencement of an educational movement in connection with the society, to extend throughout the fall and winter, and to consist of a series of papers on educational topics of particular value to the membership of the association. Among other subjects treated will be mathematics, mechanics, engineering and electricity. A paper, the first of a number on mathematics to be given by C. R. T. Fessenden, of the Westinghouse Co., dealt exhaustively with the subject of fractions. In the beginning it was emphasized that it was important that all engineers and mechanics should have a thorough knowledge of this subject, as the character of their work frequently required the use of difficult fractions. By blackboard examples he explained and illustrated the principles and use of fractions, from the elementary common fraction to problems in decimals, and gave a num-

ber of valuable rules on short methods, and the avoiding of complications in working them out. After the conclusion of the paper Mr. Fessenden satisfactorily answered and explained a number of questions on the obtaining of areas of circles, and the reduction of inches to decimals. It was announced that his next paper would probably deal with mensuration and formulas for obtaining square and cube root. On a motion by R. C. Pettigrew and George Mackie, a vote of thanks was tendered Mr. Fessenden for his paper. Mr. Pettigrew said that it was the intention of the provincial executive of the association to publish and distribute circulars containing questions on educational topics of particular interest to engineers and mechanics, and that the taking up and answering of such questions would be a prominent feature in the educational movement in connection with the local branch.

On Oct. 19th at 10.30 the C.A.S.E. and O.A.S.E. executive held a special joint meeting in the C.A.S.E. hall, Toronto. The arranging for some minor changes in the details of the clauses referring to inspectors in the draft of proposed bill (draft given in the September number of The Canadian Engineer), and also the advisability of engaging proper legal counsel to represent them before the committees who would act in harmony with the solicitor of the O.A.S.A., was discussed. It was decided to issue a circular to the subordinate associations containing a request for funds sufficient to put legislation through properly, and it was decided that the circular would also have embodied in its contents the question of a plebiscite to ascertain the wishes of the C.A.S.E. members as to whether an annual or biennial convention would be held in future. Full report of the discussion was given in our September number regarding this matter, and this is the vote decided at that time to be taken. The C.A.S.E. executive present were: President Pettigrew, Chas. Moseley, treasurer; A. C. Mooring, vice-president; John M. Dixon, Robt. Mackie, A. M. Wickens, W. Wadge and Thos. Elliott were the representatives of the O.A.S.E.

THE REED MANUFACTURING CO., ERIE, PA.

In our advertising columns our readers will find an illustration of a new malleable iron pipe vise with tool steel sectional jaws. This pipe vise is a radical departure from the old style so familiar to all plumbers and engineers, and has the maker's guarantee that one will outwear four of any solid jaw pipe vise. Another article which to engineers is of very great interest is the Economy automatic eccentric, cross-head and wrist pin oil cup for marine, traction, and stationary engines. This cup has now been on the market six years, and it is claimed that no device attached to the rotating and oscillating part of an engine can compare with the Economy in perfect lubrication and saving of oil. It is to the crank pin, the cross-head, the eccentric, and in fact to any part of the engine where there is sufficient motion to throw the oil from the bottom to the top of the cup, as the automatic sight feed lubricator is to the cylinder over the old common suction cup. Many of the large shops and factories are using these cups exclusively; the Carnegie Company having nearly five hundred in use, and the L.S. & M.S.R.R. Company have used about one thousand. Its makers state that with the old type of cup more oil is wasted during the fourteen hours the engine is idle than is used while it is running. As the Economy cup feeds only while the engine is in motion, and the oil is sprayed from the top of the cup in minute particles, it absolutely prevents any waste while the engine is idle. It is a well-known fact that the least bit of good oil will keep a smooth pin cool. The trouble with all other cups is to supply sufficiently small quantity of oil to do the work and feel secure that the cup will continue to feed. With the Economy you need not set the feed, only to remove the feed cap and replace it with another of a larger or smaller feed hole as the case may require. This can be done at any time in half a minute, without the use of any tools. After the proper feed is once ascertained it will never change; the oscillating motion puts the oil into openings, and air compression completes the operation. Long-continued use does not affect its reliability. A guarantee to save 50 per cent. in oil is given with each cup by the makers. The construction is claimed most perfect and simple.

The Clark pipe hanger is another noticeable product of the Reed Mnfg. Co., and is said to be the cheapest as well as the best of all pipe hangers. They are designed for use on steam, water, gas and soil piping, are made of high grade malleable iron, and they are unbreakable. Piping can be hung closer to ceiling than with any other hanger it is claimed, and adjustment to any required length can be had by means of a hanger bolt, piece of pipe and coupling. It can be put up or taken down in an instant, the hanger bolt being put up first and hanger clasped over it. Hanger bolts are furnished with hanger unless otherwise ordered. The Clark adjustable beam hanger is another type also made. The Reed Manufacturing Company, Erie, Pa., will send circulars fully illustrating and describing these goods, on application.

DISCRIMINATION IN CARBON DUTIES.

Editor CANADIAN ENGINEER:

We are in receipt of your letter of the 28th, and in reply beg to state that the situation is briefly this: We have been selling our 7-16 by 12-inch carbons of second quality at approximately $5 per thousand, ½ by 12-inch at $6, f.o.b., Cleveland. The duty on our goods was formerly based on face of invoice, but since the last revision in the tariff the valuation was increased to an average price of $8 per thousand for 7-16 inch regardless of billing price, and either $8.50 or $9 for the ½-inch size. The duty was also advanced from 25 per cent. to 35 per cent., based on the new valuation. The same carbons are sold in this country at same prices as we have first mentioned, and in some cases even a little less where large quantities are ordered, but as a matter of fact, there are less of the second grade carbons used in this country than in Canada, for the reason that the American consumer has no duty to contend with, consequently his carbon cost does not run up and he can, therefore, use the first grade carbon rather than to put up with a little trouble in trying to use second grade carbons. In Canada the tendency has been to use second grade carbons in order to keep down expenses. By the time our second grade carbons are landed in Canada, the duty and freight makes them cost even more than the American consumer pays for first grade carbons. This is the reason why nearly all of the Canadian trade has been accustomed to using second grade carbons. The Canadian customs are placing a valuation on these carbons on the basis of the selling prices of first grade carbons in this country. This is where the discrimination or unjustness of the revision comes in. Yours very truly,

NATIONAL CARBON CO.

ADVANTAGES OF COKE OVER COAL AS A FUEL FOR GENERATING STEAM.*

BY ARTHUR C. FREEMAN, WALTHAM, MASS.

The item of fuel being one of the large items of expense entering into the cost of manufacturing, is necessarily one in which every manufacturer is interested. The most important fuel in use at the present time is coal. The cases where wood is used are exceptional, and becoming more so as the population increases, and timber becomes scarce and more in demand for structural purposes. It is only recently that the question of coke has been seriously considered by manufacturers here in New England, although large quantities are annually consumed in the West, where it enters into competition with both hard and soft coals. One of the reasons why this fuel has not been more extensively used in New England is possibly due to the fact that it is only recently that its manufacture has been attempted on a commercial scale. The heretofore high cost has also been one of the reasons for its no more general adoption.

Coke, as generally understood, is carbonized coal, or the carbon of the coal left in the ovens after expulsion of the volatile substances by heating, or, as it is generally called, coking. The volatile substances, viz., tar, pitch, gas, ammonia, etc., are smoke producers. About one-third of the weight of the coal is thrown off in the coking process; the carbon in one and one-half tons of coal is therefore largely represented by the carbon in one ton of coke. The manufacture of coke is generally carried on in heaps, retorts, or ovens, and is spoken of as gas or oven

*A paper read before the Cotton Manufacturers' Association, at the annual convention in Montreal.

coke, referring, of course, to its mode of production. In the case of oven coke, the object is not so much to prepare coke as it is to obtain gas, tar and various other products. In the present day, coal is converted into coke almost exclusively in ovens constructed for this purpose, it having been found that by the use of ovens the operation is more readily conducted, and that a larger quantity and better quality are obtained.

Coke is prepared for various purposes: For increasing, or rather concentrating the quantity of carbon in the coal, and thus obtain a fuel which will yield a more intense heat than coal. For the purpose of converting coal into a fuel which does not become pasty when ignited. Coal in consequence of this property being unsuitable for blast, cupola, or other furnaces. Well burnt coke, or oven coke, is a hard, uniform, compact, solid mass, difficult to break, and not honey-combed, or very porous. Its color is black-gray or iron-gray, with a dull, metallic gloss. Good coke should contain very little sulphur. When discharged from the ovens, coke consists chiefly of columnar pieces about eight inches long and four or five inches thick, with smaller pieces mixed in. By a specially designed crusher, it is then broken up into various sizes, as egg, nut and pea. For boilers it is generally used as it comes from the ovens. The advantages claimed for this fuel are that it is clean, there being no dust, no dirt, no smoke, and but few ashes. It kindles quickly, makes the hottest fires, is easily controlled, and requires but little draft. It does not clog the boiler flues, thus obviating the frequent and expensive cleaning. This secures the complete utilization of the heat value of the fuel. It is smokeless. When looking at the stack of a boiler fired by coke, it is impossible to determine whether the boiler is running or not. This absence of smoke, especially around bleacheries and other places where expensive and fine work is carried on, and in thickly populated communities, where soot and smoke are so destructive, is a matter of no little importance.

Its general use would probably do away entirely with the smoke nuisance encountered in some of our large cities, and would add immeasurably to the comfort of those who travel by steam where coal is used. At the present time this question of smoke from soft coal is receiving the very serious consideration of the municipalities of some of our large eastern cities. New York is seriously threatened with the same affliction that has beset Pittsburg and Cincinnati, and Boston is fast losing its prestige as a clean and healthful city. Fine buildings are being injured by smoke, and what is far worse trying to the individual, the interior of houses likewise suffer from the same cause. From a hygienic standpoint the health of citizens must in a measure be impaired by breathing in this soot. With the volatile substances removed, the dangers from spontaneous combustion are entirely eliminated; and it can be kept with safety anywhere, and for any length of time. Coke is a fuel unlike bituminous coal in its composition, and therefore requires somewhat different treatment when used in place of that fuel. It resembles hard coal, and should be fired in a somewhat similar manner. Some changes in the ordinary grates will probably be necessary to burn coke with maximum economy and convenience, but it can be burned on ordinary grates. The following suggestions will be found useful in learning its management:

1st. In building the fire, put the coke on lightly and often, until the fire is seven or eight inches thick. An eight-inch fire will make steam much better than a heavier one. 2nd. It is better not to disturb the top of a coke fire, therefore when firing, spread the fuel evenly, to keep the fire level. 3rd. Shaking bars are very suitable for burning coke, and they should be shaken frequently. If dead bars are used, a light poker should be run under the fire frequently to keep clinkers from clinging to the grate, and to keep them broken up. A poker is better than a slice bar for this purpose, as it is lighter and more easily handled. The object is not to bar up the fire, but to detach small pieces of clinker, and prevent them from forming and running together. 4th. It is advisable to keep water in the ash pit, or to introduce a jet of steam.

Following is the result of a test made by the Mutual Boiler Insurance Co., of Boston, on the evaporative powers of coals and coke compared with the best soft coals. Steam making value is the only criterion used in making up the table below. The coke is that of the New England Gas and Coke Co., and the value is based on boiler tests, and on proximate and ultimate analysis:

COMPARATIVE EVAPORATIVE POWERS OF COALS AND COKE COMPARED WITH THE BEST SOFT COALS.

Soft Coals.	Combustible.	Probable p.c. of Refuse	Coal as Bought.
Pocahontas	100	7½	100
Best Cumberland	100	7½	100
Average Cumberland	98	7½	98
New River	95	5	97
Clearfield	95	10	92
Pittsburg (Youghiogheny)	88	6	89
Ohio (Hocking Valley)	80	6	82
Nova Scotia	83	10	81
Anthracite steam coals and coke—			
Coke (New Eng. Gas & Coke Co)	91	9½	89
Lykens Valley Pea	96	15	88
Lykens Valley Buckwheat	96	18	85
Wyoming Pea	95	15	87
Wyoming Pea, Buckwheat	95	18	84
Schuylkill Pea	93	15	85
Schuylkill Pea, Buckwheat	93	18	82
Lehigh Pea	91	15	84
Lehigh Pea, Buckwheat	91	18	81

The boiler tests are full length tests carefully made on the type of boilers in general use, and with grates suitable for the coke. They indicate a value for the combustible portion of 86 per cent., both when considering the evaporation alone, and when allowance was made for the information given by gas analysis. The proximate analysis indicated a value of 92 per cent. and the ultimate analysis indicated a value of 93 per cent., from which figures we have estimated that 91 per cent. was a fair estimate for the evaporative power of the combustible. The percentage of refuse averaged 9½ per cent. in three boiler tests. Another boiler test showed over 20 per cent. due to unsuitable grates for the size of coke used; but 9½ per cent. appeared to be a fair figure for proper grates, making the evaporative power of the coke 89 per cent. on the basis used in the table.

The capacity of the coke appears to correspond to that of anthracite coal of similar size, and to be about 80 per cent. of the capacity of the best soft coals, such as Cumberland, Pocahontas and New River. By capacity is meant the ability to evaporate steam with a given grate area and draft pressure, irrespective of the economy. In regard to the behavior of the coke, it was found to clinker slightly in a manner similar to the Dominion coal from which it is made, but nowhere near as badly as some of the pea and buckwheat and anthracite coals frequently used.

SAND FILTRATION OF PUBLIC WATER SUPPLIES.*

BY R. S. LEA, ASSOC. M. CAN. SOC. C. E.

(Continued from last issue).

In England and the continent, however, the experience of many years is available, this method, as we have seen, having been used long before the rationale of the process was understood. In England particularly, many of the supplies are from surface waters made available by means of large storage reservoirs; and in nearly every instance the stored water is filtered before being supplied to the consumers. The new supply for Liverpool, which was put into operation in 1892, comes from an artificial lake formed by damming the Vyrnwy River in Wales. This lake is 68 miles from Liverpool, and lies in a sparsely inhabited district remote from railways or towns. Yet the water from this source, safe as it may appear, is also made to pass through a sand filter before being allowed to enter the distribution pipes. In Germany the use of any surface water without filtration is prohibited by law.

But in addition to the high esteem in which the method is held wherever it has been used, there are certain health and mortality statistics which are perhaps of even greater significance. The typhoid fever death rate is now considered to be a pretty good index of the purity of a city's water supply. Keeping this in mind the tables prepared by John W. Hill, M.Am.Soc.C.E., were examined, and the death rate from typhoid

*From a paper read before the Canadian Society of Civil Engineers.

fever of 66 cities in United States and Canada over a period of years studied. These figures show that the lowest rates are for those cities deriving their supply either from springs or from surface waters which have been subjected to sand filtration carried out in accordance with the strictest modern requirements. They also indicate the general inferiority of the water supplied to American cities when compared with European supplies. Chicago and Berlin have about the same population, yet the typhoid death rate of the former is more than ten times that of the latter; or, in other words, the chances of contracting typhoid fever in Chicago are ten times as great as in Berlin. Out of the many instances showing the beneficial effect of filtration with regard to the prevalence of certain infectious diseases, two of the most noted will be cited, one in Europe and the other in America..

Hamburg and Altona, though under separate governments, practically form one continuous city with a joint population of about 800,000. They both draw their water supplies from the sewage polluted Elbe River upon which they are situated. Altona is the nearest to the mouth of the river, and its water intake being three or four miles further down is below the outfall of both its own sewers and those of Hamburg. The Hamburg intake is about two miles above the city. In 1892 an epidemic of cholera occurred, during which Hamburg, with a population of 622,530, had 17,975 cases with 7,611 deaths, while Altona, with 143,000 population, had during the same time 562 cases and 328 deaths, and in many of the cases credited to Altona the disease was contracted in Hamburg. Wandsbeck (20,000), just across the river from Hamburg, enjoyed the same immunity as Altona. Both of these places purify their water supplies by sand filtration, while in Hamburg the only attempt in that direction was the employment of settling basins. A filtration plant was, however, in process of construction at that time, and was put in operation in May, 1893, since when the typhoid rate has diminished from about 30 to 6 per 100,000. The other case is that of Lawrence, Massachusetts, which is situated on the Merrimac River, a few miles below Lowell. In spite of the great dilution, the water of this river which supplies both cities is seriously polluted by the sewage draining into it from the towns built along its banks; and as a consequence the typhoid fever rates in both places were unusually high. In Sept., 1893, a system of intermittent sand filtration was completed. The effect upon the health of the citizens is shown in the following figures:

Year.	Deaths from Typhoid Fever per 100,000 Population.
1887	114
1888	114
1889	127
1890	134
1891	119
1892	105
1893	80
1894	47 (23)
1895	31 (17)
1896	19 (4)
1897	16

For the last four years the figures in the brackets represent the number of deaths among people (principally mill operatives) who were accustomed to drink canal water without filtration; so that the actual reduction in the death rate which should be credited to the filters is much greater even than the figures indicate. Many attempts have been made during the last 12 or 15 years to improve upon the sand filter, but so far without success. Some of the methods invented involve less expense for construction or give better chemical results; but the thoroughness of the bacterial purification effected by the sand bed has not been equalled by any.

The only one of these methods which has been used to any considerable extent is the American or Mechanical System of Filtration, which is employed in several places in the United States. Sand is the material used in this process also, but it is contained in cylindrical iron tanks. The water enters the tanks, usually under pressure, and is driven through the sand at a rate 50 times as great as the maximum allowed in the case of the filter bed. For this reason the latter method is sometimes referred to as Slow Sand Filtration. With such a high rate the surface film must be formed artificially; and this is done by adding a solution of alum to the water, which forms with the carbonates present a white flocculent precipitate. Such a filter will, of course, soon become clogged; but it can be quickly and easily cleaned without removing any of the sand from the tank. The results produced, under test conditions at least, are undoubtedly good; and it has the advantage over the filter bed of somewhat lower first cost. On the other hand, the charges necessary for repairs and depreciation will be considerably higher on account of the less permanent character of its construction; so that if proper allowance could be made for this, the difference in the actual cost of filtering a given quantity of water by either process would not be very great. In any case it will probably not involve an addition of more than 10 per cent. to the ordinary cost of the water. Indeed, calculations have been made showing that if a proper valuation is put upon the lives saved by its use, the construction of a filtration plant is often in the long run a source of economy. Such considerations, however, seem quite unnecessary. A city's water supply should be pure, wholesome, and attractive in appearance, just as the streets should be clean and well paved, and the public buildings architecturally beautiful. Besides, having gone to the expense of obtaining a public water supply, indifference with regard to its purity or unwillingness to provide for it would seem to be utterly unreasonable; especially when it can be secured for such a comparatively small increase in the total cost as sand filtration involves.

It would be much cheaper, of course, to purify only that part of the supply which is used for purely domestic purposes. But that would require a double set of distribution pipes; and we should also lose the satisfaction of knowing that the whole of the public supply could be used for any purpose with perfect impunity so far as health is concerned. And when we consider that the expense of filtering the whole supply only amounts to two or three cents per month for each consumer, it will scarcely be considered excessive.

METAL IMPORTS FROM GREAT BRITAIN.

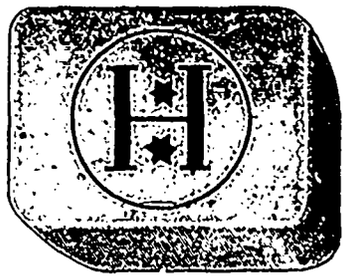
The following are the sterling values of the imports from Great Britain of interest to the metal trades in September, 1898-99, and the nine months ending September, 1898 and 1899:—

	Month of Sept.		Nine Months ending September	
	1898.	1899.	1898.	1899.
Hardware	£2,803	£2,018	£17,420	£15,188
Cutlery	3,704	5,538	39,545	39,304
Pig iron	273	5,792	8,386	14,607
Bar, etc.	405	3,288	6,676	14,257
Railroad	2,147	55,311	9,119	113,902
Hoops, sheets, etc.	8,059	16,203	44,181	84,510
Galvanized sheets	4,371	8,952	43,712	49,069
Tin plates	5,268	23,394	101,437	141,660
Cast, wrought, etc., iron	3,188	7,435	19,850	39,750
Old (for re-manufacture)	—	1,766	3,574	4,190
Steel	4,203	16,917	39,388	69,677
Lead	4,192	1,657	23,918	34,097
Tin, unwrought	417	4,218	12,292	18,433
Cement	2,859	3,704	17,683	22,643

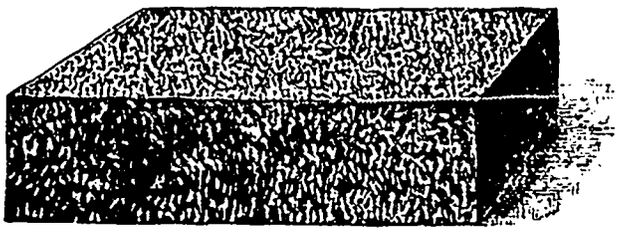
DRAUGHTING.

A most important feature of any engineering or manufacturing establishment is its draughting room. Here the draughtsman prepares the designs for work or machinery it is intended to construct, and on the character and accuracy of the draughtsman's work a great deal depends. For the successful prosecution of his work the artist requires good light and suitable materials. Up to a recent date no Canadian house carried a stock of mathematical instruments and drawing materials adequate to the wants of a manufacturing country such as Canada has grown to be, and supplies of this character have had to be procured from abroad, involving delay and much expense to obtain the same, and not always with satisfactory results. The Art Metropole, of Toronto, has been gauging the wants of manufacturers and engineers in this respect, and has been steadily adding to the stock such articles as leading draughtmen regard as the best for their purpose. And to-day, it is claimed, there is no better stocked house in America in this line than the Art Metropole, Toronto. Here will be found mathematical instru-

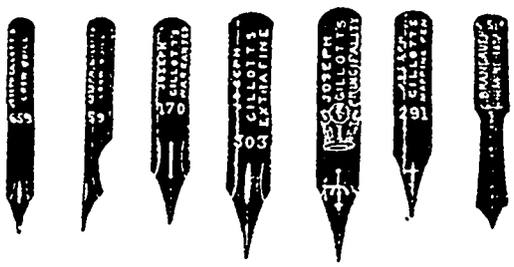
ments of the highest grade, the most popular brands of tracing linen blue print papers, drawing and detail papers, as well as all the lesser accessories such as pens, inks, pencils, rubber, etc., any of which articles may discomfort the user very much, if not of good quality. We illustrate a few things, seemingly small in themselves, but in many cases of great value to a draughtsman.



For example all can appreciate a good rubber, and we here show what is claimed to be the best draughtsman rubber, namely, Hardtmuth's grey pliable rubber, which erases readily without abrasion of the surface of the paper. It may be had in a variety



of sizes. Another rubber indispensable to the artist is a good sponge rubber, which makes a soiled drawing look fresh and new with a few strokes. This is also illustrated. Pens suitable for artists and draughtsmen are also hard to procure, but this



firm carries a full line of everything in this department. Those which are claimed to be the most popular pens for draughting, and for illustration are shown here.

LITERARY NOTES.

A very convincing little circular is that issued by the B. F. Sturtevant Co., of Boston, Mass., regarding their exhaust heads, which shows that by the utilization of centrifugal force in the operation of this head, the water is thrown outward with 1,000 times the force exerted upon the steam, and is thereby absolutely separated from it.

"Modern Buildings of New York City" is the theme of one of the most artistic publications issued in the interests of the valve trade. It contains some fifty pages, and beautiful photo-engravings of these buildings are shown, amongst which we notice the New York Life, The Empire, Commercial Cable (21 stories), Postal Telegraph, St. Paul Building (25 stories), Siegel, Cooper Co., New York Athletic Club, New York Herald, and Hotels Majestic, Netherland, Savoy, Manhattan, Waldorf, Astoria, and numerous other modern edifices in which are used Fairbanks' valves. The Fairbanks' Co., Montreal, will be pleased to furnish architects (names of architects erecting these buildings is given), and others interested in valves, etc., with a copy of the book. We congratulate the Fairbanks' Co. in sending out such a work of art so free from ordinary common place advertising features, which so often mar a book of this nature.

Wall Cards, H. & J., published by the Mechanics' Supply Co., Quebec, are original in composition, and of great service to parties doing a combined French and English plumbers' supply trade, as well as to machinists' tool users. The names of tools, fittings, furnaces, and valves are given in both languages. The printing is excellent, and the general appearance of the cards make them worthy of a place in any office, machine or plumbing shop.

The annual report of W. Bell Dawson, C.E., engineer-in-charge of Tidal Surveys in Canada, has been issued in the usual Blue Book. It is a report of progress, and as such is welcome. The department is most ably conducted, and the criticisms which are made of its works from time to time in the public press are only criticisms of the small amounts devoted to this service by the Government, not to the way it is expended.

"Small Engines and Boilers" is a manual of concise and specific directions for the construction of small steam engines and boilers of modern types, from 5 h.p. down to model sizes for amateurs and others interested in such work, by E. P. Watson, late editor and proprietor of The Engineer, author of "Modern Practice," "Manual of the Hand Lathe," etc., etc., illustrated, 30 full page working dimensioned drawings. Published by D. Van Nostrand Co., New York.

"The Growing Time in Canada" is the title of a handsomely illustrated pamphlet issued by The Toronto Globe. The public buildings of the various provinces and of the Dominion are shown, as well as points of interest in the chief cities. The engraving was done by Moore & Alexander, Toronto, and is a very fine display of the art.

"The Statistical Year Book of Canada for 1898" has been issued from the Government printing bureau by the Dominion Department of Agriculture. This is the fourteenth year of issue, and, as on each former appearance, the Year Book is more interesting than before. A neat folder gives statistics for the past thirty years of the population, revenue, expenditure, public lands, lands in cultivation, postage, shipping, imports, exports, public debt, expenditure on railways and canals, the working expenses of all our railways, their earnings and profits, full details of chartered banks and postoffice savings banks. Geo. Johnson, F.S.S., is to be congratulated upon the excellent work he is doing in preserving in so compact and convenient form the statistical history of the country.

"A Practical Course in Mechanical Drawing," by William Fox, M.E., assistant professor of Applied Mathematics, College of the City of New York, and Chas. W. Thomas, M.E., instructor in descriptive geometry and drawing in the College of the city of New York. There are numerous illustrations. Published by D. Van Nostrand Co., New York.

Our advertising department has received four handsome wall cards from Jenkins Bros., Boston, Mass. They are issued in the interest of their well known valves, "Jenkens'" '96 packing, and the Sellars' pattern injector.

"The Canadian Home Journal" has passed under the management of a new company, called the Canadian Home Journal Co., and the current number shows that the change is to the advantage of its readers. This journal is now the official organ of the Women's Historical Society, and that department has much information of value to every Canadian who cherishes the records of the country's past. The subscription remains the same, $1 a year.

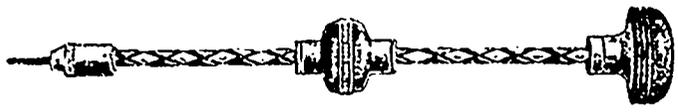
The 5th edition of the Mechanics' Pocket Memoranda is to hand, published by Colliery Engineer Co., Scranton, Pa. This book is very complete and compact, and is intended for machinists, steam engineers, electrical workers and anyone interested in these and kindred branches will find it of great value. It is bound in pebbled black leather, pocket inside cover, gilt title and edges, and rounded corners.

We have just received No. 4, September, 1899, of Specifications, a half yearly publication of over 700 pages issued, for architects, surveyors and engineers when specifying, and for all others interested in building. This most valuable work is published by the proprietors of the Builders' Journal and Architectural Record, London.

—Leaks in metallic pipes can be easily stopped by a patching device, a U-shaped yoke being passed around the pipe, with the ends of the yoke carrying a detachable head, with a screw in the centre, which presses a cushioned patch over the leak.

NEW RECIPROCATING DRILL AND RATCHET SCREW DRIVER.

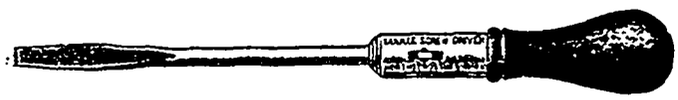
This drill is used in drilling steel, iron, brass and other metals, as well as all varieties of woods. It is so constructed that the drill runs continuously to the right, during both the forward and backward movement of the driver, hence drills continuously. The pressure to feed the drill is had by the pressure against the head of the tool, which is provided with ball bearing to reduce the friction. There is no tool made just like it. The chuck is of new design, has three jaws, is accurate, strong, durable, and will not get out of order. No drill points are furnished with this tool—the user furnishing such quality, style and size best suited for work required in wood, iron, steel, brass, etc.



NEW RECIPROCATING DRILL.

The chuck will hold any drill with shank 3-16-inch diameter or less. To open or close chuck move the driver up to chuck, push down the catch in lower end of driver, which holds fast the driver on spindle. After drill is put in chuck and tightened, push up the catch, releasing driver from spindle so it can be moved backward and forward to operate drill. The movement or traverse of the driver is 8½ inches, and full length of tool (without drill), is 16 inches. Every tool guaranteed.

Most ratchet screw drivers made possess one very serious drawback in practical use—that the friction in ratchet mechanism is so great that unless a screw is first made tight in wood by some other means the ratchet screw driver turns the screw out in its backward movement as fast as it is driven in by the forward movement of the driver. The screw is simply turned in and out, no progress made in getting it to its place. The blade of driver instead of remaining at rest during backward movement is carried back by the excessive friction of ratchet and pawls, and the screw with it, except the screw is first driven tight enough in wood to outbalance this friction. Most ratchet drivers are quite noisy in their operation, unhandy to change from right to left, made in a quite limited range of sizes and too high in price to make them popular. This ratchet driver over-



RATCHET SCREW DRIVER.

comes all these faults. The friction in ratchet mechanism is so slight as to be hardly felt, the backward movement is as easy as in a good "stem-winder" and just as noiseless. When a screw is screwed in it stays where put, and is not screwed out when handle is turned back. The construction of ratchet and pawls is such that neither can bend or break, wear or get out of order, and permits a very compact arrangement. The adjustment for right or left hand is exceedingly simple. For right hand or to ratchet a screw in, push the slide to end of slot towards bit; for left hand or to ratchet a screw out, push the slide towards handle of driver. If the slide is placed midway between ends of slot, the blade is held rigidly and the driver can be used as an ordinary screw driver with fixed blade. The materials and workmanship are of superior quality in every detail. The drivers are strong, durable, handsomely finished, and are made in these sizes, 2, 3, 4, 5, 6, 8, 10, 12 inches. North Bros., Philadelphia, are the makers of these new and interesting tools, and in the Aikenhead Hardware Co.'s advertisement on another page, others just as unique will be found illustrated.

—The city of Nicolaiev, Russia, is about to install a complete system of water supply. The water is to be taken from a depth of sixty to ninety feet by a series of wells, a collecting basin, and a standpipe. The plant is to be based upon a supply of about 2,000,000 gallons per day of eighteen hours. The pipe will amount to about sixty miles, dimensions not stated, with all necessary connections and fireplugs. Two pumping engines are specified, with Babcock & Wilcox boilers. Tenders for the plant as a whole or in part will be received for about four months. Interested parties should communicate with V. A. Datsenko, mayor of Nicolaiev, Cherson, Russia.

PAVEMENTS BETWEEN STREET RAILWAY TRACKS.*

BY C. H. RUST, CITY ENGINEER, TORONTO.

In 1891 the exclusive privilege of operating the street railways in the city of Toronto, for a period of thirty years, was disposed of to a company now known as the Toronto Railway Company. The clauses of the agreement, made between the city and the company, that refer more particularly to this paper, read as follows:

"The purchaser shall maintain the ties, stringers, rails, turnouts, curves, etc., in a state of thorough efficiency and to the satisfaction of the city engineer, and shall remove, renew or replace the same as circumstances may require, and as the city engineer may direct. When a street upon which tracks are now laid is to be paved in a permanent manner, on concrete or other like foundation, then the purchaser shall remove present tracks and sub-structures, and replace the same, according to the best modern practice, by improved rails, points and sub-structures of such description as may be determined upon by the city engineer as most suitable for the purpose, and for the comfortable and safe use of the highway by those using vehicles thereon, and all changes in the present rails, tracks and roadbed, construction of new lines or additions to present ones, shall be done under the supervision of the city engineer and to his satisfaction.

"(A). In the event of the purchaser desiring to make any repairs or alterations to the ties, stringers, rails, turn-outs, curves, etc., on paved streets, the purchaser shall repave the portion of the roadbed so torn up at his own expense.

"11. When the purchaser desires or is required to change any existing tracks or sub-structures for the purpose of operating by electric or other motive power, approved by the city engineer and confirmed by the council, the city will lay down a permanent pavement in conjunction therewith upon the track allowance (as herein defined) to be occupied by such new tracks and sub-structures. This shall first apply only to existing main lines and thereafter to branch lines or extensions of main lines and branches, as and when the city engineer may from time to time recommend and the city council may direct and require; but such tracks as are now laid on a permanently formed roadway must, when so required as aforesaid, be changed by the purchaser as hereinbefore provided, without any change of roadbed being made or any expense occasioned to the city thereby."

Under the terms of the agreement the company pays the city treasurer $1,600 per annum per mile of double track and 8 per cent. of the gross receipts. When the receipts exceed $1,000,000, 10 per cent. is to be paid. To raise the money for constructing these permanent pavements debentures were issued, payable in ten years, and the revenue derived from the mileage and percentage of gross receipts is used to pay interest and sinking fund upon these, the total amount of bonds issued up to the present time being $1,210,776, and the annual payment to provide interest and sinking fund is $149,136. This is at present very nearly the amount received from the street railway company, but as these pavements between the tracks will last for a much longer period than ten years, in a few years there should be a considerable revenue derived from this source.

A great diversity of opinion has arisen as to the meaning of the word "permanent," used in connection with pavements. In 1888 this question was in the High Court of Justice before Judge Rose, in a case brought by the corporation of Toronto against the old Toronto Street Railway Company, and after a considerable litigation it was finally settled, without, however, the judge giving his opinion as to the meaning of the word "permanent." When the present company obtained its franchise the interpretation of the word was again subjected to a great deal of discussion, and in 1893 the continuation of the work of changing the rails by the company and the construction of the pavements were postponed from April until August, pending a settlement as to the meaning of this word. The writer has always taken the ground that in this case the word "permanent" refers to pavements with a concrete foundation, and this has since been taken as the meaning of the word as mentioned in these clauses. It is a great pity that this word should be so frequently used in connection with pavements. It would certainly be well in future cases to state explicitly what is a permanent pavement.

*A paper read before the American Society of Municipal Improvements, at the Toronto Meeting.

In compliance with the provisions contained in the previously mentioned clauses, in the spring of 1892 plans and specifications for paving the track allowance on King, Queen, Yonge and other streets were prepared, and on the 28th of June, 1892, the Street Railway Company laid down a temporary track on King street, west of Simcoe street, and the contractor for the pavements commenced work. The work of changing the tracks and constructing permanent pavements on the above streets was carried on continuously until winter set in (with the exception of a week's intermission during the time of the Industrial Exposition). The amount of track taken up and relaid this season was 29.9 miles. The rail adopted by the company and approved of by the city was a 6½-inch steel girder rail, weighing seventy pounds to the yard, and having a web three-eighths inch in thickness and a base of 4½ inches wide. A slight alteration was afterward made in the size of the base, making it 5 inches instead of 4½ inches. The rail now weighs about seventy-three pounds to the yard. From experience since gained a heavier section of rail should have been used. The following are the quantities required to build one mile of single track: 114.714 tons of seventy-three pound rails per mile; 5.85 tons of fish plates, seventeen pounds per pair; 1,800 cedar tires; 1 ton of spikes, three-quarters pound each; 1 ton of bolts and nuts, one pound each.

The work of constructing these pavements and the laying of new rails was carried on continuously until the work was practically completed in 1894, there being only a few extensions constructed since. In constructing these new pavements the street railway company took up the old rails, tamped the gravel under the ties, put down new rails and lined and leveled them and the paving contractor did the rest of the work. It may be of some interest to give the amount of work done in each year, the average cost per lineal foot (the width paved being 15 feet for double track), the average rate of progress per day and the different classes of paving material:

1892—29.9 miles single track cost..... .....$322.555 00
1893—26.1 miles single track cost..... 392,030 00
1894— 9.8 miles single track cost..... 116.942 61

Average cost per lineal foot of double track for the different classes of pavement during these years was:

Asphalt $5 23
Granite 2 43
Brick 4 21
Cedar blocks 3 83

This covers the cost of stone or scoria toothing, but where granite was used the contractor was allowed to relay the blocks that were on the street. Average amount done per day was:

Asphalt—131 lineal feet of double track.
Granite—56 lineal feet of double track.
Brick—73 lineal feet of double track.
Cedar blocks—96 lineal feet of double track.

In 1894, on McCaul street, the method of construction was slightly altered as to the system of laying the granite or scoria toothing. It was found that when the blocks were laid as headers and stretchers that the water lodged next to the block and assisted in destroying the asphalt. To prevent this it was decided to lay scoria blocks, 4 x 5 x 9 inches, parallel to the rail, and then lay the asphalt. The practice had been to lay the first six inches of concrete up to the bottom of the rail, then lay the scoria blocks in mortar, and finally put in the remainder of the concrete. On this street a change was also made in this respect. The whole of the concrete was put in at once and while still wet scoria blocks were pounded into it and left to consolidate with the concrete before the asphalt was laid down. In any extension constructed since 1895 wooden ties have been dispensed with and steel tie bars, 2 x ⅜ inches, placed 6 feet apart, are used, the rails being laid on a solid bed of concrete 8 inches in depth by 20 inches wide. This method of construction is much superior to the first type adopted, and is largely used in other cities. After an experience of six years of the different materials used, it is evident that, with the conditions existing in Toronto, asphalt is not a suitable paving material to be used between street railway tracks. After having been down only four years, the asphalt commenced to disintegrate. This was at first more noticeable where the asphalt joined the toothing, but it was not long before the rest of the material between the rails commenced to wear into holes. This was due probably to the following causes: The lack of proper foundation under the ties, which was shown by the settlement of the rails in several places, the impossibility of properly tamping the asphalt between the toothing, and the constant watering of the asphalt, rendered necessary by the dust caused by the passage of the cars, and also by climatic conditions. Upon King street, which was the only asphalt pavement laid without toothing, a rut was soon formed, rendering necessary constant repairs. The fact of the lip of the rail not being quite as high as the head, and the gauge of the track being 4 feet 10⅞ inches instead of 4 feet 8½ inches, probably had a great deal to do in forming this rut.

As previously mentioned, the first pavements were laid in 1892, and in 1897 it became necessary to commence tearing up the asphalt and replacing it with granite, scoria or brick, depending upon the amount of travel upon the street. By 1900 all the asphalt between the rails will have been replaced by a more permanent material. Up to the present time seven and one-half miles of this work have been done. As these asphalt pavements were guaranteed for five years, arrangements were made with the contractors whereby they substituted brick for this asphalt, and were paid $1.50 per square yard, but afterward when the guarantee expired the price paid for substituting scoria for asphalt averaged about $2.40 per square yard. This includes taking up the old asphalt and also four inches of concrete. The amount of money spent up to the present time in substituting a more permanent material than asphalt is $137,340.19. In putting in blocks in place of asphalt, the asphalt was first taken off and then the concrete had to be picked out so as to afford room for the blocks, which were bedded on a cushion of sand. Fortunately, on most of the streets the concrete was put in between the rails just to a depth of four inches, and it was not a very difficult operation to take this out. Granite is no doubt the most durable material to use between street railway tracks, but owing to the very strong opposition of the cyclists to this material not so much of it was used as the department would have liked, and scoria blocks, imported from England, were used instead. On streets where there was not a great deal of travel Canadian bricks were used. Cement grout was almost entirely used for this work, although some filling was done with paving pitch; but cement was found to be the most satisfactory. Owing, however, to the impossibility of stopping street car traffic while this work was in progress, it was very difficult for the filling to become properly set. On King street during the past summer, where we were substituting scoria block for the asphalt, a portion of the pavement between the tracks was laid with concrete. It has been down now some two months, but not long enough to know the result.

ORIGIN OF THE B. GREENING WIRE CO., LTD.

Wire, in its various manufactured forms and composition, has during the present generation become so important a factor in some of the great inventions and engineering achievements, that a few facts as to its uses and manufacture may be interesting to many of our customers. It is but within the present century that the electric telegraph, the ocean cables, the great suspension bridges, the useful and important telephone, the electric railroads, the drilling for natural gas, the making of wire fencing, nails, etc., has created such an immense demand for this article, and stimulated an industry that now takes such high rank amongst manufactures. The art of making wire has been traced back to the year 1700 B.C. Gold wire decorated the sacerdotal robe of Aaron. A specimen of wire, made by the Ninevites 800 years B.C., is exhibited at the Kensington museum, London, England. Homer and Pliny referred to similar productions in their early writings. Metal heads, with imitation hair of wire recovered from the ruins of Herculaneum, are in the Portici museum, Naples. From such remote eras up to the fourteenth century, wire in its general acceptance was produced by hammering out strips of metal, and not by the process of "drawing," as now practiced. In the middle ages this industry was extensively pursued, and the artificers thus engaged were termed wiresmiths, but in the earliest days of the manufacture, gold, silver and bronze appear only to have been used. It is substantiated by technical records that the present method of drawing wire was practiced in the Lenne district of Germany during the fourteenth century, and about the year

1350 a wire drawing mill was erected at Nuremburg by a man named Rudolph.

The first needle manufactory in France was started by an Englishman, named Christopher Greening, at St. Omer, and the town recently celebrated the four hundredth anniversary of the establishment of the industry. About 1600 A.D., it is recorded that at Tintern Abbey on the Wye, pins and needles were manufactured by one Greening by name. In the year 1630, a proclamation was issued by Charles I. to the effect that the home industry had made such advancement that further imports of wire were prohibited. About the year 1799, Nathaniel Greening, who came from Tintern Abbey, commenced the manufacture of wire at Warrington. A few years later the firm of Greening & Rylands was established, and carried on business until the year 1840, when the partnership was dissolved. Mr. Greening taking his sons into business, and establishing the firm of N. Greening & Sons; Mr. Rylands' sons continuing under the firm name of Rylands Bros. It was with the firm of Greening & Rylands that the late Benjamin Greening, second son of N. Greening of the firm in question, served a seven years' apprenticeship as a wire drawer; then, commencing business for himself, continued until 1858, when he removed to Canada, and became one of the pioneers of the wire industry here. Under the firm name of B. Greening & Co. he commenced the drawing of wire, wire weaving and rope making, and for many years carried on a successful and steadily increasing business until his death, in 1877, when he was succeeded by his son, S. O. Greening, who built new works and added many new lines to their already extensive business. In 1889, the B. Greening Wire Co. was incorporated as a joint stock company, with Samuel Owen Greening as president, since which time important additions have been made to their buildings and machinery.

THE BRITISH FIRE PREVENTION COMMITTEE.

The British Fire Prevention Committee, under whose auspices tests of materials are conducted, was founded after the Cripplegate fire, London, of November, 1897, and was fully incorporated early this year. It counts a membership of some five hundred architects, surveyors, engineers, municipal officers and others directly or indirectly interested in fire prevention, among whom are practically all the leading members of the professions named. The offices are at No. 1 Waterloo Place, London, Eng., where the library includes a file of some sixty technical journals from all parts of the world, and the regulations and building acts, etc., of all countries. Regular publications are issued by the committee (over thirty already having appeared), and business meetings are frequently held. The founder was Edwin O. Sachs, the architect. Three of the primary objects of the committee are defined as follows: To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures. To use its influence in every direction towards minimizing the possibilities and dangers of fire. To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable. It is with the idea of meeting these objects that a testing station has been established. The present tests will be of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability will be assured, records being mostly taken automatically, or by photography, and the temperatures being easily regulated by the application of gas. All reports on tests solely state the bare facts and occurrences, with tables, diagrams and illustrations, and on no account will reports include expressions of opinion, or any expressions that might be read as comparisons or criticisms. The general arrangement and direction of the tests is in the hands of the executive, and in accordance with certain principles laid down after careful study and experiment. The actual tests are attended by the members of the council and the members of the committee in rotation, care being taken that the attendance is always thoroughly representative of the technical professions primarily interested in the specific object under investigation. As to the financial aspect of the station, the establishment expenses have been met by a special subscription which will also cover the expense of conducting tests of general technical interest. Tests with patented materials, makers' systems, etc., are, however, subject to a scale of charges, but these charges are so figured as to only just cover the actual cost. The services of the members conducting or attending tests are given gratuitously. In the first six months' work at the testing station no less than 27 official tests were undertaken, and the results were embodied in twenty reports. Of these 27 tests there were 5 with floors, 2 with ceilings, 4 with partitions, 7 with doors, 8 with glazing and 1 with treated wood.

THE ENGINEER'S AND ELECTRICIAN'S HAND-BOOK, A REFERENCE DIRECTORY.

When the Canadian Association of Stationary Engineers a couple of years ago determined to publish a hand-book containing in a convenient and compact form a great deal of information which successful stationary engineers require to be familiar with, a number of our leading business houses, whose specialties brought them in close contact with the engineers, such as engine and boiler makers, pump manufacturers, manufacturers of dynamos and electrical machinery, elevators, radiators, belting, oils and engineers' supplies generally, took the opportunity which was offered them of placing their products permanently before the engineers, by securing advertising space in the volume. At the same time they gave tangible expression of their good will to the engineers by aiding in the publication of a work which was of great educational value. The time that the stationary engineers had at their disposal for preparing such a work being limited, it was found necessary to place the business arrangements in the hands of an agent. The members of the committee which had the matter in hand were, James Milne, A. E. Edkins, E. J. Philip, Albert Slute, A. M. Wickens, S. Thompson, Wilson Phillips and Secretary J. W. Marr, of Toronto No. 1. The agent employed was W. H. McCarthy, with whom the committee made such liberal terms as to entirely free the society from the suggestion that the venture was in any sense a commercial one. The educational features were paramount and the good of the order was the only object sought.

The agent's work was rendered very light, because the credentials given him by the committee were in most cases sufficient to ensure his receiving an order for an advertisement when they were presented to those, who, as we have already explained, were interested in the success of the project. We append the letter of introduction given the agent:

Toronto, Sept. 13th, 1897.

To Whom it May Concern:

This is to certify that the bearer, W. H. McCarthy, is authorized to solicit advertisements for Engineer's Manual, to be published under the auspices of the Canadian Association of Stationary Engineers, and to collect for such advertisements on publication of said Engineer's Manual.

Given under our hand and seal this 13th day of September, 1897.

[Copy].

JOHN W. MARR,
Secretary, Toronto No. 1, C.A.S.E.

Notwithstanding the generous terms made with the agent, the association was obliged, after the publication of the book, to enter suit in the Division Court, their solicitors being McLean & McCallum, to recover from Mr. McCarthy the small percentage of the receipts which was the association's share of the proceeds. It was impossible to serve a writ, however, as the defendant had removed himself beyond the jurisdiction of the Court.

A short time ago one of our advertisers handed us a shabby volume without an index, whose pages were not even numbered. Its title set forth that it was the Engineer's and Electrician's Hand-Book and Reference Directory, provincial edition, compiled and published by the Reference Publishing Co. The reading matter in the volume seems to have been selected at haphazard from former hand-books, from technical journals and from the household columns of the country weeklies. Such valuable bits of information as the following are happily illustrative: "To soften old putty in sashes—run a red hot iron over it and it will peel off easily." "To find the weight of a grindstone 4 feet 6 inches in diameter, 7 inches thick," etc.

The chief interest in this literary venture lies, however, in the fact that many of the leading advertisers in the Engineer's

Manual, compiled by the Canadian Association of Stationary Engineers last year, are also found in the pages of this unfathered publication. Almost at the same time as we received the Reference Directory, we received the following letter:

Editor Canadian Engineer:

Sir:—There have been a number of enquiries lately about an engineer's hand-book. I am authorized by the Book Committee to state that the C.A.S.E. have not issued a book this year, neither have they authorized any person to get one out for them.

Yours respectfully, W. J. Webb,

October 26th, 1899. Secretary Toronto No. 1.

The columns of The Canadian Engineer have been at the service of the C A S.E. since the formation of the association, and we determined to investigate a matter so closely affecting its interests, and also those of the commercial world generally. The majority of advertisers in the Engineer's and Electrician's Hand-Book and Reference Directory were found to be under the impression that this book was being brought out under the auspices of the C.A.S.E., because the volume shown them when canvassed by the advertising solicitor was a handsome leather-bound copy of the Engineer's Manual of the year before, and the solicitor was W. H. McCarthy, who had been the agent of the C.A.S.E. the year before. A rumor, which we were unable to confirm owing to the advertisers being out of town, states that the original letter was also used to secure advertisements.

Several of the advertisers, such as the Jubilee Grate Bar Co. and the Downer Pattern Works, having become suspicious of the bona fides of the publication, refused payment for the advertisement and the copies of the book ordered, claiming that they had believed the book to be published by the C.A.S.E., and that the books delivered were very inferior to the sample submitted. Suit has been entered to compel payment in these cases, and a number of adjournments have been granted at the request of Mr. McCarthy's solicitor, he being out of the country, where he will probably remain.

Other advertisers only discovered the true state of affairs during the course of our investigation. They had unhesitatingly paid their accounts, being fully persuaded that the Reference Directory was published by the C.A.S.E. Among minor irregularities perpetrated we found that limited editions were gotten up for delivery to special advertisers, who believed the terms of their contract were similarly carried out in the whole edition G F. Haworth, of Sadler & Haworth, in placing his advertisement had stipulated that in consideration of the price paid no other advertisement of leather belting was to appear. There certainly is no other such advertisement in the fifty copies which were furnished to Sadler & Haworth, but the Beardmore Co's advertisement appears on the back cover of all other copies of the issue which we have traced. Norman G. Macleod, with the Beardmore Belting Co., Ltd., assures us that he was told by Mr. McCarthy that the C.A.S.E. was publishing the work, and Mr. McCarthy sold him the space in the book which is now occupied by Sadler & Haworth, afterwards offering to move the Beardmore Belting Co.'s advertisement to the back cover without charge Thus he carried out his promise to give Sadler & Haworth the only advertisement of leather belting in the book. The following firms have been interviewed by a representative of The Canadian Engineer, and all tell practically the same story of misplaced confidence. In some cases the prices paid were one hundred per cent greater than others: Beardmore Belting Co., Sadler & Haworth, E. Rogers & Co., Coulter & Campbell, Mica Boiler Covering Co., Aikenhead Hardware Co., Jubilee Grate Bar Co., Reid & Brown, Westman & Baker, Downer Pattern Works, Dodge Mnfg. Co., Redpath, Reid Automatic Smoke Consumer Co., Pendrith & Co.

The other firms whose advertisements appear in the Reference Directory, but whom time or circumstances have prevented us calling upon are: Canada Metal Co., Rice, Lewis & Son, Morrison Brass Co., Burns & Co., Conger Coal Co., Standard Fuel Co., Royal Electric Co., United Electric Co., P. H. Patriarche Boiler Insurance Co., St. Lawrence Foundry, Luxfer Prism Co., A. R. Williams, Queen City Oil Co., Canadian Rubber Co., Chas. H. Riches, B. & H. B. Kent, and Fetherstonhaugh & Co.

We are sure that the full account of this affair which we have given will be of interest, not only to those directly affected but to all who recognize legitimate advertising as the path to success in business. Too often wide-awake business men invest money in advertising without any of the careful investigation which they would bring to bear on any other transaction involving a similar amount. In this way grave injustice is done to legitimate advertising mediums, which have been built up by great expenditure of time and money

THE EVERETT COKE WORKS.

The coke ovens at Everett near Boston, Mass., which H. M. Whitney stated some time ago would soon use three-quarters of a million tons of Nova Scotia coal a year, are described in a recent issue of The Mining Record: Four only of the many by-products of coal are sought for at the works, namely, coke, gas, tar, and sulphide of ammonia. All of the tar is disposed of to the National Tar Company, while for the ammonia there is a ready general demand. As yet little or no gas is being disposed of, as connections with the mains of other gas companies have not been completed. On the wharf there are towers for discharging, of the same kind as those erected by the company at Montreal. There are also coal pockets for receiving coal. From the towers the coal is conveyed in tubs by means of an endless rope to pockets situated about the centre of the coke oven plant. From the towers the tubs run until a pocket is reached into which the coal is discharged. The empty tubs do not return by the road they came, but continue on and go up an incline on the opposite side. When an oven is to be charged an iron car, hopper-shaped, is run under a chute—or the pocket—filled and run to the particular oven, as required. The car contains six tons of coal, which is the quantity necessary to a charge. When the coke is ready a steam ram shoves it out into a peculiarly constructed, movable, chute shaped car, with a movable gate at foot, to prevent the coke from running over on to the railroad underneath. This car is, say, thirty feet long. As the coke comes from the oven it falls on, and runs down and over the iron sheets on the car. As the coke fills the space on the car in front of the oven door it is moved along until the whole surface of the car is covered with coke. During the time of discharging water is poured on to cool the coke. The coke comes out of the oven in an almost solid mass, but breaks some, of course, on falling into the car. After the coke has cooled sufficiently, the iron gate on the car is lifted, and the coke runs into railway coke cars. After January, 1900, there will be 400 ovens, which will require no less a quantity than 2,400 tons of coal daily. This, after making allowance for an occasional oven being allowed to cool for repairs, will bring the quantity of coal necessary, in charging the ovens for a year, up to 750,000 tons, the quantity stated by Mr. Whitney that would be required. With so much favor has the coke, for locomotive and other purposes, been received, that it is in contemplation to erect an additional 400 ovens. That would mean an annual consumption of coal of 1,500,000 tons, and an annual revenue to the province of the large sum of $187,500. The gas made so far has been employed chiefly in the burning of the coke, and in heating the uncharged ovens. Each ton of coal produces 10,000 feet of gas. Of this quantity 48 per cent. returns to the ovens, to produce heat. The more gas returned to the ovens the quicker made is the coke. When all the ovens have been heated 50 per cent. of the gas made will be returned for the purpose of quicker burning. This will leave 5,000 feet of gas, for heating and lighting purposes, for every ton of coal coked. In other words the company will have for disposal, after the 1st of January, the large quantity of 12,000,000 feet of gas daily, a quantity much larger than is consumed by all of Boston and its environs.

The Berlin, Ont., Rubber Mnfg. Co., Ltd., has almost finished installing its plant and already some 75 tons of machinery are in place. The main building is white brick, three stories, 145x 53 feet; the boiler-house is 48 x 50 feet, with a chimney 100 feet high. The contract for the motive power went to Goldie & McCulloch, Ltd., Galt. There are two large horizontal return tubular boilers of 130-h.p. each. These boilers will be fired by two Jones underfeed automatic stokers, supplied by the General Engineering Co., Ltd. On the premises is an 8-inch artesian well, 255 feet deep, to supply water. The officers of the company are: J. Kaufman, president; A. L. Breithaupt, secretary-treasurer, and George Schlee, manager.

Industrial Notes.

The gas company at Sarnia, Ont., is laying larger mains.

Willis Chipman, C.E., has prepared plans and estimates for waterworks in Gananoque, Ont.

R. Dillon, Oshawa, Ont., maker of saw sets and cross-cut saw handles, is putting in a plant for forging bolts, nuts, etc.

The Imperial Paper Mills, Sturgeon Falls, Ont., want that town to give them an additional bonus of $12,000 with several other privileges.

The dam of T. G. McMullen's pulp mill at Union, N.S., was carried away October 14th. It will not be rebuilt before next summer it is said.

The Maritime Clay Works, at Pugwash, N.S., are under contract to supply the Dominion Iron and Steel Company with 7,000,000 bricks.

Ritchie & Ramsay, manufacturers of coated papers, New Toronto, have erected an extension 100 x 60 feet, three stories high to their factory.

The heating apparatus in the Penetanguishene, Ont., Reformatory has been changed from wood to slack coal burning. A considerable saving will be effected.

The Waterloo, Ont., water tower will be 115 feet high, diameter, 20 feet; capacity, 225,687 gallons. Hunter Bros., of Kincardine, are the contractors. The cost is $6,000.

The Syracuse Smelting Works, Montreal, are now running day and night. Orders received by the company before the annual inventory is taken will be filled at special prices.

The grist mill recently completed by R. J. McDougal & Son, Lancaster, Ont., is supplied with power by a 20-h.p. gasoline engine, manufactured by Goldie & McCulloch, Ltd., Galt, Ont.

It was stated some time ago that a well-known hardware merchant of Halifax, N S., and another of Dartmouth, N.S., were about to put up a rolling mill at the latter town. The Maritime Merchant now announces that they will establish a steam laundry.

Oelschlager Bros. Berlin, Ont., are putting in an elevator at Schaefer, Killer & Co.'s, Waterloo, and one into C. H. Doerr & Co's, Berlin, biscuit factory, and have an order for a two ton elevator from the Berlin Rubber Co.

September, 1899, is the banner month for business in the history of the Austin Separator Co., Detroit, Mich., manufacturers of steam and oil separators. The Austin is one of the oldest baffle plate separators on the market, and one of the most popular.

Fred. C. Beresford, London, Ont., superintended the drilling of ten wells for the Berlin, Ont., waterworks. The wells are an average of 150 feet deep and will furnish a daily flow of 1,000,000 gallons. Berlin has hitherto had a water supply from a small lake. The well water is said to be of very fine quality.

Waterloo, Ont., has leased a suitable lot for a furniture factory to the furniture firm of Lippert & Pommer for a term of ten years at a rental not to exceed the school taxes on the lot and building. At the end of the ten years the lot will be deeded to the company if they are still in business and employ at least twenty-five skilled workmen.

J. M. Ruddock, of the Miramichi Foundry and Machine Works, was the successful tenderer for the super-structure of the new steel bridge across the Nashwaak at Marysville, N.B. There will be four spans of 112 feet each and one span of 43 feet. The work will be done at Chatham, N.B., and taken to Marysville by the Canada-Eastern railway for erection. The price is about $25,000.

The buildings of the Cushing pulp mill, near St. John, N.B., which will be complete by the end of the present month, cover 56,517 square feet, and comprise the following buildings: Machine, 180 by 66 feet; screen, 144 by 60 feet; blow-off, 144 by 30 feet; digester, 144 by 28 feet; wood, 160 by 45 feet; boiler, 131 by 75 feet; engine, 50 by 60 feet; chemical, 156 by 50 feet. The chimney is to be 200 feet high, and a wharf 370 feet long is being built. The output will be 50 tons of pulp daily, and 250 men will be employed.

Fisk & Co., curriers and fine leather makers, Montreal, are asking Lachine, Que., for a bonus of $25,000 to establish a factory in Lachine to employ 60 people, and pay $35,000 annually in wages.

Edmonton, N.W.T., is offering free site and exemption from taxation for ten years to anyone who would erect and maintain a fully equipped foundry and machine shop within the corporation limits.

J. H. Wilcox, H. Buckel, J. E. McGarvin, F. Wilcox, Alice M. Buckel, Toronto; J. Buckel, New Hamburg, Ont., have been incorporated as the Cyclone Woven Wire Fence Co., Ltd.; capital, $30,000; chief place of business, Toronto.

Last winter the Goldie & McCulloch Co., Ltd., Galt, Ont., sold a "Model" gasoline engine to D. P. Tobin for cutting ice. So well did the experiment work that the company has shipped two more to Mr. Tobin to be used for the same purpose this season.

D. A. Ripley, Pittsburg, U.S.; G. W. Burkhart, J. P. Warrick, Detroit, U.S.; H. S. Warrick, W. A. Smith, Kingsville, Ont., and S. H. Chisholm, Cleveland, U.S., have been incorporated as the Ontario Glass Co., to make glass in Kingsville, Ont.; capital, $100,000.

The Prescott, Ont., waterworks are now practically complete, and water will be turned on about the end of the month. Wm. Watson, whose name is familiar to all readers of our columns as a writer on sanitary matters, has been engaged on the works as inspector for the engineers during construction.

The Carborundum Co., Niagara Falls, N.Y., and Ontario, has just issued a neat little booklet, which shows that carborundum, though a higher priced abrasive than emery, is rapidly increasing its sales. The pamphlet contains a number of letters which say that carborundum wheels are the best in use.

St. Henri, Que., has bonused the Lang Biscuit Manufacturing Company, Montreal. The council exempts the company from all municipal taxes for ten years, the company undertaking to build a factory in the town, and to expend at least $100,000 annually in wages The company has bought part of the Drummond property, and will erect a building four stories high.

W. McDonald and D. McGregor, Westville, N.S.; R. Bell, D R. Campbell and J. H. Marshall, St. John, N.B., have been incorporated as the Maritime Glass Co., to carry on the manufacture of ornamental glass by bending, staining, silvering, cutting, etc.; capital, $15,000; chief place of business, St. John, N.B.

Colin Campbell, St. Hilaire, Que.; G. R. Starke, R. D. McGibbon, Q.C., J. A. Prevost and Victor E. Mitchell, barrister, Montreal, have been incorporated as the Arlington Cab Co., Ltd., to buy the business of the Arlington Private Cab Stables, and establish a line of automobile cabs to ply for hire in Montreal; capital, $100,000; chief place of business, Montreal.

Ernest Rolph, of Sproat & Rolph, architects for Lever Bros., of Sunlight Soap fame, has let the following contracts, amounting to over $140,000: Carpenter work, W. & J. Clarke, Toronto; masonry, Cannon & Sons, Toronto; steel structural work, about $50,000, Hamilton Bridge Co., Hamilton; roofing, Forbes Roofing Co., Toronto; galvanized iron work, Douglas Bros., Toronto; soap machinery and soap pans, Jno. Inglis & Sons, Toronto: Heine boilers will be used.

The Goldie & McCulloch Co. has at present a number of large orders for flour milling machinery. Among these are the equipment for a 175-barrel mill at Saskatchewan, N.W.T., to be known as the Farmers' mill, which will be installed in a few weeks; a 50-barrel mill at Leduc, N.W.T., for J. P. Findlay; a 150-barrel mill at Brantford, Ont., for Wood Bros., which has just been put in; and for the Dowling Manufacturing Co., at Edmonton, N.W.T., a mill with a capacity of 175 barrels of flour per day, now being installed. Quite a number of other orders, for smaller mills in various parts of Canada, are also being filled.

The Sissiboo Pulp and Paper Co., which made a successful flotation of stock last month, will absorb the property of the Sissiboo Falls Pulp Co., at Weymouth, N.S., and will build a new mill three miles further down, operating both. The two will have a combined capacity of forty tons of dry pulp per day or about 12,000 tons annually. The work of erecting the new mill will be commenced at once, so that it will be in operation next year.

The Hamilton Bridge Company has taken out a permit to build an addition to its works.

There will be a million dollar station and hotel built by the C.P.R. in Winnipeg next year.

Arrangements are said to be under way for the establishment of a beet sugar refinery at Aylmer, Ont.

The contract for the new sulphite pulp mill buildings at Sault Ste. Marie, Ont., has been let to W. J. Hill.

A great deal of building has gone on in Petrolia, Ont., during the past season.

It is proposed to organize the Lambton Co-operative Creamery Co. among the farmers in the neighborhood of Petrolea, Ont. The capital stock will be about $25,000.

The electrical fountains put into the Crystal Palace, London, Eng., are supplied by pumps built by the Goulds Mnfg. Co., Seneca Falls, N.Y.

A neat folder containing particulars of the large leather belt being made for the Ogilvie Milling Co. has been issued by Sadler & Haworth.

The market for iron and steel scrap is reported very active by the Syracuse Smelting Works, Montreal, which company is large buyers of these materials.

The House of Refuge for Ontario county will be built in Port Perry, Ont., that town having offered a bonus of $5,000, and a free site. The building will cost $20,000.

The Dominion Government has placed an order for an iron show case with the Goldie & McCulloch Co., Ltd., Galt, Ont., to contain the mineral display at the Paris Exhibition.

Fifteen large bagasse filters for sugar plantations in Mexico have just been shipped via New York and Vera Cruz by the Goldie & McCulloch Co., Ltd., Galt, Ont. The same firm has on hand an extensive order for special machinery for the St. Charles Condensing Co., which is building a branch in Ingersoll, Ontario.

F. C. Billings, superintendent of the famous Billings & Spencer works at Hartford, Conn., manufacturers of fine steel drop forgings, writes of the Yankee Twist Drill Grinder, described in our September number: "It is the best drill grinder Billings & Spencer have ever used." This grinder is sold by the Fairbanks' Co., Montreal.

Shurley & Dietrich, Galt, Ont., are now supplying their eastern trade from the Beaver works in Sherbrooke, Que., recently taken over by them. They will also make axes in Sherbrooke. They are also removing the iron bedstead factory from St. Catharines, Ont., lately bought from the R. H. Smith Manufacturing Co., and are putting up a large stone building in Galt for its reception.

The Goldie & McCulloch Co., Ltd., Galt, Ont., is turning out some very large engines of late. Among others are engines for the Vulcan Iron Co., Winnipeg; R. C. Ennis, Neepawa, Man.; the town of Barrie and the town of Prescott; Berlin Rubber Co., Berlin, Ont.; Dominion Bridge Co., Lachine, Que.; Kennedy & Sons, Owen Sound, Ont.; Intercolonial Railway Co., St. John, N.B., and the Standard Shirt Co., Montreal.

During the last two years the development of trade in connection with the Albion Iron Works, Victoria, B.C., has been little less than phenomenal, says The Toronto Globe recently. In 1896 the company were employing about 90 men. To-day they have about 260 men on their pay roll. In addition to this they have within the last two years added to their plant, involving an expenditure of $75,000. For the last two months they have had shifts working night and day in order to keep pace with their orders.

It has been cabled from London that there was an extraordinary military parade at Aldershot, October 31st, when 15 traction engines and 40 trucks were inspected previous to their departure for South Africa. A stretch of sandy, rocky road was selected for the tests and gave an excellent chance to observe the points of the engines. A steep ditch and banks, two and three feet high, were safely traversed. Though at times the wheels sank axle deep other engines pulled out the disabled ones. The Duke of Connaught and Prince Louis and Victor Napoleon attended the trials, and were much pleased with the result. Twenty-four of these engines will be despatched to South Africa.

The B. F. Sturtevant Co., of Boston, Mass., has issued a circular relating to its exhaust heads, which makes clear the efficiency of centrifugal force as a means of separating water and steam.

The Waterloo, Ont., Manufacturing Co., agricultural implement makers, has decided to build an addition to its factory, 200 x 60 feet, two stories high. One story will be completed this fall.

The new buildings erected or in process of erection since January 1st, 1899, in Vancouver, are stated by The World to be valued at $2,475,000, and the value of the municipal improvements also being undertaken at this time amount to $280,000.

There will be three ventilating shafts placed in the northern part of Toronto to ventilate the sewers which in the upper portions of the city at times emit a horrible stench. If this experiment proves successful these ventilating pipes will be generally introduced.

There is a very large prize offered for the best plans for a system of waterworks, drainage and electric lighting for the town of Levis, Que. The prizes are $1,000 for the best and $500 for the second best plan. The details will be found in our advertising columns.

E. Dowling, W. Dowling, R. P. Ottewell, J. H. Dowling, J. B. Dowling and H. W. Dowling, farmers, Northwest Territory, have been incorporated as the Dowling Milling Co., Ltd., with a total capital stock of $40,000, headquarters in the Edmonton Settlement, in the District of Alberta, N.W.T.

The L. S. Starrett Co., Athol, Mass., U.S.A., has decided to discontinue the manufacture of milling cutters, and has sold the stock, machinery and good will of the cutter department to F. J. Gay, for the past five years a partner with them in that branch, and also manager of it. E. T. Ward is to be associated with him under the firm name of Gay & Ward. The L. S. Starrett Co. is confining itself to the manufacture of fine mechanical tools already fairly known in Canada to machinists and the tool supply trade.

The Association of Architects of the Province of Quebec opened its new rooms in Montreal a short time ago by holding a reception, which was attended by members of the association and a number of distinguished guests. Invitations had been given to the president of the Royal Canadian Academy, who was present, and to academicians in Montreal; to the office-bearers of the Art Association, of the Canadian Society of Civil Engineers, and of the Renaissance Club; Dr. Bovey, dean of the Faculty of Applied Science at McGill University; Professor C. H. McLeod, T. W. St. George, the professors of the Ecole Polytechnique, etc. The president of the association, Professor Capper, of McGill University, received the members and their guests.

One of the reasons why Canadian pulp is now so much in demand in England is because of the enormous cost of pulp wood in Sweden, the former source of supply. Formerly a cord of pulp wood, 4 x 4 x 8 ft. cost in Sweden $2.50. Now it costs $10. The industry has so reduced the supply in that country that a reduced cut and practically prohibitive prices have resulted. An instance is given in a contemporary of one English mill in Sweden that had 600,000 logs last year for pulp purposes. Of this lot 300,000 were only five inches at the top, thus showing that the larger trees are getting very scarce. A representative of an English firm lately made contracts in Nova Scotia, it is said, for 25,000 tons of pulp to be delivered next year.

F. S. Evans, of the E. & D. Bicycle Co., recently stated that the very large trade in Canada previously done by the companies now incorporated in the American Bicycle Co. is to be preserved and continued by a syndicate of Canadan capitalists, who have purchased for Canada from the American Bicycle Co. all their patents, rights, good will, and business, and will immediately establish in Canada a complete manufacturing plant, capable of turning out not less than 30,000 bicycles per year. In addition to this plant, the plants of the Canadian Typograph Co., manufacturers of the E. & D. bicycle, the E. C. Stearns Co., and the Wheeler and Christy Saddle companies, will be taken. This plant will be established in Canada in two months. Toronto has been chosen as the site, if suitable buildings can be secured. The company will have a capital of $2,500,000.

The engine in S. G. Parkins' shingle mill, Lindsay, Ont., was wrecked by the breaking of the belt which drove the governor. This threw off the main belt, and the engine raced with the result stated.

After the 15th of November the headquarters of the Canada Cycle & Motor Company, Ltd., will be at the southeast corner of Bay and Front streets, Toronto. They have leased the entire building containing about 25,000 square feet. The entire management for all the factories will be concentrated here, and the offices are now being made ready for the accommodation of the staff. Meanwhile they are occupying temporary quarters on the fourth floor of the Canada Permanent Building, 18 Toronto st.

Marine News.

There appears to be every prospect of the building of the southern portion of the Trent Valley canal.

Angus MacAuley, Southampton, Ont., has received the appointment as captain of the Government Upper Lake patrol boat "Gilphie."

The Richelieu and Ontario Navigation Company paid a dividend of three per cent. out of the half year's profits on the 2nd of November.

The directors of the Quebec, Hamilton and Fort William Navigation Company have accepted the tender of an English firm to build two vessels at a cost of $275,000.

The corporation of North Vancouver is submitting a bylaw to the voters of the district to borrow $12,000 to be used in buying and operating a ferry steamer between Vancouver, B.C., and North Vancouver.

M. Connolly, who has the contract for dredging and building the Government wharf at St. John, N.B., says that he will have the dredging completed and the stone work of the wharf sufficiently advanced to permit of a vessel coming alongside, during the present month.

An order has been placed by the Lodestar Co., Kaslo, B.C., in Liverpool, Eng., for the construction of a hull, boiler and machinery for a new steel steamer, which is to arrive in Kaslo about the end of February next, when she will be put together. The steamer will be 65 feet long and 16-foot beam.

It is reported that the contract for the extension of the Lorne Graving dock, at Levis, is to go to Thomas Powers, Levis, Que., the lowest tendered. Departmental estimates are $117,000, but it is said Powers' tender is above this figure. The dock is to be lengthened from 445 feet to 600 feet.

J. J. Long, president of the Collingwood Dry Dock Company, stated recently that arrangements were about completed for establishing at Collingwood a modern shipbuilding plant of large proportions. Alexander McDougall, Duluth, formerly general manager of the American Steel Barge Company, will be a director in the company. The dry dock will be taken over by the new company.

The water front at the foot of Yonge street, Toronto, known as Pier No. 21, will hereafter be called the Richelieu and Ontario Navigation Company's dock. With the new management there will also come new alterations and additions to the wharf. From the foot of Scott street and extending for a distance of 300 feet a new wharf will be built adjoining the present structure. When this is completed it will provide an excellent berth for the palace steamer "Toronto."

The Canada Atlantic Transit Company, recently incorporated, has elected officers as follows: President, J. R. Booth, of Ottawa, vice-president and counsel, H. F. Stevens, St. Paul; secretary, J. T. Rose, Duluth; treasurer and assistant secretary, C. T. Fleck, Ottawa, assistant treasurer, W. H. Burk, St. Paul; general manager, E. J. Chamberlain, Ottawa. Most of the officers are connected with the Canada Atlantic Railway Company, with which it will operate. The company has operated the Menominee fleet of six boats since early in 1897, between Duluth and Parry Sound, and Chicago and Parry Sound. This fleet was recently sold to the National Steel Company, and the Canada Atlantic has purchased the "George Orr" and "Arthur Orr." They will purchase four more vessels.

T. W. Paterson, manager of the Victoria & Sidney railway, states that the company has decided to build a steamer to be on the route by the 1st of February, which is to be a screw vessel, 90 feet long by 20 feet beam, and fitted both for freight and passenger service. Her machinery will be built in Toronto. When on the route she will make two round trips a week to Nanaimo from Sidney, and will spend two other days of the week among the islands, maintaining a mail service, in addition to doing all other transportation business.

Capitalists from the marine provinces are figuring out the possibilities of establishing a trade between the coal fields of Nova Scotia and the iron ranges of Ontario. To carry iron ore from the Atik-Okan or Mattawin deposits, by way of Fort William or Port Arthur, becomes a project well worth consideration when the St. Lawrence canals have been deepened, and a waterway of 14 feet deep established. The vessels would not have to return light, because, being assured of full cargoes eastwards, they could probably afford to carry coal west to Montreal, Toronto, or even Lake Superior ports, at very low rates. The development of the Maritime Provinces coal trade is increasing rapidly. September coal shipments of the Dominion Coal Co. amounted to 196,000 tons, an increase of 32,745 tons over the same month last year. From March 1st to September 30th, this year, seven months, 1,031,500 tons, against 838,285 tons in the same period of last year; increase, 193,215 tons.

Mining Matters.

Campbell & McNabb, Douglas, are working a mica mine at Mt. St. Patrick, Renfrew county, Ont.

A valuable discovery of iron is reported on the property near Dog Lake, in the vicinity of Battersea, Ont.

The Canadian Copper Co., Sudbury, Ont., finds it almost impossible to secure men enough to carry on its work.

The Truro, N.S., Foundry and Machine Co. will have ready in a short time a 60-stamp mill for Waverly, N.S., gold mines.

The Copper Crown Mining Co. is going to extend the I.C.R. at Pictou, N.S., to its smelter now under construction, the Minister of Railways having promised to pay the company for the outlay.

The Le Roi Mining Company recently ordered from the Jenckes Machine Company, three 100-h.p. boilers. These will be used to furnish the power for the 40-drill compressor plant, recently ordered by the company, and will be delivered early in March next.

John Cook, director of the Boerth Mining Co., stated recently that the mill at Ardoch, Ont., is running steadily and turning out gold in good quantities. The ore runs an average of $17 per ton, with considerable gold in the concentrates that will be treated later on.

One of the members of the staff of the Geological Survey, recently returned from field work in New Brunswick, states that alluvial deposits of gold have been discovered on the Serpentine, a branch of the Tobique, in Northumberland county, which seems to show splendid indications of the existence of gold in good paying quantities.

The Hall Mines, Ltd., Nelson, B.C., have just closed a contract with James D. Sword for a new steel wire tramway rope 50,000 feet in length. This rope is of a high grade steel, and has a breaking strain of nearly 70 tons, and weighs about 35 tons. It is to replace the old cable, and will be specially manufactured for the work required. This will be the fourth cable used at the mine.

Archibald Blue, of the Ontario Bureau of Mines, returned recently from a trip to the Michipicoten district; he said there was a great deal of mineral, and iron was the principal product. There has not been much development work done yet and there is much room for exploration. A branch of the Algoma Central Railway is being built from the Clergue iron mine to Michipicoten harbor. A branch will also be run to Dalton, to connect with the C. P. R. Surveying parties are going out now to prepare for the Algoma Central.

The Jenckes Machine Co., Sherbrooke, Que., shipped two car loads of mining machinery recently to the War Eagle Mining Co. It will be erected at once.

Railway Matters.

The C.P.R. has ordered ten more compound engines from the Kingston locomotive works.

The Canada Atlantic Railway is building a large number of 35-ton freight cars at its Ottawa shops.

The Shawenegan Falls branch of the Quebec & Lake St. John Railway has been open to traffic since October 23rd.

J. S. O'Dwyer, C.E., returned to Granby, Que., after exploring a route for a projected railway from the headwaters of the Skeena, to the headwaters of the Stickeen rivers, for the Dominion Government.

The Milwaukee Southwestern Railroad Co. announces that it proposes not only to build a line 200 miles long, extending southwest from Milwaukee, but that it intends to go into the lake and rail business, co-operating with the Canada Atlantic.

The Rainy River Railway is being pushed with great vigor by McKenzie & Mann's contractors. Between 5,000 and 6,000 men are at work on a section of 150 miles stretching from Stanley, on the Port Arthur, Duluth & Western Railway, southwesterly towards Rainy River, and next spring 10,000 men will probably be engaged in order to try and complete the line to secure a share of next year's northwest harvest

The C.A.R. train that took the Government party to the opening of the Soulanges canal ran 81 miles in 70 minutes. Among those on board were, Hons. J. I. Tarte and Fielding; Collingwood Schrieber, Deputy Minister of Railways and Canals, I. K Jones, secretary. J R Booth, E. J. Chamberlin, W J Pompore M P., H B. Spencer, of the Canadian Pacific Railway, F Marceau, superintending engineer of the Quebec canals; R. B. Rogers, superintending engineer of the Trent canal; R C Douglas, of the Department of Railways and Canals, the representatives of the Montreal, Ottawa and Toronto papers, and others

The Grand Trunk Railway has a surveying party at work making arrangements for improving the grades and double-tracking the line from Hamilton to Niagara Falls, Ont. This special work has been under consideration by the G. T. R. management for some time, and consequently the company of late has been putting in the stone abutments to bridges double width, so as to carry a double track when it would be required It is expected that the contracts for widening the roadbed, track laying, etc., will be let during the winter, and the construction work commenced early next spring, and the double tracking finished some time next summer. When done this work will complete a double track run from Toronto to Niagara Falls.

Personal

R. R. Smith, superintendent of the Sherbrooke Street Railway, is ill with an attack of typhoid fever.

W. H. Randall has been appointed foreman of the meter and machine shops of the Toronto waterworks, Soho street.

Jas. Flemming, head of the foundry firm of James Flemming & Sons, St. John, N.B., died October 10th of apoplexy.

H. C. White, of Jenkins Bros., Boston, called on us during the past month. He reports good demand in Canada for this firm's goods.

Alex Lister has left Perth, Ont., for Birmingham, England, where he has secured employment with the Birmingham Tramway Co.

H Orpen for twenty four years foreman of the meter and machine shops of the Toronto waterworks, was presented with a gold ring by his friends in the department Mr Orpen resigned a short time ago.

J. Tees is now representing the Oliver typewriter in Toronto. This machine is built by the Linotype Co.

Chas. Potter, optical instrument maker, Toronto, died Nov. 3rd, aged 68 years, after many years' illness.

J Laprairie, Montreal, has been appointed by the Canadian Pacific Railway Co., inspector for the car works at Perth, Ont.

E. Lafontaine, assistant engineer of the Department of Public Works, Ottawa, died in Vancouver, Oct. 10th, of typhoid fever.

The death of George A. Browne, traffic manager of the Richelieu and Ontario Navigation Company, took place at Atlantic City, October 12th. He was 40 years of age.

Mrs. Campbell, Guelph, Ont., has been given a verdict for $1,000 and of $500 each to two children in her suit against the Acton Tanning Company for the death of her husband.

Frank H. Pitcher, McGill University, Montreal, who has been demonstrator in physics for the past five years, has just been appointed engineer of the Montreal Water and Power Company.

Thos. Eversfield, engineer in charge of the heating and lighting plant of Toronto University buildings, has resigned, and Fred. Hanmer, formerly machinist at the Fensom Elevator Works, Toronto, has taken his place.

Jas. Gunn, Royal Military College, Kingston, son of Alexander Gunn, postmaster of Kingston, Ont., has received from the Imperial War Office an appointment in Egypt on the staff of the Government railways, under Lieut. Girouard.

T. G. Hazlitt, president and general manager of the Dickson Lumber Company, died at Peterborough, Ont., Oct. 12th. He was a native of county Armagh, Ireland, and came to Peterborough when a young man, and engaged in the lumbering business. In 1870 he became manager for the Dickson Lumber Company. He was 76 years old.

Joseph Smith, bridge foreman on the Canadian Pacific Railway on the North Bay division, while recently engaged in the work of repairing the trestle near Desbarats station, was struck by a passing train and knocked off the trestle, falling on his back, a distance of about fifty feet. He was removed to the hospital at North Bay, Ont., in a most critical condition.

C. N. Coburn, who has been looking after the engineering work in connection with double-tracking C.P.R. main lines in Ontario, has been appointed resident engineer of the C.P.R., at Smith's Falls, Ont. He supersedes A. K. Kirkpatrick, who, it will be remembered, was selected some time ago by the British Government to be engineer of the government railroads in Egypt

The position of General Manager of the Canada Cycle and Motor Company, limited, has been offered to and accepted by Joseph N. Shenstone, the well-known secretary of the Massey-Harris Company, Ltd. He had much to do with the building up of the successful business of A. Harris, Son & Co., of Brantford, and since the formation of the Massey-Harris Co., Ltd., has been a director and secretary of that company.

The remains of the late James A. MacMahon, railway contractor, son of the late Philip MacMahon, were interred in Dundas, Ont., October 16th. Mr. MacMahon was born in the town of Dundas 47 years ago, and his life has been spent in contracting. He had just been awarded a contract for 90 miles of railway construction in Eastern Canada, when he died. Amongst the large engineering works which deceased superintended may be mentioned the Government dry-dock at Levis, Que., section 33 Welland Canal, several large contracts on the C.P.R., G.T.R., M.C.R., and the Canada Atlantic Railway bridge across the River St. Lawrence at Coteau Landing.

Ottmar Mergenthaler, the inventor of the linotype, died at Baltimore, Md., October 28th, of consumption. He was born in Wurtemburg, Germany, in 1854, and came to the United States penniless and friendless, when 18 years of age. He was employed by a Baltimore firm that was making some models of printing machines for James O. Clephane, a Washington stenographer. He took a deep interest in the work, and for four years devoted his time to inventing a type-setting machine of his own. After many experiments he made a complete change of system in 1880, and adopted the plan which resulted in the present linotype machine.

We regret that the senior member of the firm of the Brown & Sharpe Manufacturing Co., Lucian Sharpe, died at sea while returning from a trip to Germany. The deceased was born March 20, 1830. He worked on his father's farm in his youth and received a common school education. Leaving the farm, he served a five years' apprenticeship with Joseph Brown, and was admitted to a partnership in 1853. The firm of Brown & Sharpe was incorporated as the Brown & Sharpe Manufacturing Co. in 1868.

Iron and Steel.

The Montreal Rolling Mills Co., Montreal, is negotiating with Sydney, C.B., for encouragement to locate rolling mills in that town.

Work is being rushed on the branch line from the Kingston & Pembroke Ry. being built into the Caldwell mine at Calabogie, Ont.

The Rhodes, Curry Co., Ltd., Amherst, will build large work shops at Sydney, C.B. The company has already bought the land which is close to the junction of the Intercolonial and Louisburg Railways.

The Dominion Iron and Steel Co., Sydney, was advertising at the end of October for 250 men to mix concrete, 500 men on night work, 100 men to load scows, 100 horses and carts, and 50 carpenters.

The directors of the Hamilton Iron and Steel Company have decided to practically rebuild the furnaces and make other improvements at a cost of $50,000. When completed the furnaces will have a capacity of 250 tons of iron a day.

The Beaverton Express says that recently an experiment was made at Phoenix foundry in that town with peat made by the new compression system as a fuel for smelting iron. The Express reports the failure of the experiment, the fuel being too light.

The Nova Scotia Steel Co., New Glasgow, N.S., is building another smelting furnace. The large steel building will be extended some eighty feet to cover the new furnace and bring the steel traveling crane in connection with it. The furnace will produce 100 tons a day.

The work is progressing on the steel plant which is being built in Hamilton, Ont., near the smelting works, the construction is in charge of Clifford C. Smith, who represents the Wellman-Seaver Company, Cleveland. There will be two furnaces, each having a capacity of fifteen tons. The main building will be 144 feet long and 90 feet wide. The furnaces, which are open hearth, will use gas.

The discovery of iron on the line of the Rideau Canal in Frontenac and Leeds counties is no new thing, though considerable attention is being given to it. The old inhabitants in Lansdowne and neighboring townships still speak of Lyndhurst village by its old name of Furnace Falls, for there were iron works at that point nearly a century ago.

Application has been made for a charter of incorporation for the Canada Foundry Co., with a capital of $1,000,000. The company is composed of Messrs. E. B. Osler, M.P., W. R. Brock, W. D. Matthews, Wm. Hendrie of Hamilton, Fred. Nichols, T. W. Horn and W. H. Winslow of the Chicago firm of Winslow Bros. It is the intention to establish a foundry in Toronto, and later on another in the West, probably at Vancouver. All kinds of cast-iron work, including every branch of architectural work, will be turned out.

The concreting and brick work on the Dominion Iron and Steel Co.'s blast furnace No. 1 was finished October 6th. Work on the other furnaces was to be finished November 15th. McManus, Low & McManus, contractors, have been working day and night, an electric plant having been installed, but the cement for the concrete work ran out, and the work has gone behind. The contractors were supposed, when the ground was prepared, to average 800 yards of concrete per day. The area to be concreted is 25,000 yards. Two cars of cement were brought from Montreal, but the cost of transportation was too great, and so the work had to wait.

An important auction sale took place in Montreal, Nov. 1st, when the assets of the Londonderry Iron Co., Londonderry, N.S., were sold for the sum of $153,000 cash to interests represented by H. S. Holt, Montreal. The capital of the company, which was incorporated under a Dominion charter some years ago, was placed at a million dollars, divided into $400,000 preferred and $600,000 ordinary stock. The directors were: Lord Mount Stephen, Sir Chas. Tennant, Glasgow; A. S. McClelland, Glasgow; J. J. Greenshields, London, Eng.; A. T. Patterson, Montreal; Jno. Turnbull, Montreal, and R. McD. Patterson, Montreal. Some time since the company went into liquidation, and the property was placed on the market. The assets of the company, which have now been purchased, consist of about 30,000 acres of mineral land, town lots at Londonderry, N.S.; together with the plant and machinery now contained in the building and on the property of the company. The property known as the Chignecto colliery, and situated at Maccan, N.S., as well as all outstanding claims, unsold material, stores, goods, and any rights belonging to the company on the 25th of last September, are all included in the transaction.

F. H. Clergue, Sault Ste. Marie, who founded the great pulp industry at that place, is now organizing a $20,000,000 iron and timber and transportation company. This is the Ontario Lake Superior Company, which is being formed by the same capitalists who organized the Consolidated Lake Superior Company, with which it will be allied. The new company is to acquire the entire capital stock of the Algoma Commercial Co. and the Algoma Central Railway. It will thus, it is stated, acquire title to some 2,000 square miles of timber and mineral lands adjacent to the Canadian lands of the Consolidated Lake Superior Company. A railroad line is being built as part of the project, and 40 miles is to be in operation next year, from Michipicoten harbor, on Lake Superior, to two hematite iron mines, one of which is the Helen mine, owned by the Consolidated Lake Superior Company, in the Michipicoten range. The plan is eventually to extend the road 120 miles to connect with the Canadian Pacific at or near Misanabie. It is estimated that the company will handle during its first year 1,500,000 tons of ore for the Consolidated Lake Superior Company. Jas. Conmee, who has charge of the construction work on the railway, stated recently that 2,000 men were at present employed in connection with the company's projects. Half a million tons of iron ore were ready for shipment at the Helen mine, and there were ten millions in sight.

H. M. Whitney, at a reception tendered him at Sydney a couple of months ago, summed up the prospects contingent upon the establishment of the new iron works in these words: "I believe that the establishment of these iron works will be the means of introducing the town of Sydney to the length and breadth of the whole world. I cannot control my enthusiasm when I think of the future. The dormant energies of the country will be awakened. Here, right at our very doors, is the basic source of all prosperity. We know that on yonder spot all the elements that go to produce iron and steel, can be assembled cheaper than on any other spot on the face of the earth. We have limestone almost at our feet, immense coal fields right at hand, and magnificent iron areas within a few hours' sail from the centre of production. It has been demonstrated that Cape Breton coal is the best in the world for metallurgical purposes. The establishment of the iron and steel works signifies more than the works alone. Industries that depend upon the production of those metals are bound to follow. I have no doubt that there will be a gradual extension from one thing to another, and, unless I am greatly mistaken, before many years the production of this vast concern will stretch from the Atlantic to the Pacific, and the material manufactured be exhibited in all the marts of the world. To the province of Nova Scotia will be restored its old shipbuilding industry, for, when there is coalition in the manufacture of iron and steel, all industries depending upon these two metals must naturally prosper."

The iron mines of Belle Isle, near St. John's, Nfld., bought for $1,000,000 from the Nova Scotia Steel Co. by the Dominion Iron and Steel Co. are thus described by Elias Rogers, one of the directors of the company, in a recent issue of The Toronto Globe. The deposit is of peculiar formation and different from anything I have ever seen. The ore can be taken out more

cheaply than in any other mine that I know of, said Mr. Rogers. It is in the form of segregated cubes, which can be detached by the use of a crowbar, one man being able to pry off tons at a time. The only preparatory work necessary is to strip off from six inches to two feet of soil on the surface and by the insertion of a crowbar in the cracks which run vertically throughout the depth of the deposit the ore is pried off and falls into small cubes exactly in the condition we want it for smelting. All that remains to be done is to shovel the ore into the ore cars and ship it to the smelter. It is a high grade ore, the surface of the deposit at the workings has very much the appearance of a tiled floor. The seams are nearly horizontal, with a slight dip to the north. No. 3 seam, the seam at present being worked, is from eight to ten feet thick, and from where it outcrops to where it goes under the hill is perhaps 300 feet wide and three miles long. The ore is taken out so easily that no blasting is really necessary, although occasionally a cartridge may be put in several feet from the face of the working to loosen hundreds of tons at a time. This ore can be laid down at the smelter cheaper than is being done by any other mine in the world. The conditions for handling the ore could not be better. The natural formation of the island is perfect for the purpose of handling the ore at the least possible cost. The company from which we purchased had already constructed a first-class plant for handling the ore economically. There is a double track line running across the island and terminating at the loading pier. The cars are operated by means of an endless cable, to which they are gripped at distances of about fifty feet. The loaded cars going down grade help to operate the light cars going back to the mine by the gravity system. The cars are unloaded automatically into pockets, from which the ships are loaded. There is also a large pocket constructed in the rock, which will hold many thousand tons, from which the ore can be emptied by means of a conveyor in the bottom and running through to the pier. This will enable the company to continue mining and store the ore should there be any delay of vessels. The cost of the ore free on board vessels is about 30 cents per ton. The Dominion Iron and Steel Co. will handle 4,000 tons of this ore per day.

Electric Flashes.

C. H. Mitchell, C.E., and Guy Winn are preparing a report on a proposed power scheme at Bracebridge, Ont.

The Goderich Knitting Co., Goderich, Ont., has installed an 80-light incandescent plant, supplied by the Jones & Moore Electric Co.

J. Haynes, Brigden, Ont., has placed an order with the Jones & Moore Electric Co. for an incandescent lighting plant for his mill.

Clelland Bros., Meaford, Ont., are installing an electric light plant which they have bought from the Jones & Moore Electric Co., to light up the factory.

The Niagara Falls town council is considering the proposals of the Niagara Central Railway Company for the extension of that road and its conversion into an electric line.

The Niagara Falls Park and River Railway showed their appreciation of the work of the fire brigade at the power house fire by sending a cheque for $100 to the town council.

The Mack Machine Co., Belleville, Ont., is placing an incandescent plant in its works. The order for the dynamo was placed with the Jones & Moore Electric Co., Toronto.

There has been great delay caused in the power development works at Rugged Rapids, Ont., by the breaking away of the temporary dam. Supplies cannot be brought in till the temporary dam is in position. The contract calls for the completion of the works by December 1st.

Geo. Forbes, F. R. S., London, Eng., electrical expert; Clemens Henshell, New York, hydraulic engineer; Dr. Coleman Sellers, of Philadelphia, expert engineer and ex-president of the Niagara Falls Power Co., were recently at Niagara, in consultation with W. B. Rankine, secretary and treasurer of the Niagara Falls Power Co., regarding the development of power on the Canadian side.

The West Kootenay Light and Power Co. has ordered another 30-h.p. three-phase induction motor from the Canadian General Electric Co.

The Canadian General Electric Co. is furnishing the Montreal Street Railway Co. with 20 of its standard general electric 1,000 railway motors.

Bothwell, Ont., has made a considerable extension to the electric plant recently, the work having been carried out by the Canadian General Electric Co.

The Canadian General Electric Co. has received an order from the Summerside Electric Co., Summerside, P.E.I., for a standard 120 k.w. single-phase alternator.

E. W. Stickney, Esq., Newburgh, Ont., has decided to place an incandescent dynamo in his factory, the order for which has been given to the Jones & Moore Electric Co.

The Standard Chemical Co., Deseronto, Ont., has recently installed an electric lighting plant in its factories. The apparatus was supplied by the Canadian General Electric Co.

The Palmerston Carriage Co., Ltd., of Palmerston, Ont., has ordered from the Royal Electric Co. a complete lighting plant, consisting of a 100 light dynamo, switchboard and wiring.

Richardson & Sons, Bedford, N.S., have bought a complete electric lighting plant from the Royal Electric Co., for their factory. The Maritime Electric Co., of Halifax is installing it.

The corporation of Neepawa, Manitoba, has contracted with the Canadian General Electric Co. for a standard 75-k.w. monocycle alternator with switchboards, transformers and wiring supplies.

The Canadian General Electric Co. is installing two standard 45-k.w. multipolar generators for Tooke Bros., Montreal, together with switchboards, and three 15-h.p. direct current motors, and three 8 h.p. motors.

The Montreal Cotton Co., Valleyfield, Que., is continually increasing its power plant, and has just placed another order with the Canadian General Electric Co. for six 50-h.p. and one 100-h.p. induction motors.

Donnelly & Drum, Ottawa, Ont., have recently ordered from the Jones & Moore Electric Co., an incandescent dynamo. This firm have also received orders from three Quebec firms for incandescent dynamos during the past month.

A new electric company has been formed in Dutton, Ont., for the purpose of supplying light, heat and power to the corporation, merchants and residents of the town. The Canadian General Electric Co. is supplying all the electrical apparatus, transformers and wiring. The initial order is for a 30 k.w. single-phase alternator.

The town of Paris, Ont., is to have a second electric light company, W. H. Meldrum, with a number of local people, having formed a new company, and have purchased a complete outfit consisting of a Leonard-Ball engine and boilers, and from the Royal Electric Co., a complete "S.K.C." two-phase system, the dynamo having a capacity of 50 k.w.

The Trent River Paper Company, Frankfort, Ont., has placed an order with the Royal Electric Co. for a 40-k.w., S.K.C. two-phase generator with transformers and supplies. It is the intention of the paper company to not only light its own large premises, but also Frankford (one mile distant), Stirling (nine miles distant), and possibly Foxboro and Wooler (six miles distant). Work of excavation was commenced on the 27th of May last, and the fact that this month this company will be making paper is an evidence of the capability of the manager, Walter S. Miller.

Another large manufacturing business is being established at Sault Ste. Marie, Ont., which promises to reach vast proportions in the very near future. F. H. Clergue, president of the Lake Superior Power Co., has been instrumental in interesting American capital in the formation of the American Alkali Co., of which he is the vice-president. They purpose manufacturing caustic soda and other similar products under electrolytic processes, and the initial plant will require 1,000 h.p. for its operation. There has been placed an order with the Canadian General Electric Co. for three 300-h.p. specially designed generators to be direct connected to water wheels. The plant is expected to be in operation shortly.

The J. D. King Co. has decided to operate a portion of its Toronto factory by electricity, and has placed an order with the Jones & Moore Electric Co. for a 20-h.p. motor, and also a 6-h.p. for the elevator.

The Richmond Electric Co., Richmond, Que., has installed a second 75-k.w. "S.K.C." generator. It has also installed a number of two phase motors from 5 to 15 h.p., that operate from the "S.K.C." system.

Since October 21st, Dundalk, Ont., has had its municipally owned electric light. The plant consists of Leonard engine and boilers, and an S.K.C." 30-k.w. dynamo. The streets are lighted with incandescent lamps.

The steamer "Sardinian," which is to transport the Canadian contingent to South Africa, is well supplied with artificial illumination for "The Soldiers of the Queen." The Royal Electric Company, of Montreal, started to install a complete electric lighting equipment on this steamer, Saturday, October 21st, and turned over the plant, consisting of one 20 k.w. direct current generator with 325 lights installed, complete in operating condition, Thursday, October the 26th.

The following is a list of some of the motors sold by the Jones & Moore Electric Co., during the last month, which goes to show the growing popularity of their new type of machines: Littlejohn & Vaughan, Eakins & Ferris, H. F. Sharpe & Co., Atkinson Bros., Social Tea Co., two machines, making the third this year; Toronto Law Book Co., L. Sexsmith & Co., W. C. Hunt, McFarland, Gray & Southgate, two machines, making three this year; J. W. Dobson, Toronto Glass Co., M. & H. Peterson, L. M. Swawite, Toronto Show Case Co., Canadian Camera Co., all of Toronto; Queen's College, Kingston. Five machines have also been sent to Winnipeg, Man.

ACCIDENTS OF THE MONTH.

Edward S. Evans, who for eight years had charge of the shops of the Toronto Electric Light Co.'s works, died last month

A. Ellis, an employee in the Fernie saw and planing mill, lost his life, October 27th, by falling on a circular saw. He was a native of Dobbington, Ont.

Water thrown on a fire in the Dominion Carbide Co.'s works in Ottawa, caused an explosion which wrecked the building, and seriously injured 15 men.

Nicholas Milburn was killed, October 13th, at Nanaimo, B.C., while working in Protection Island shaft, his face and head being crushed by a fall of coal.

Peter Wiese, Chandos, Ont., was killed in an explosion at a gold mine near Apsley, in North Peterboro'. Another miner, named Galbraith, had his eyes blown out and one hand and the fingers of the other hand blown off, which caused his death.

H. M. Innes and H. Doley, prospector, were drowned while prospecting for gold at Windermere, B.C. Two other miners named James Mills and Charles Crane were killed about the same time at Moyie Bay by a premature blast in Lake Shore mines.

A man named L. Giguere, aged 26, employed at Howard & Craig's sawmill, Beauce, Que., was at work running a bark peeling machine, when in stepping around it he slipped and was thrown against the frame with such force as to break his skull, and he died in a few minutes.

John Atkinson, Toronto, 32 years old, employed by the Great Northwestern Telegraph Co., as lineman, accompanied by James Grasby, St. Chrysostome, Que, 26 years old, a blacksmith by ocupation, were drowned in Little Wolf Pond, near Ogdensburg, N.Y., October 17th.

A freight train from Madawaska to Depot Harbor, Ont., on the Canada Atlantic Railway, ran into a landslide at Rock Lake station, October 18th, as a result of which fireman Homer B. Barney, Jericho, Vermont, was killed, and engineer Arthur Grogan, of Depot Harbor, injured.

G. A. Sampson, of the Aikenhead Hardware Co.'s staff, while assisting in the cutting off of a piece of cast-steel in the iron store department of the firm, was struck in the wrist by a particle of the steel which embedded itself in the bone, and had to be located by X-rays before the surgeons could remove same. Mr. Sampson has been particularly unfortunate, and had scarcely recovered from a severe operation, and it came very hard on him in his rather weakly condition of health, especially as there was great danger for a time that he would lose his arm.

Wm. Partlo, an Ingersoll, Ont., miller, had a narrow escape from a horrible death a short time ago. He was superintending the remodelling of King's mill, when he fell down the wheel-hole, alighting on the pipe which goes to the wheel, and thence falling into the water below. The wheel was running at the time, and had he fallen a few inches either way he would have been ground to pieces by the machinery. He was partially stunned by the fall, but had sufficient strength left to raise himself out of the water, and he was rescued from his perilous position as quickly as possible and medical aid summoned. An examination revealed the fact that no bones were broken, but he sustained severe injuries to his back.

An accident occurred at the cement works, Napanee Mills, Ont., Oct. 25th, by which George Thompson, aged 18, lost his life. He and H. Sweet, a lad about his own age, were alone at the time. Sweet for some reason flung a cement sack over a shaft making over 200 revolutions per minute. According to Sweet's testimony, Thompson asked him how they would get the bag. Sweet replied, "It will have to stay there." Starting to go about his work, he noticed where the sun was shining on the opposite wall a shadow flying around. Turning his head he saw Thompson on the shaft. As soon as possible the machinery was stopped, and Thompson's lifeless body dropped to the floor, horribly mangled.

PETROLIA AND THE STANDARD OIL CO,

Editor CANADIAN ENGINEER:

Your article in a recent issue of your publication was a gross misrepresentation of the facts as they exist in and around the town of Petrolia, and while the information may have been furnished you from a source which you presumed was authentic, the intention of the originator of the ghost story was clearly to injure a prosperous town from some spiteful or selfish motive. True, Petrolia has lost its refining industry, and with it a certain percentage of population, but Petrolia was a good town when this department was located chiefly in London, and other centres outside the oil producing territory. The last twelve months have seen more improvements in the town than any equal period for some years. Granolithic sidewalks are being constructed extensively, and a great amount of building is being done, including business blocks and a very large and expensive church. Merchants report business as good as any season they have had, and collections prompt. The real prosperity of Petrolea has always depended on the production of crude oil, and to-day there are very few idle drilling rigs in the territory. As a matter of fact Petrolea was never asked to bonus the Bushnell Oil Co., and further, when the Bushnell Co. purchased the refining plant of Fairbank, Rogers & Co., it was well known that they were a branch of the Standard. The Canadian oil trade had nothing to fear from the Standard or any other corporation, so long as the Government could withstand the inducements that American capital was prepared to offer in return for certain favorable concessions, the chief of which was the privilege of importing oil into Canada in tank ships and tank cars, and certain minor changes in the tariff and inland revenue restrictions. The present Government gave the Americans all they asked, and the Standard then quietly and in a business-like way purchased all the refineries in Petrolea, and closed them up, and located the entire refining industry at Sarnia, as they must necessarily have their works at a lake port to take advantage of the tank ship concessions. You will now find oil being carried in tank ships owned by the company to points all along the lakes and St. Lawrence routes, at a loss of thousands of dollars freight to American railways. As to what the Standard will pay producers for crude oil in the future one cannot say, but to-day they are paying $1.62 per barrel for what was selling at $1.40 per barrel when they assumed control. They can pay as high for crude as is required, as they have control of the market in the refined product, and can advance the price of refined oil in proportion to what they are paying for crude (or more so). Petrolia may have lost some industries, but it has always been so far ahead of other similar towns in the West, that even with those industries gone,

it is still one of the best towns to be found anywhere, and you will see no grass on the streets, and no lack of business and enterprise, in proof of which note the fact that they passed this week a bylaw with only eight dissenting votes, giving franchise to a company to put down deep wells for gas and install plant, etc., for heating and lighting.

November 4th, 1899. PETROLIAN.

SIR WM. MACDONALD'S GENEROSITY.

Prof. Robertson, Dominion Commissioner of Agriculture, delivered an address before the Ottawa Public School Board, November 2nd, on the subject of the introduction of manual training into Canadian schools At the close of the address he said: Sir Wm. Macdonald offers to pay for the equipment required for educational manual training in one place in every province in the Dominion, and also to meet the expenses of qualified teachers and incidental maintenance for three years in all those places. In Ottawa, he offers to equip and maintain for three years as many centres as are required to give all the boys (about 1,000), between the ages of 9 and 14 in the Public schools an opportunity to receive this training. It is hoped that after a year or two an equally valuable course of practical instruction, suited for girls of the same ages, may somehow be provided, and doubtless nature studies in rural schools will be joined to them. In Ottawa the plan will, incidentally, provide for evening classes for those actually engaged in trades who need and want technical instruction. Sir William has authorized me to make a similar offer to the school authorities of Brockville, Ont., of Charlottetown and Summerside, P.E.I., of some places in the province of Quebec, of Truro, N.S., of Fredericton, of Winnipeg, Man., of Calgary, N.W.T., and of some place in British Columbia. To begin it on right educational lines a thoroughly trained and experienced teacher of high attainment will be brought at first from Scotland, England, or the United States. Next summer it is proposed to pay the expenses of several teachers from Canada in Great Britain and Sweden to take the course of training there, to see for themselves the educational systems and methods of those countries and to meet teachers and other education reformers in them. When those Canadian teachers return they will be as lights set on hill tops. The fire of their inspiration, information, and enthusiasm will spread Such in brief outline is the proposal I have the supreme satisfaction and happiness of announcing. It must result in immediate, lasting, and far reaching benefit to the boys of Canada I am sure we all join in the earnest hope that Sir William C. Macdonald, the wisely patriotic and generous benefactor, may long live, gladdened by knowing that the children and the grown men and women of Canada rise up and call him blessed.

FIRES OF THE MONTH.

Oct. 4th St Matthew's church, North Sydney, C.B.; loss, $12,000.— Oct 6th. Taylor Bros.' sawmill, near Port Elgin, N. B., loss, $4,000, no insurance.——Oct. 6th. MacPhee & Meader's flour mill, Moulinette, Ont.; damages, $4,000; insurance, $1,500 Oct 9th. The buildings at Fort Lawrence, N.S., of the Chignecto Ship Railway, which were erected during the construction work.——Oct. 16th. N. Levinsen's sawmill, Lake Megantic, Que. — Oct. 18th. Elgin's tannery, London, Ont.——Oct. 18th. F. H. Manning's sawmill and barrel factory; loss, $5,000 ——Oct. 19th. Murray's planing mill, Winnipeg; loss, $12,000, partly insured.— Oct. 19th. Grist and sawmill belonging to D. Purriston, near Richmond Corners, N.B.——Oct. 25. The Fulton Bros.' sawmill, Fingal, Ont.; loss $5,000; no insurance.——Oct. 27th. Kennedy Bros.' evaporating factory, Leamington, Ont.; loss, $2,000.

—Granville C. Cunningham has been appointed manager of the Central Electric Railway, London, Eng.

—F. W. Draper, B.Sc., of Rolla, Missouri, has been appointed lecturer in Metallurgy in McGill University.

—We have received a pamphlet of 250 pages, being the Proceedings of the Illinois Society of Engineers and Surveyors, 1899, a report of the fourteenth annual meeting held at Champaign, Ill., in January last.

—The Marine Review, Cleveland, O., issued a special number in honor of the return of the United States Admiral from the Philippines, which contains a large number of very fine pictures of the ships of the United States Navy.

Recently the Boston and Maine Railroad began to sprinkle oil over its tracks to lay the dust, having constructed two special cars for the purpose. About fifty miles of track was covered the *first day, and the sprinkling will continue until the entire system* in the vicinity of Boston at least is covered. The oil costs 8⅛ cents a gallon, and the cost of sprinkling per mile is $6,250. After three annual sprinklings the oil will remain effective for from three to four years. Hereafter, when renewal of ties are made, or other disturbance of the road bed is called for, the overturned earth will be oiled from huge tin pots with ff ttened nozzles.