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CONTENTS OF THIS NUMBER:

For THE CANADIAN ENGINEER.

REVOLUTION OF THE PRESENT RAILWAY SYSTEM BY THE ADVENT OF THE ELEVATED ELECTRIC RAILWAY.

BY A. DAVIS, CONSULTING ENGINEER, MONTREAL.

About sixty years ago England gave birth to the steam surface railway, and inaugurated the present system, and now it is about to inaugurate the railway of the future. England waits the proper time before adopting any new invention, and spending money uselessly. Her people will generally make sure of the new undertaking, and will then wait to see if anything better will turn up that can replace what is already in operation with lasting advantage, as they have done in the present case. They have waited sixty years for new developments in railway systems, but in reality there has been comparatively no change in the last fifty years, although it must be admitted that the speed has been increased on passenger trains during the past forty years about twenty miles per hour. The changes in themselves have not been elementary, but consist only in making the cars more comfortable for the traveling public. The weight and size of the railway rolling stock has been increased greatly for facility and economy in operating railways of America, but not so rapidly in England. In this fact the prudence of the English people again shows itself. They correctly think there is a limit, and have stopped increasing the weight of their rolling stock, and have turned their attention to how it would be best to meet the emergency which demands greater facilities and quicker means of transit, with more absolute safety.

Our American railway managers as yet see no limit, and they are increasing the size of the carrying capacity of their rolling stock. From ten to thirty-ton car engines are also increased in power and corresponding weight; all this with one idea in view, and that to reduce the cost of operation of their line. Of course, this looks well calculated to give the company the desired result. The main substance in this decision is the great saving of labor; in fact the managers will tell the directors of their companies that in place of two trains being required to move a given quantity of freight, one train with one staff will do the work, so that 50 per cent. is saved on engine drivers, firemen, conductors, and brakesmen, and 50 per cent. on locomotives. This is for freight trains only, as the number of passenger trains remains the same. When this report is made at a directors' meeting, there are smiles and happiness all round. They are also shown the great change made by steamship companies of replacing the small steamers with those of four times the carrying capacity. In this, no doubt, a great saving is obtained without so great an outlay. A large expensive steamship must be paid for to replace, say four of the smaller ones, but it cannot be compared with the change that follows in the railways increasing the carrying capacity of their rolling stock proportionately. The changing of the small steamers to the large ones means one steamer to each four, hence one crew, one set of officers, one set of engines and boilers, in fact, one complete ship at sea, one steamer berth at harbor, all in place of four. It is true that the crew will number a few more men than on a small steamer, and the consumption of coal is greater, but not nearly as much coal will be used as on four smaller ones. The risk of accidents at sea is lessened by 75 per cent., therefore the saving must be very great. Also, the steamship company does not lose the small steamers, as steamers of almost any size can be put into service at various classes of carrying on the sea, so that reduces the expense to a large extent, and the extra expense ends there.

Now let us see how differently the change affects the railway companies when the carrying capacity is proportionately changed. In place of one ship, thousands of new cars are required, and in place of one engine, hundreds of new locomotives are needed. This is not all. The very moment this new heavy rolling stock is ready to be put into operation, new and heavier rails, new and larger ties, and new and stronger bridges are required for the whole line, as well as new turntables for locomotives; the road-beds require additional ballast, and in many cases new engine-houses are needed. In the repairing shops additional machines to

take in the larger parts of the larger locomotives will be necessary; in fact the companies may look to the expense of a new railway, less the right of way and road-bed, to meet the change, all in addition to almost the total loss of the rolling stock, rails, bridges, etc., as all of it can only be scrapped at best, as when the change on a few of the trunk lines takes place, all other lines will have to follow or they could not compete, so that old rolling stock will be discarded, hence the great loss: so that when all the cost of this change has been correctly figured it will change the net receipts after the interest has been paid on many milions of outlay. Again, the maintenance of the new heavy rolling stock, and the wear and tear of the rails, bridges, road-bed, and rolling stock itself, will be much greater. The same number of bearings will have greater friction, hence a large increase of lubrication and wearing material. The road-bed and bridges will suffer in proportion; the extra friction, which will have to be applied to the wheels to stop these heavy trains, and to moderate their speed on down grades, and likewise on the pull-up grade—the extra adhesion required to the rails—all this will cause quicker destruction, and again the accidents.

While it is strange to say that the system of steam surface railways has been in existence about sixty years, there have been comparatively no improvements outside of the enlarging of the cars and locomotives, and making them stronger and more comfortable for travellers, and indeed following the extravagant luxury of hotels, etc. Outside of this the system is comparatively the same. The speed of passenger trains has been increased about twenty miles per hour in forty years. The cost of transit for persons and freight remains about the same on the all around average. Regarding accidents: While various devices have been applied, the only one which has been of any consequence in minimizing the number of accidents to the employees is the automatic coupler, which is still far from perfection. The number of accidents on railways of all kinds and under all circumstances have been continually on the increase, and the cause of this is that the competition of railways has become greater as new railways have been built continually, and railway managers have had but one object in view, and that is, cheapness of operation of their line, so that cheap material and construction has been used; anything that would call for a little additional expense for the minimizing of accidents not being entertained. The crowding of railways into large cities has become so congested that accidents are almost of daily occurrence. Now, what is to be done to insure safety of travel on railways—quicker transit?

The elevated electrical railway is no doubt the railway of the future, and as England gave birth to the first system of steam railways, that country is about to give birth to the coming system. They are about to build an elevated railway in a district full of railways, that is, between Liverpool and Manchester. This proves that they feel sure that the new mode of transit will and must be this system, that will gradually take the place of the surface railways, both for passengers and express freight. First, there is the surety that an elevated railway can be made so as to insure positive safety from all accidents whatever, running at 100 miles per hour, or more, because being elevated no contact with moving or other objects on the ground surface will be liable, no accidents from floods or washouts, landslides, or misplaced switches will occur, nor from broken wheels or rails, or any kind of collisions resulting from the mal-intent of anyone putting anything on the track. In the case of trains following each other, the connections would be cut from the power of the following train by the operations of the first train, which might be stopped from any unforeseen emergency; so that the following train would have no propelling power in case of the necessity to stop the first train, and the electric signal would automatically strike the bell on the train that followed. As to falling off the track, that would be prevented by a gab grip that would follow the T of the top cord of the truss, so that it would be impossible for the wheels to mount the rail or get the body of the car lower than the top cord of the girder, only four inches distant. The side of the car is also protected by the sides of the girders, which have a flat, smooth plate running on both sides, which would come in contact with rollers fitted on the sides of each car. There would be no snow to ever block the line or cause any expense or accidents; no grades of any consequence, so that the uniform speed would be constant; no short curves to create danger or extra friction, the track would always be uniform and the cars would always run very smoothly; no dust and cinders or grit to cut up bearings and the machinery, thus all axles could be made to run smoothly in ball bearings with comparatively little lubricant, and the cars would be free from smoke and dirt of any kind.

One can fancy the comfort to travel in cars that are perfectly safe, running smoothly, with good and clean ventilation, also the enjoyment of looking over all the surrounding country as a good panorama. The electric single rail projected by F. B. Behr, for the elevated railway to be built from Liverpool to Manchester, is not the style of railway that can be practically successful. With the single rail system, the one wheel would not be sufficient to attain a very high rate of speed, as the one rail system would cause the wheels to slip, the extra friction would be a great detriment, which would be caused by oscillation that must take place from the uneven loading of cars, wind, etc. While the new system invented is perfectly free from any interference from the above causes, and the railway itself can be built much cheaper, lighter and safer, the cars remain the same type as the surface cars are at present. Of course the cost of building an elevated railway would be greater on the first outlay than a surface railway, on account of the height it must be made at some places, such as crossing rivers, towns, etc. This will require pillars or piers to be made very heavy and strong for perfect safety. But on the other hand the mileage can be reduced on the average at least 25 to 30 per cent. There would be comparatively no right of way to pay for, as only the pillars will take up any valuable space in the country, and very little anywhere. No embankments, no ditches, water culverts, stone or brick arches for roadways, no tunnels to be cut through mountains, no fences, no men to guard level crossings or on the track, no accidents to trains on crossings, and no expense caused by the killing of people or beasts on crossings, and no ballast required, which with its maintenance is a very large item.

After all the above items and the constant maintenance of the same is carefully summed up, it will go

very largely to make up the difference in first cost. Then comes the difference in cost of operation of the two systems. One, the electric elevated, comparatively no dead weight of locomotives, and only the motor car, and less than half the dead weight of the cars to be hauled over the line: the staff of engine drivers and firemen with all the assisting staff at engine houses reduced; no haulage of coal and water over the line; no water stations, water pipes, and water pumping engines; coal stations and the staff—all will be reduced to three power stations per 100 miles, where its boilers, engines, and machinery are stationary; no cost for its haulage; also the engines, as already stated, use up the line with their heavy weight; all the heavy gear wears away much faster. No damage from fire caused from sparks of locomotives, and no more burning up of trains and passengers when trains are run off the track and down embankments or in collisions. Also by removing the passenger trains from the surface railways will give much more facilities to freight trains, which will also prevent many accidents and delay to the freight in transit. Now this is only a question of the first outlay, which cannot help but double itself in a short time, and be a blessing to the human race in its advance with the commercial progress of each year. I am quite sure that my system of elevated railway will accomplish all I claim here, and even more when all the details are fully considered.

Now, as to its possibility of revenue sufficient to warrant the outlay. Say that such a line should be built from New York to Chicago. The present time consumed to make that run is about 35 hours, while the time would be only 7 hours by the elevated, the distance being reduced to 700 miles, and the train running at 100 miles an hour, would be 7 hours in place of 35 hours, or 14 hours in place of 70 for the round trip; outside of the person arriving by the elevated perfectly rested and ready for business, in place of requiring six or eight hours to rest after one has travelled to Chicago by the present system. As to number of passengers, they could afford to go a distance of 300 or 400 miles, to start for Chicago from New York. Say passengers from Quebec, Montreal, or Boston, could reach New York in one night and take the elevated, they would still make the journey in about half of the present time, and the same in the vicinity of Chicago. An elevated line built now between these two points would be only a beginning of the new system, which would not only be a great rate of interest on the outlay, but a general benefit to the travelling human race.

PROPOSED IMPROVEMENT AT LACHINE RAPIDS WORKS.

The Lachine Rapids Hydraulic & Land Company is undertaking a considerable amount of work this year, at the Lachine Rapids, the experience of the past two winters having exhibited the action of the water and ice both at the head and tail races. Last winter, for instance, the water in the tail race was abnormally high, higher, it is said, than it has been for thirty or forty years, and while the head race was not materially affected, so far as the supply of water was concerned in the river, yet the ice entered the intake and would not permit of sufficient quantity of water entering, without drawing down, so that they had to meet the worst conditions possible, namely, the highest back water and low head water inside the intake. Various schemes have from time to time been suggested for preventing the entrance of this ice into the head race, principally by means of large and deep booms.

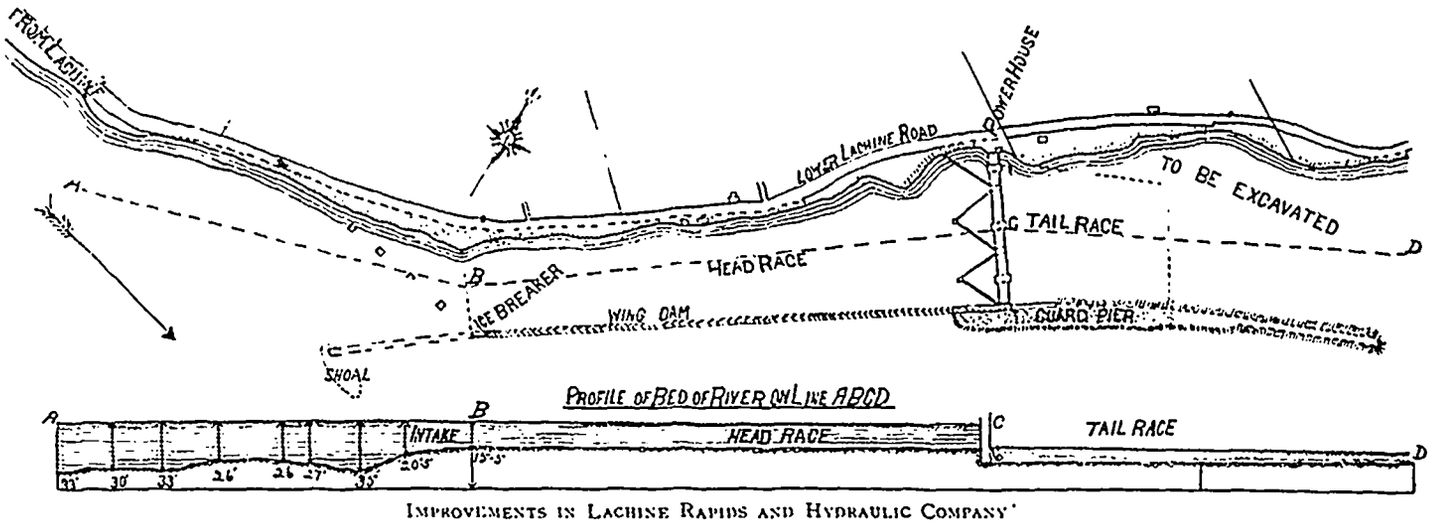
W. McLea Walbank, the original promoter of the company, and one of its engineers, was decidedly against this principle, inasmuch as he contended it would be almost impossible to construct a boom that could be held there, and in addition to which, the current is so strong that even a deep boom would be of little or no use.

After the ice went out of the river this spring, Mr. Walbank had his assistants carefully sound the river above the intake, and submitted to the directors a scheme for the improvement of the works and suggested consultation with outside engineers. The result of the soundings taken in the river showed that there was a deep channel connecting with the main channels of the river at McDonald's Point, as shown on the accompanying plan. This deep channel continued down to almost in front of ice breaker, where the water was turned almost at right angles into the river. The result was that the current had a tendency to draw the ice from the river opposite McDonald's Point, following the deep channel and discharging between the shoal and ice breaker, and naturally depositing ice at the mouth of the intake, which gradually filled up and impeded the flow of water. The channel between this shoal and the ice breaker is somewhat over 20 feet deep. The plan proposed by Mr. Walbank was as follows: Raise the existing wing dam the level of the water in the head race during the month of December, so that there would be absolutely no water running over during winter; also extending the wing dam the same level about 1,000 feet further up the river. The result of this would be to make the intake, in place of 525 feet wide, nearly 2,000 feet wide, and the water in place of being 12 feet deep, would be between 30 and 40 feet deep. The current at present there would be destroyed and the river freeze over. The main direction of the river current would then be at an angle with the head race, rather than leading into it, as at present. For the improvement of the tail race, he suggested the raising of the guard pier about 4 feet, and the extending the same down stream, a distance of about 1,000 feet, and excavating of a deep channel between the guard pier and main shore, and removing the shoals. The object of the extension of the pier was to deflect the ice into the stream. The river below the rapids freezes over in some winters, and forms natural dams in the river itself, which raises the water very considerably, last winter coming one foot over the present guard pier. The object of raising it was to prevent a re-occurrence of this and to allow the tail water to take the discharge of the wheels only, without being influenced by the water in the river, except the natural backing up which occurs every year to a greater or less extent, and which is allowed for in the original plans. In addition to the foregoing, a glance pier from McDonald's Point, running completely down stream, was suggested.

T. C. Keefer, an engineer of very high standing in hydraulic matters, and well-known to our readers, was consulted by the company, and he has reported to the Lachine Rapids Company, endorsing the scheme

here outlined. He says, in his report: "The closing of this cross river channel will not only send the river current and its ice above and outside of, instead of below and inside the shoal, and move it at least one thousand feet from the comparatively narrow and shallow entrance to your head race, but it will destroy the current leading to its mouth. It will move the entrance from its present position to a line opposite the head of the shoal, where the water is both wider and deeper, so that it will be three times greater in area than at present. Above McDonald's Point, the shore line trends to the right, and its course, if produced down stream, would strike the shoal about where the extended wing dam would have its ice breaker. When this extension is made, the shore line of river current, instead of rounding McDonald's Point and flowing in shore, will flow nearly in a straight line toward the new ice breaker and outside the shoal. Your entrance basin, instead of being five hundred feet wide and twelve feet deep, will be about four times as wide and three times as deep. Its current will, even when all your wheels are going, have little attraction for the frazil compared with that of the St. Lawrence, where it has a fall of twelve inches per mile. At present you have no entrance basin, but feed direct from one of the deep channels of the river which brings its frazil to your doors, but with the proposed extension you will have a deep basin covering over two acres of surface, which will freeze over nearly to the line between McDonald's Point and the shoal on which your new ice breaker will be planted. This bordage ice on its river edge will be thickened by wind and wave, and act as a boom to exclude passing frazil. It will not entirely exclude it, for when the river above is covered at its wider part, and its ice is crowded into the narrower width, as it approaches the rapids the frazil will flow deeper and some of it will be forced under the bordage ice and out of the influence of the river current, when it immediately rises to the under side of the bordage, is frozen to it and thus thickens the ice boom. When the full draught of all your wheels is in force, some of the frazil elbowed out of the river may descend farther down, but will be arrested by its friction against the surface ice and laid up for the winter in the new basin before it can reach your head race. This ice boom will probably take a curved form (chiefly toward the lower end), and more frazil be forced under on the side toward the wing dam than near McDonald's Point, leaving an inshore unobstructed channel under the bordage ice. The extension of the wing dam will have the effect of raising the level of the head race (thus increasing the water power), but to what extent it is impossible to say, probably not exceeding six inches. The level of your wing dam should be such that no water can flow over it when ice is running in the river, especially frazil, because the draught caused by this overflow might exceed that caused by your wheels and bring in too much ice. When the cross river channel is closed, I do not think there would be any tendency of 'field' ice to enter the new basin for reason stated above, and then the level of the wing dam could be governed by the frazil level, as that will be after the extension."

Mr. Keefer further endorses a separation of the tail race from the river and the deepening of its channel, but was of opinion that the glance pier was unnecessary. The company has decided to immediately carry out these works, and the contract has been awarded to W. J. Poupore, M.P., Ottawa, as mentioned in the last issue of the Canadian Engineer, and whose firm are now making good progress in the work, the contract calling for its completion by December 1st. In addition to the foregoing, the Lachine Rapids Co. will protect its patrons by installing an auxiliary steam plant, which will place the works beyond any question of being able to supply their demands.



IMPROVEMENTS IN LACHINE RAPIDS AND HYDRAULIC COMPANY'

CANADIAN WATER POWER AND ITS ELECTRICAL PRODUCT IN RELATION TO THE UNDEVELOPED RESOURCES OF THE DOMINION.*

(Concluded from last issue).

In order to present more fully the recently enhanced value of our Canadian water power, some reference is necessary to certain properties of electricity, the power which has happily been described as "the most romantic form of energy," by Wm. Henry Preece, C.B.F.R.S., in his recent address as president of the Institution of Civil Engineers. Inasmuch as the cost of production of electrical energy depends upon continuity of output, water power must be the ideal one for this purpose, at least until some cheaper power is discovered. In some places where steam is now used for electric light, other industries have been added to secure the more continuous use of the power in daylight hours. The only quality in which any deficiency has been exhibited by electricity is for lighthouse purposes,

*Presidential Address read before the Society, May 23rd, 1899, by Thos. C. Keefer, C.M.G., President of the Royal Society of Canada.

a lesser power of penetration in fogs, in which respect it is inferior to oil or gas; but even this has in the present year been more than compensated for by the successful application of "wireless telegraphy," by which, in any weather, communication between the ship and the shore can be established. The shores of the St. Lawrence from the Atlantic to the lakes are lined with water power which can be used to light, in fair, or protect, in foul weather, the passing vessel; to ring the bell or blow the horn. When water is applied for light and power purposes, its economy is always the important factor; but it is chiefly to its value for electro-chemical industries that Canada will look to reap the greatest benefits, because in these it is not merely a question of competition of power producers, but one in which intense electricity has the monopoly, and in the case of some of them, as in the production of aluminium, calcium carbide, carborundum, etc., their existence depends upon ample supplies of an intense electric current, for the generation of which abundant and cheap water power is indispensable.

Touching electro metallurgical processes, Mr. Preece says: "Every electrolyte requires a certain voltage to overcome the affinity between its atoms, and then the mass decomposed, per minute or per hour, depends solely upon the current passing. The process is a cheap one and has become general. Three electrical h.p., continuously applied, deposits 10 lbs. of pure copper every hour, from copper sulphates, at the cost of one penny. All the copper used for telegraphy is thus obtained. Zinc in a very pure form is extracted, electrolytically, from chloride of zinc produced from zinc blende, in large quantities. Caustic soda and chlorine are produced by similar means from common salt. The passage of electricity through certain gases is accompanied by their dissociation, and by the generation of intense heat. Hence the arc furnace. Aluminium is thus obtained from cryolite and bauxite. Phosphate is also separated from apatite and other mineral phosphates. Calcium carbide, obtained in the same way, is becoming an important industry. Electrical energy can be generated on a coal field, where coal, of good calorific value, is raised at a cost of three shillings per ton, cheaper than by a water fall, even at Niagara."

Eastern and Western Canadian coal fields are separated by thousands of miles, but water power is abundant throughout nearly all this coalless region. Our Western coal fields are vast and their market at present limited. If coal can be raised cheaply enough and the raw material for the work be discovered in the neighborhood, they may give rise to electro-chemical and electro-metallurgical industries without the intervention of water power. The commercial production of calcic carbide (acetylene gas) by electrolysis, is the discovery of T. L. Wilson (a grandson of the late Hon. J. M. Wilson, of Saltfleet, Ontario), who has established works on the water powers of the Welland Canal and has shipped this product all round the world. The electric production, commercially, of caustic soda and chlorine, is under the patent of Ernest A. Lesueur, son of the Secretary of the General Post Office Department, Ottawa. This manufacture is now being carried on by a Boston company at a New England water power.

There is another field nearly as widespread as our water power in which electricity is destined to play a most important role, and this is mining, which is now spreading over the Dominion with the same rapidity as the utilization of our forests for pulp and paper purposes. Over this area minerals have been discovered and in many cases tested and successfully worked, and from recent results we appear to be on the threshold of remarkable developments in this direction, especially as so small a portion of so great an area has been prospected sufficiently for mining purposes. For power purposes alone, electricity is invaluable in mines, and its multifarious uses (as enumerated by Mr. Preece) are "for moving trams and for working hoists; it lights up and ventilates the galleries, and, by pumping, keeps them free from water. It operates the drills, picks, stamps, crushers, compressors, and all kinds of machinery. The modern type of induction motor, having neither brushes nor sliding contacts, is free from sparks and free from dust. Electric energy is safe, clean, convenient, cheap, and produces neither refuse nor side products." The Canadian mining districts are well supplied with water power, and all the wonderful effects of electricity are available for us upon a larger and more economical scale than elsewhere. In connection with this abundance of water power, and from the fact that a large proportion is at present situated remote from present railways and present settlements, the question of profitable limit of electrical transmission is most important—if indeed, it be now possible to put a limit on anything connected with electricity, with or without the aid of a wire. If, as reported, Lord Kelvin has placed the profitable limit at 300 miles, this is sufficient to utilize the greater part of the water power upon the two watersheds north of the St. Lawrence river. Professor Elihu Thomson says: "Up to the present time it was practicable to transmit high pressure currents a distance of 83 miles, using a pressure of 50,000 volts. If a voltage higher than that were used, the electricity would escape from the wires into the air in the form of small luminous blue flames." As showing how far we are yet behind nature, Professor Thomson says the estimated voltage from a lightning discharge ranges from twenty to fifty million volts. Wherever the raw material for electro-chemical, electro-metallurgical, or other industries, affords sufficient inducement, and the water power is at hand, the forest will be penetrated much more rapidly than heretofore, and settlements advanced in new directions. What can be done in this direction is best illustrated by the development of a single industry in the wilds of Minnesota, north of Lake Superior, and adjoining Canadian territory. Over four hundred miles of standard gauge railways have been built, through what was a trackless wilderness in 1885, to reach iron ore beds, the ore from which is shipped to Lake Erie and thence again railroaded 200 miles into Pennsylvania. This one business has, in mines, railways, docks and fleets of steamers, required an investment of $250,000,000, and has led to as low a rate, by water, as 1 cent per bushel for wheat between Chicago and Buffalo, and 20 cents per ton for coal from Lake Erie to Duluth, nearly 1,000 miles. One-half of the charcoal iron, and more than half of the pig iron made in the United States, is smelted from Lake Superior ore.

The substitution of electricity for steam as the motive power for railways on many roads is regarded as inevitable sooner or later. It has already taken place

as regards suburban railways, notably in the case of the Charlevoix road and Hull and Aylmer railway, where water is doing the work which has heretofore been done by coal. The chief obstacles to an early change on the larger roads are the hundreds of millions invested in locomotives, and the very large outlay required to equip existing steam roads with the electric system. The principal inducement would be the passenger service, owing to the increased speed possible—it being confidently stated that, with electricity, a speed considerably over one hundred miles per hour could be attained. Moreover, there would be the entire abolition of the poisonous smoke which drops upon the Pullman in preference to any coach ahead of it. While the conversion of trunk lines would be attended with a cost which is for the present prohibitory, this objection does not apply to new lines which may be worked independently, or in connection with electric ones. When the time arrives for such railways, water power will have a field of usefulness of which we can at present form little conception. Water wheels and wires would displace the coal docks, the coal laden vessels, the huge coal yards, and the trains required for distributing their contents over hundreds of miles of lines. An interior line connecting Lake St. John, on the Saguenay, with Lake Temiscamingue, on the Ottawa, which could ultimately be extended, via Missanabi, Nepigon, and Lac Seul to the Saskatchewan, would be a colonization road, removed from the frontier—one which could be worked possibly altogether by water power, and would open a virgin tract in which electro-chemical and electro-metallurgical industries might arise, as well as those connected with the products of the forests and the mine.

The more extended use of our water power, in the immediate future, for manufacturing and mining purposes, especially for the electro-chemical and metallurgical productions, naturally leads to the consideration of the character of the output, especially with regard to markets, and transportation problems generally. Transportation, next to production, is the most important commercial question to a country of vast distances and low-priced products, affording great tonnage, such as we produce; and for which we have expended hundreds of millions in canals and railways, harbors, light-houses and steamers, a sum disproportioned to our realized wealth, as it certainly is to our population. But, *"noblesse oblige,"* we possess a vast estate, are compelled to develop it—and await results. The question of transportation determines, to a great extent, the existence, or otherwise, of a possible industry, and enhances or diminishes the value of every article of export just in proportion to its efficiency and economy. On the other hand, where transportation is necessarily expensive, cheap production may maintain an industry—and here is where our abundant water power may come in. The geographical position of Canada in relation to the commercial centre of gravity of the North American continent is at least noteworthy. This centre is very near Lake Erie. From the western end of this lake the water route to the Atlantic at the Straits of Belle Isle follows the general direction of a great circle which cuts the commercial heart of Europe, and is therefore upon the shortest route, or "air line." Our two peninsulas, Sarnia-Detroit and Sault Ste. Marie, which are the railway gates of the lake region, afford the most direct routes to the Atlantic for all the North-Western States, and are traversed by the trunk lines of railway. From Lake Erie water communication on the largest scale extends through Lake Huron to the extremities of Lakes Michigan and Superior. One-third of the population of the United States are dependent upon the Great Lakes, largely as to exports and imports, and wholly as to rates—which are fixed by the water for the rail routes. One-half of the population of the United States is found within a radius of 400 miles from Cleveland, a Lake Erie port claimed to be second only to the Clyde, as a shipbuilding one, and also the largest iron ore market in the world. The paper and pulp industry, as well as some of the electro-chemical and metallurgical ones (to the present list of which many additions may be made), are distinguished by the large tonnage produced, the output of several pulp mills exceeding one hundred tons per day. For this the St. Lawrence is the natural route for exportation, and to it this heavy tonnage is of the greatest importance as a means of attracting "tramps," as well as liners during the open season. Increase of sea tonnage into the St. Lawrence is essential to our inland commerce; by it only can sufficient west-bound freights be secured to attract a proper share of the commerce of the lakes, after all has been done to give to the latter quick despatch at Montreal or Quebec. There is probably no place in the world where inland transportation is carried on with greater expedition and economy than in the valley of the St. Lawrence. This is due to the character of the inland navigation, unequalled elsewhere, and to the influence which this exerts upon the railways competing with it; and also, because the valley of the St. Lawrence is not only the greatest highway for agricultural products, but of mineral ones, as well as of the products of the forest and the fisheries. More than half of the iron ore produced in the United States is mined around Lake Superior. Into this lake an increasing number of railways are pouring the produce of the vast wheat fields between it and the Rocky Mountains, and thus placing this grain within a thousand miles of Montreal, which is the nearest seaport, by hundreds of miles, and the only one which can be reached by vessels capable of navigating the lakes. Wheat grown in the foot hills of the Canadian Rockies has already reached Lake Superior by an all rail haul of 1,500 miles, a distance considered prohibitory in the early days of railways, as one which would absorb the whole value in the cost of carriage. The lateness of harvest in our North-West, and the early closing of navigation in the St. Lawrence, will soon over-tax all our means of transport, both water and rail, during the interval between September and December. The Welland and St. Lawrence canals and the portage railways between Montreal and Lake Huron constitute the Canadian routes, and much, which cannot arrive by water in time for export, will be stored up at nearest lake ports for winter railway carriage to tide water warehouses on the St. Lawrence, for export at Atlantic ports—or for conversion into flour at Ontario and Quebec water powers. This accumulating tonnage from our Western plains and our Eastern forests must call for a proportionate extension of export facilities which should attract tonnage to the St. Lawrence. Already Montreal has eighteen regular lines of

steamers to transatlantic ports, exclusive of tramps. New York alone of the Atlantic ports exceeds this in number. Montreal has five regular lines to Liverpool and the same number to London, two lines to Glasgow, and two to Hamburg, and one each to Bristol, Manchester, Belfast and Antwerp. Baltimore has twelve regular lines of steamships to Europe, Boston nine, and Philadelphia eight. No doubt all these Atlantic lines exceed Montreal in number and tonnage of vessels, as well as in cargo carried. They have twelve months' navigation against seven for the St. Lawrence. The real significance of Montreal's eighteen regular lines of steamships is the demonstration that, in spite of climatic drawbacks, or inferiority in other respects, the St. Lawrence is the route towards which northern exports will gravitate during its open season.

PORTLAND TERMINUS OF THE GRAND TRUNK.

From Chicago on the west, to Portland on the east, change and improvement everywhere meet the eye of the traveller on the Grand Trunk Railway System. In all these changes nothing has been done for mere display or whim, but in every case money has been spent to give increased comfort and safety to passengers or to afford increased facilities for transportation of freight. An instance of the latter may be cited at Portland, where every provision is being made for the winter traffic, which the company will need to provide for at this terminus. Nature has marked out Portland as one of the great sea-ports of the United States in the future. Possessing a wide and deep harbor, well protected from storms by its archipelago of rock-ribbed islands across Casco Bay, of which Portland Bay is an arm, it is not only a safe winter port, but is so guarded by islands and capes as to be easily made a station of immense strength in time of war. Along this harbor the Grand Trunk owns a sea front of nearly a mile, and during the past two years the present management, foreseeing the needs of the sea-borne traffic of the port, have prepared to provide what the steamship companies are even now demanding, for arrangements are concluded which will make Portland the winter port of call of steamship lines, enough to give it practically a daily service to Europe. These contracts include a weekly boat each by the Allan and Dominion lines to Liverpool, a weekly boat to London direct by the Thompson line, fortnightly boats to Glasgow by the Allan and Donaldson lines each, fortnightly boats to Bristol by the Elder-Dempster line, to Hamburg by the Hamburg-American line, while there are reports of a fortnightly service to Antwerp by the Leyland line, and to Manchester by the Manchester line, though the last two proposals have not yet taken shape. To meet this traffic, which will be inaugurated in November, the Grand Trunk recently joined hands with some Portland capitalists in building a second grain elevator, the new one having a capacity of a million bushels, and being provided with three conveyors running direct to their own wharves, so that three or more steamers can take in grain at the same time. Ten cars can unload grain at one time in this elevator, which is provided with all the latest machinery for quick work, being able to deliver 30,000 bushels per hour. While the grain trade has been well looked to, other merchandise is amply provided for by four new freight sheds, each about 500 feet long and 100 feet to 120 feet wide. This gives six sheds alongside of which tracks are laid, and from which seven or eight ships can load at a time. In fact, ten vessels have been loading or discharging cargo at a time at the G.T.R. wharves, which can accommodate vessels of 500 feet length. There are also two coal wharves owned by the company, having ample capacity for present needs. Last year new tracks were laid in the company's yards to accommodate 1,500 cars, and this has been followed by the erection of new stock yards to accommodate the growing export cattle trade. The city of Portland, which has now a population of about 60,000, including the suburbs of Deering and South Portland, and which has an active board of trade, with a membership of over 300, appears to be fully awake to its opportunities. Its suburbs and the islands of Casco Bay are every year being resorted to more by Canadians, who always meet with a hearty welcome from the hospitable people of the Maine coast, and who find in the temperate climate and bracing sea breezes of this region an ideal summer resort.

THE CEMENT INDUSTRY.

The great increase in the production of Portland cement in Canada is causing considerable remark among those interested in engineering and the building trades. There does not appear to be a corresponding expansion in the business of the producers of the natural rock or hydraulic cements, and these latter complain that there is a prejudice growing up which is against them, and in favor of Portland cement makers.

The peculiar qualities of Portland cement, as distinguished from the natural or rock cements, are: A very much higher strength at early dates; greater uniformity in manufacture, due to the constituents being brought together artificially and therefore being controlled with ease. It can be laid in frosty, even winter weather, with safety; it will stand wear of pavements, etc.

The characteristics of natural or rock cements, which commend them to use, are: Their continually increasing strength, by which in time they are nearly equal to Portlands; safeness, as they are not over-limed; cheapness, near point of manufacture, where early strength or frost proofness are not requisite, and where concretes are not to be immersed in water for several months.

THAT "COMPRESSED AIR" FIZZLE.

Readers of The Canadian Engineer will remember our discussion on some of the auto-car schemes exploited in the United States, and particularly the Croker-Leiter scheme, relating to compressed air auto-trucks. Complete verification of our prophecies is to hand, in the form of an announcement that all the compressed air companies and affiliated concerns—nominally capitalized at about forty millions—are all to be merged into one central corporation, with H. Payne Whitney, son of William C. Whitney, as president of the new company, which will have a nominal capital of one hundred millions. Does this mean that we are to see the auto-trucks by hundreds doing work in our streets? Not at all; for, as the Cycle Age well says, "Nothing has as yet transpired in the way of inventions or tests that would make compressed air appear as

available for ordinary motor vehicles. The compressed-air motor is chiefly adapted for street railway power and for heavy freighting over very short routes." But the compressed air exploiters started in to revolutionize all traffic in the big cities, and cartage companies and all haulage vans were to be done away with. Is there nothing left, then, for the compressed air magnates to exploit? Yes; electricity! It is soberly stated that "the American rights, under the Krieger electric patents, are reported to have been purchased by them, and they are known to be pursuing further investigations into motive powers." This statement is corroborated by the fact that the word "air" has been dropped from the title of the new company, which is "The International Power Company." The Horseless Age remarks: "Putting two and two together, therefore, it looks as if the sceptics were right, and we should not be afflicted with these barbarous 'auto-trucks' after all. Perhaps when the company really gets down to business we shall have good, common, everyday motor trucks propelled by steam, gasolene, kerosene, or anything but compressed air." Now we will be prepared for the collapse of the Whitney-Elkins-Widener windbag.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS TENTH ANNUAL CONVENTION.

Berlin, Ont., had the honor of entertaining the members of the C.A.S.E. for their tenth annual convention, and she proved a worthy hostess. The convention opened on the 15th August, and ended with a banquet on the evening of the 17th. The delegates, who were accompanied by their wives, made the Brunswick Hotel their headquarters. The executive and the balance of the delegates were assigned to the American House, and the banquet took place in the hall of the Walper House. The convention held their business meetings in the Christadelphian Hall.

Tenth Annual Convention Canadian Association Staticnary Engineers

It was nearly noon on the 15th when President Bro. W. F. Chapman, in the chair, supported by Vice-Pres. Bro. R. C. Pettigrew, opened the session with the following opening charge from the C.A.S.E. ritual: " Brothers—It is my duty to rule with justice, promptness and forbearance, and it is your duty to make our meetings entertaining and instructive, avoiding all useless discussions and personalities, upholding your obligations by using toward each other brotherly love and kindness. Thus securing the great object for which we are organized, that of meeting together socially for mutual improvement and discussing the best methods of managing the world's greatest motor, steam, and its appliance to power. I hope each brother will be decorous and attentive to the business of the evening. I now declare this association open for its legal business."

The following committees were selected by the president, the first named in each case being chairman:

Committee on Credentials—Bros. Edkins, Marr and Turkington.

Committee on Finance—Bros. Webb, Wickens and Pettigrew.

Committee on Mileage—Bros. Bain, Ironsides and Jamieson.

Good of the Order—Bros. Dixon, Wickens, Oelschlager, Moseley.

The following answered the roll call: Executive—Bro. W. F. Chapman, president; Bro. R. C. Pettigrew, vice-president; Bro. G. C. Mooring, treasurer and acting secretary; Bro. W. Bear, conductor; Bro. J. Wendell, door-keeper. The delegates from branch associations were: A. E. Edkins, J. D. Moseley, J. W. Marr, W. J. Webb, J. G. Bain, of Toronto No. 1; John M. Dixon, Toronto No. 18; Jos. Ironsides, Hamilton No. 2; J. Ogle, J. Forsyth, Brantford, No. 4; W. Jamieson, Dresden No. 8; W. Oelschlager, Berlin No. 9; R. Turkington, Brockville No. 15; F. A. Pflug, Waterloo No. 17. Other members present were, A. M. Wickens, E. J. Philip, J. G. Bain, Jas. Bannan, of Toronto; R. W. Greene, Guelph; Nathan Uttley, Waterloo; W. Liedt, J. Schneider, G. Steinmetz, W. Oelschlager, of Berlin; Jos. H. Walker, of Kincardine. Among the visitors present at the meetings were T. J. Halsey, of the Fairbanks Co. of Montreal, and his samples of valves, asbestos-packed blow-off cocks and asbestos ring gate valves, interested the members very much. W. V. Uttley, of Berlin News-Record, was unwearying in his attendance, and coming of an engineering family took an active interest in the meeting.

Welcome to Visiting Delegates by President Oelschlager, C.A.S.E., No. 9.

On behalf of the Berlin Association No. 9, I have great pleasure in extending to you, Mr. President, and delegates of the Canadian Association of Stationary Engineers, a hearty welcome to our town, on this the 10th annual convention. The growth of the association here has been slow but sure. The members of the Berlin branch, realizing the benefit of the meetings, are good in attendance. In conclusion we welcome you collectively and individually, and trust that your stay in this German city will be most pleasant and profitable.

Annual Address of President Chapman.

Brethren—I have the honor to welcome you to this our tenth annual convention. I am aware that in selecting you as delegates, our various branches have sent their best men. Consequently, I am confident that your deliberations will result in the advancement of our organization, and that in dealing with the various subjects brought before you, the one and only aim sought shall be the greater good of the C.A.S.E. I am sure that naught but good will shall prevail, indeed, such is one of

the cardinal principles of our order. I need not ask for your hearty support, as this has always been given to the occupant of the chair. We have not increased the membership during the past year, only one new association organized, and very few new members added to replace those who withdraw and those taken by death. But brethren, I have the pleasure of saying that we have received into the C.A.S.E., out in Calgary, a lot of energetic members, that in the near future will have their subordinate lodge second to none in our fair Dominion. I have also in my possession a letter from Bro. Wm. Cross, also one from a Mr. Cook, chairman of a committee appointed by the engineers out at Rossland, asking information as to the starting of an association in that place. So you see if we have lost in the east we have gained in the far west, where everything grows in abundance, and to an enormous size. You will be asked to look over a bill drafted by a committee appointed by the Ontario Association, also to give your opinions and co-operations, that a greater effort may be put forth to have the bill become law, at the next meeting of the Local House. In this connection I should say that in this movement, not only are the members of the two associations a unit in favor of such a law, but I might add, almost all the qualified engineers of this country are with us, as well as most of the steam users. It may be necessary at the present convention to again take up the matter of bi-annual conventions, with a view to the curtailment of the expense necessary for an annual meeting. Steps should also be taken to arouse the engineers of the Dominion to the loss they sustain in not being of our membership. I regret very much the steps taken by our secretary, also by Montreal No. 1. I presume most of you have seen the item in The Canadian Engineer, that Montreal had moved to withdraw from the executive. For what reasons? Because they did not get from the executive the results desired in accordance to what they pay in, also that the cost of attending the convention was too great Now, brethren, do you think that is the object? They have had for the past two years the executive secretary, a man possessed of good ability, and I consider it the most important office in the executive. So if they have not obtained what they want in the way of information it is their own fault. I think it would be wise to appoint some good past president to the secretaryship, and keep him for a term of years, and have him devise some scheme whereby the subordinate associations will be drawn in closer touch with the executive head. For instance, he might send out problems to the different lodges, for them to work out and return, and any errors they might make could be rectified by him, whereby keeping up a correspondence, and making the executive head a medium of instruction. These are a few points I have brought out for your consideration, and I feel satisfied that your best judgments will be used in dealing with them. The finances will be dealt with by the executive treasurer, therefore I will not touch on them. Brethren, in conclusion, I desire to express to you my deep sense of gratitude for the great honor you conferred on me a year ago, when you elected me to the high and honorable position of president of this association, and for the loyal manner you have stood by me. In closing I will only add it is my heartfelt wish that your deliberations at this convention may be so conducted towards each other that everything we shall do will redound to the benefit and honor of our good association.

Moved by Bro. Wickens and seconded by Bro. Pettigrew, that the president's address be handed to the Committee on the Good of the Order for discussion.

The minutes of the last meeting were then read by Treasurer and Acting Secretary Bro. G. C. Mooring, who was handicapped badly, owing to the poor notes of last meeting, and press of business coming on him in his dual capacity; he regretted that they had not been put into proper shape. They were adopted on a motion by Bro. Dixon, seconded by Bro. Edkins. The president informed the married men accompanied by their wives that carriages would be ready for the ladies at 2.30, for the purpose of giving them a drive round the twin cities. On a motion by Bro. Marr, seconded by Bro. Ironsides, and carried unanimously, it was decided to adjourn until 3 p.m.

At the afternoon session Bro. Oelschlager introduced Mayor Eden, and several of the councillors, and the delegates and visiting engineers listened with great pleasure to the following speech, in which the mayor gave them welcome:

Address of Welcome by Mayor Eden, of Berlin.

It affords me very much pleasure to meet the delegates of the Canadian Association of Stationary Engineers, and especially is it a pleasure to greet you in our town of Berlin. I am glad to see that a number of the delegates have brought their wives with them, for I feel satisfied that they will retire much earlier in consequence. The stationary engineer fills a most important position in connection with the welfare of the country. In the first place, they virtually hold the key to our manufacturing industries, whereby the trade and commerce of the land is very much increased. They also control to a great extent the labor employed in cities and towns, and without this employment, the cities and towns of our country would be very much reduced in prosperity and population. This must show to the engineers the necessity of each of you being intelligent and ingenious. A man to-day to be of any use in any profession must be more than a machine. You are showing your wisdom in forming yourselves into an association and meeting regularly to discuss new requirements in your particular lines. No doubt many of you are clever individually, but all can learn from one another. It should be your object to try and benefit your employer by giving him as much power as possible with the least expense. Now as mayor of this town, I extend to you all a hearty welcome to our town of Berlin—a town which we boast of as being the best in this fair Dominion—a town which employs to-day more stationary engineers than any other town its size in Canada. I understand that only a few of our engineers have as yet joined the association, but I trust your meeting here will act as a stimulus and result in having all our engineers identify themselves with the organization. Our town is known as a most hospitable one, and I can assure you the freedom of the city wherever you go. No doubt you will be most interested in our manufacturing establishments, and I can assure you from what I know of our manufacturers, it will be a pleasure for them to show you through their factories. I trust you will enjoy your visit here in such a way that you will see fit to meet here again in the near future, at which time we will have all our streets fixed up in keeping with the rest of the town. I again extend to you, friends, the freedom of our town.

Reply to Address of Welcome from Mayor Eden, of Berlin, by President Chapman.

Mr. Mayor and Aldermen:—

On behalf of the delegates here present, attending our tenth annual convention, I thank you for the honor you have done us in welcoming us in such a handsome manner to your beautiful town, noted not only for the proverbial hospitality of its citizens, but also for their well known go-aheadativeness and public spirit. We join with you, Mr. Mayor, in pride of the beautiful cities, towns and waters of this Canada of ours, and not only those are we proud of, but we are proud of our fair Dominion at large, believing that it is bound to become one of the greatest and grandest countries on this earth. And, Sir, appreciating this truth, it becomes us as engineers, to sow the seed of theory and practice combined, which are the fundamental principles of our order. I am sure the delegates, one and all, appreciate as highly as I do your presence amongst us. We have come together to combine business with pleasure. The object of our association is to help one another, not only in a social and brotherly way, but chiefly to educate ourselves in our calling, thus benefiting our employers as well as ourselves; and I am sure we are more than pleased to hear from the eloquent welcome you have tendered us, that you thoroughly understand our aims and objects. I feel sure that our sojourn in your town will be most agreeable and pleasant for us all, and that we shall return home carrying with us happy recollections of our stay in the beautiful town of Berlin. Our branch here is composed of energetic citizens, as is evidenced by the programme of enjoyment provided for the entertainment of their visitors. When we add to this the hearty co-operation with them of the Chief Magistrate, and citizens generally, we have indeed reasons to approve of the decision of last year's convention, in deciding to come to Berlin. I need hardly say, Mr. Mayor and Gentlemen, that during the proceedings of this convention, we shall at all times be pleased to have you attend our sessions when you feel disposed to do so. We have met with cordial receptions wherever the conventions of the association have been held, but

nowhere has it been more generous and hearty than in Berlin. Again Mr. Mayor and Aldermen, on behalf of the delegates here assembled, I thank you for your welcoming us to your town.

Bro. G. C. Mooring, in his capacity as acting secretary, then read the annual report, and his report as read brought member after member to their feet. It was certainly incomplete in many details, and it looked at one time as if the executive were somewhat to blame. Secretary Robertson had, according to his letter of explanation, met with various and trying accidents, and other experiences, which had all tended to a complete abandonment of his official duties, and the report was finally referred, on a motion by Bros. Dixon and Moseley, to the Finance Committee for analysis. Bros. Wickens, Webb and Pettigrew demanded an investigation, and were answered by Bro. Edkins, who said it would not help matters any even if the executive were dragged into the matter; he was followed by acting secretary Mooring, who explained matters from his standpoint as acting secretary, and had done all he could to give them facts. For a few minutes the executive had a busy time answering questions, which came thick and fast, and the atmosphere cleared only when Bro. Mooring read a private letter to himself, and in which the secretary took all the blame. It was a revelation to the representative of The Canadian Engineer how such matters could be discussed in such a fair manner, and how straight questions such as were asked could be answered calmly and without any show of personal feeling. It speaks well for the manliness of the individuals composing the C.A.S.E., and many executive heads could get good pointers from our C.A.S.E. in convention. The matter, however, was finally referred to the following special committee, consisting of Bros. Webb, Wickens, Pettigrew, Edkins and Dixon.

Forwarded to the Committee on the Good of the Order for a report on same, and moved by Bro. Edkins, seconded by Bro. Pettigrew, that the committee be given until Thursday a.m. to prepare their report. The treasurer, Bro. G. C. Mooring, then read his report for the year.

The following notices of motion were then given:

That our conventions in future be held every alternate year or bi-annually, instead of annually as at present —John M. Dixon

That the per capita tax be reduced from 70c. to 50c. per year. —Chas. Moseley.

That two days session in future be the limited time apportioned conventions.—John Marr.

The report of the Credential Committee was on motion by Bro. Dixon, seconded by Bro. Wickens, accepted and referred to the Mileage Committee. Bro. Dixon, who is an indefatigable worker, and one of long experience, then read the report of the Parliamentary Committee. A discussion followed the reading of this, led off by Bro. Ironsides, and participated in by Bros. Wickens and others, and after being fully discussed and ample explanation given it, was received by Bro. Edkins and seconded by Bro. Bain, and the committee was dismissed. In connection with this report it might be said that last year a committee was formed, and Bro. Dixon was the convener. The members of the committee were stationed far apart, and as a result no concerted action was possible, so they had failed in their object. It was brought out in the discussion, before referred to, that to be a success the new committee would be chosen differently.

A copy of the new bill, which is proposed to be submitted to Parliament, was distributed at this stage of the proceedings, and after a motion had been made by Bro. Mooring, a committee of one, Bro. Oelschlager, was appointed to have badges made for the delegates. Meeting adjourned.

The programme for the evening was varied, and it was thoroughly enjoyed by all. At 9 p.m. special trolley cars, supplied by Manager McLelan of the Street Railway Company, carried the executive, delegates and ladies to the Zimmerman House at Waterloo, where a reception was tendered them by Waterloo Association No. 17. A pleasant time was spent. Bros. John M. Dixon and J. W. Marr supplying the vocal music, and the variety of the contributions was very great; many of the choruses were taken up by the crowd, and Bro. Dixon gave a creditable exhibition of the duties of a choir-leader, his invariable good nature and sympathetic remarks leading the chorus singers far above the plane on which they had started, and the presence of a number of German friends did not deter him in achieving his object. The gentlemen friends of the party having received an invitation to a German supper from Mr. Wegener, the party left for Berlin about 10 p.m., and soon afterwards were enjoying this unique feast of pretzel, Limburger cheese, brown bread, weiners and other delicacies of the Fatherland. Past President E. J. Philip put in an appearance, having travelled from Toronto in his automobile, accompanied by his mother, an old lady of 74 years of age. Toronto was left at 11 a.m. and Berlin was reached at 8 p.m., having travelled 70 miles. This was the first auto-mobile to enter Berlin, and attracted great attention. Bro. Philip was the centre of attraction for the newspaper men, and the fact really was, he was the most talked of man in town. He introduced his brother, G. O., who is one of Berlin's successful merchants, the manager of the Opera House, and a liberal-minded citizen. Songs and stories helped pass the time, and the host sang several German songs, his rendering of the well-known "Der Wacht Am Rhine," being particularly enjoyed by the English members of the party. The inn, which is named the "Progress," is a fac-simile of the German style.

Handsome mural paintings adorn the walls, and scrolls containing mottoes similar to the following are entwined with the figures: "First weigh, then risk it;" "Love what is rare," "Drink what is clear," "Speak what is fair," "Eat what is pure." Needless to say this supper was a grand success and was one of the most pleasant experiences of the Berlin meetings.

The convention re-assembled at 10.30, Wednesday morning. The first business attempted was the reading of Finance Committee's report. It was adopted and the committee discharged on a motion of Bros. Moseley and Webb. Next came the report on the Good of the Order, and it was decided to take up the report clause by clause. Bro. Dixon read the report through and then submitted

Clause 1. Resolved that the president's address contains much that is essential to the vitality of the association. His references regarding our development has a slightly regretful tone, but the causes certainly cannot be laid to our charge; they rather lie at the doors of those associated with us at the time, whom it was impossible to control, much less coerce into activity. Adopted on a motion by Bros. Wickens and Moseley.

Clause 2. Resolved that the outlook for our extension in the near future has a hopeful aspect, inasmuch as enquiries have reached us from the Pacific Coast, requesting organization under the C.A.S.E. charter, wishing to enroll themselves as comrades in the march. We suggest that all such enquiries be closely attended to by our incoming executive. Adopted on a motion by Bros. Ironsides and Oelschlager.

Clause 3. Relative to Bill proposed at last session of 1898 convention. Your committee formed at last convention found it impossible to take action for the following reasons: The O.A.S.E. took up the matter enthusiastically, and obtained an interview with the Hon John Dryden, M.L.A., and at his suggestion they amended the Bill, and intend presenting the new version at the next session. We, your committee, desire to impress upon the individual members the necessity of supporting this association in their efforts on your behalf. Amendment to Clause 3, proposed by Bro. Moseley and seconded by Bro. Pettigrew, That the committee should recommend that a special committee be appointed to act in conjunction with the O.A.S.E., as a further means of support, also that funds be placed at its disposal to help in the forwarding of their object, and that they be realized by a special appeal through the executive to the primary associations. The amendment was incorporated with the original and adopted.

Clause 4. Resolved that president's suggestion that a past president be elected to the office of secretary is a wise one. We wish to add the following, that said office of secretary be held for a term of not less than two years, and the official be eligible for re-election at the pleasure of the convention. Adopted on a motion by Bros. Pettigrew and Mooring.

Clause 5. This clause after a great difference of opinion was withdrawn. It provided for the holding of the C.A.S.E. convention bi-annually. Since the subject was first brought forward some years ago, no method of coming to an agreement had been proposed. The general opinion in former conventions was against it. Converts, however, have been made, and yet many of the delegates had come uninstructed as to how their

vote should be cast. Interesting discussion for and against resulted. Bros. Pettigrew, Dixon, Bain and others spoke against the change, and argued strenuously for an annual meeting. Some of the speakers demanded a live, working executive as a cure for the apparent waning of interest. Bro. Dixon, in a fair, impartial manner, took up both sides of the question, and left it in the hands of the individual members, by suggesting a plebiscite vote, and wished to move an amendment to that effect, which was done, and the amendment carried by a majority of three. In connection with above Bro. Pettigrew advanced an argument, which, perhaps, was not noticed much at the time, but was discussed freely outside the convention. It was argued by him that the Canadian Electrical Association was a competitor of the members individually of the C.A.S.E. Now the Canadian Electrical Association is composed altogether of electrical experts and employers of labor in plants operated primarily by steam power or water, and it does not appear reasonable to consider them in the light of competitors of an institution which exists chiefly for the education of steam producers.

Clause 6. Notice of motion by Bro. Moseley, that per capita tax be reduced from 70c. to 50c. Adopted on a motion by Bros. Pettigrew and Edkins.

Clause 7 was withdrawn. It dealt with the time limit of conventions, and it was found that the constitution had covered the ground fully.

Clause 8. Resolved that the executive be reminded that a motion stands on the books regarding the issuing of instruction papers. So far no course of instruction has been brought to our notice which would be so effective in retaining the interest of our members and to enable them to come in closer touch. Your committee begs leave to emphasize this present motion and suggests that strong pressure be brought to bear on your executive in regard to the preparation of these question and answer papers, of such paramount importance to our individual members. Adopted on a motion by Bros. Edkins and Ironsides. All of which is respectfully submitted. Bros. Dixon, Oelschlager, Moseley, Wickens, committee.

The president received a telegram from Goldie, McCulloch Co., inviting the delegates to visit their works in Galt, and it was decided unanimously to accept the invitation for the afternoon. The convention at 12.30 decided to adjourn until 9.30 a.m., Thursday.

After dinner the train was taken for Galt, and the trip down was very enjoyable. In fact beautiful weather during the whole convention was the order. Just a short distance from Berlin we ran quite close to the sewage farms, and so far the disposal of their sewage has been accomplished successfully by this system.

The C.P.R. bridge at Galt was also an object of interest, particularly because the bridge has been raised some few feet without in any way interfering with the traffic. At last Galt was reached, and as it was the first visit of many to this thriving and pretty city of factories, many were the exclamations of interest as delegates recognized the familiar names of machinery manufacturers whose products they had used. Easily the largest of them all was the immense stone block of their hosts, and as they filed into the office of the firm Mr. A. R. Goldie met them and personally conducted them through the different departments. Mr. Goldie has the faculty of conveying very much information in few words, and is perhaps the youngest man in Canada occupying such a responsible position, being general superintendent of the entire works.

It is needless to say that the visitors were very much interested, they having no idea that the Goldie & McCulloch establishment was so large. They were much interested in the engine department: the immense floor of the erecting room was completely filled with engines in different stages of construction. Some of these were as large as 400 and 500 h.p.; there were Wheelock slow speed engines, and Ideal high speed engines, the latter suitable for direct connected electric lighting. After visiting this shop they went into the machine shop where the very latest improved lathes, planers, etc., were all busily engaged turning out work for these engines and other machinery. System and good management were apparent on every hand. The very best facilities for handling heavy work are placed for the convenience of the workmen all through the shops. The writer noticed that the most modern of machinists' tools were used by the workmen, and it might be of interest to lathe and planer users to know that Goldie & McCulloch Co. was the first in Canada to install the patent tool holders and boring bars manufactured by the Armstrong Bros. Tool Co., of Chicago.

If these two shops were of interest, perhaps the moulding shop proved even more interesting. This immense department is 160 feet long by 90 feet wide, equipped with all the very latest appliances for handling ladles and heavy castings. There is one Whiting travelling crane, entirely operated with compressed air, the capacity of which is 40,000 lbs. In addition to this are six hydro-pneumatic swinging cranes, placed on each side of the floor, making it possible to pass ladles and castings from one end of the shop to the other. The cupolas, of which there are three very large ones, are placed at one end of the shop, as are also three great core ovens; at the other end is the cleaning room, which has cranes and compressed air appliances of all kinds for cleaning castings. The brass foundry is in this same building, but separated from the moulding shop proper. After visiting the shops mentioned above the visitors were taken through the other departments, the wood working machinery, the gas engine and the flour mill machinery department, the safe works and the boiler and other shops. While these different departments were of much interest to the engineers, of course it cannot be expected that they took the same interest here that they did in the engine construction department. President W. F. Chapman, in a few well chosen words before the delegates left, tendered a very hearty vote of thanks to Mr. Goldie for his kindness and courtesy in showing them through the works, and Mr. Goldie fittingly replied, after which three hearty cheers were given for the Goldie & McCulloch Co., Limited, of Galt, Ont.

The balance of the time in Galt was spent in sight-seeing and visiting the many friends of the delegates, and at 7.30 all arrived back in Berlin, the evening being spent in visiting Victoria Park and other points of interest.

The final session commenced at 9 a.m., Thursday. The Mileage Committee read their report and it was adopted on a motion by Bros. Edkins and Pettigrew. In consideration of his long services and ever ready assistance, Bro. A. M. Wickens' name was added to the list, on a motion by Bros. Dixon and Moseley.

Report of special committee was then read by Bro. Dixon. They had the difficult duty of analysing the reports and letter of the secretary. After deliberation they had drawn up a letter which was deemed satisfactory, and to show their good-will to the members of the Montreal branch, which had withdrawn, it was embodied in the letter that the C.A.S.E. ask them to accept as a gift the charter, by way of a practical illustration of the good will extended.

The new Bill occupied the attention of the meeting for a short time, and on a motion by Bros. Moseley and Pettigrew a new Parliamentary committee was formed, Bro. Dixon, convener, and Bros. Edkins, Webb, Moseley and Mooring members. The sum of $50 was put at their service for contingencies. A motion was also carried to the effect that the incoming secretary be requested to purchase a new supply of by-law and constitution books, and was adopted unanimously.

The election of officers was the next order of business. Two scrutineers were appointed, Bros. Walker and Bear. For president, Bro. Pettigrew, acclamation; vice-president, Bro. Mooring, acclamation. Bro. Dixon was also nominated but refused to stand. The secretary, under the new law, was to be selected from the past-presidents, and Bro. A. M. Wickens was elected on his past record, unanimously. The treasurer's position was the first to require a vote, and Bro. Moseley was the choice. The position of conductor also required a vote, and Bro. Oelschlager was declared elected. The position of doorkeeper was the most exciting and last official voted for. Three candidates offered were Bros. Bear, Turkington and Dixon, and Bro. Bear was the fortunate one. Past President Chapman then installed the new officers: Bro. Webb acting as conductor for the occasion. A vote of thanks was tendered the scrutineers. Toronto was selected as next place of meeting. The new president presented the retiring president with the handsome past president's jewel, and the few words spoken by Bro. Chapman were full of feeling, and expressed his deep gratitude for the honor done

him, marking the cessation of duties as the representative head of such an honorable body of men.

Votes of thanks were passed to the Berlin association and the chairman of the Reception Committee for his arduous and successful work, which had made their visit so pleasant, to which Bro. Oelschlager replied; the ladies of Berlin for their hospitality in entertaining the visiting ladies, and Bro. Steinmetz was appointed the bearer of this vote to them. The acting secretary, Bro. Mooring, was voted a sum of money as a slight acknowledgment of his services, and his reply was an expression of his desire to reach the highest office in the C.A.S.E., and he thanked them for placing him a step nearer his goal. Bros. Wickens and Moseley also expressed their thanks for the honors tendered them. A vote of thanks was tendered the local press, The Berlin News-Record being mentioned in particular. The Canadian Engineer was also tendered a hearty vote of thanks. President Pettigrew then delivered the closing address, and intimated his desire to build up the association. He was proud of the executive chosen, and the election of a past-president to the position of secretary would do much to strengthen his hands, and could only lead to the best of results. He prophesied a great future for the C.A.S.E. The present convention had done much to clear away the obstructions hindering their progress, and the next convention would prove what he said. The National Anthem was sung heartily, and the convention was over.

THE BANQUET.

The convention was brought to a close by a banquet in the dining hall of the Walper House. The attendance was good, and the Berlin association could be congratulated on the manner in which everything was arranged. Bro. Oelschlager acted as chairman, and was supported at the head of the table by the officials and prominent guests. The chairman read letters of regret from Mayor Eden; Goldie, McCulloch Co., Galt; J. J. York, Montreal, and others.

The toast of the Queen brought into evidence the patriotic spirit of the guests, and the National Anthem was sung heartily. "Canada Our Home," was responded to by L. J. Breithaupt, M.L.A., and in reviewing the history of Canada the speaker made the statement that the diamond jubilee was the means of making Canada better known than any other event in her history. As an employer of labor he dwelt on the dignity of labor, the great future in store for us, the increase of the exports from Berlin and her sister city. He said much had yet to be done in the making of Canada's great and unbounded possessions known. Great ignorance of the actual condition of affairs in Canada at times came to his notice, whether feigned or not he could not say, but he did not think our resources were realized by the nation to the south of us. He believed that there was no reason why in course of time Canada should not develop her resources so as to rival the progress of the United States. In the unavoidable absence of Mayor Eden, Dr. Bowlby, deputy reeve, spoke to the toast of "Mayor and Council. The trade and commerce of Berlin was his subject. The great manufacturing concerns were fully described, and the speaker informed them that they were there to stay. Messrs. Rumpel and Hagen also spoke a few words in their position as aldermen. Mayor Diebel, of Waterloo, although far from being a well man, made a pleasant speech, and his jocular references to the leading products of Waterloo were fully appreciated. The executive head and delegates came next. President R. C. Pettigrew lauded the C.A.S.E. for their efforts along educational lines and considered them the greatest educational body in Canada, outside the Public schools. Education and progress were the corner stone and motto respectively of the society; although only in existence for a little more than twelve years, having had great difficulties in its path, and many prejudices to overcome, it kept steadily advancing, and now numbered over 20 branches, and if legislation such as they asked for was granted they would feel as if they had accomplished something. Vice-President Mooring and Treasurer Moseley followed with remarks of gratification suggestive of the good time they had enjoyed in Berlin. Manufacturing Interests was responded to by Samuel Rogers, president Queen City Oil Co. Mr. Rogers is a self-made man, and in his remarks commenced with reminiscences of the winter of 1844: his experiences are typical of the hard road to success travelled by the farmer's son in the early days of a new country. At that time his sole ambition was to own a farm; however, when that object was gained, his ambition was still far from satisfied, and up through the years he kept advancing until his present position rewarded him. Canada's great wealth and the great future were subjects upon which the speaker spoke eloquently. His advice to the Canadians was to keep their resources and young men in Canada, particularly referring to the eagerness with which young men from our country were sought after by the business men of the neighboring Republic. Mr. Rogers concluded his speech with a detail of figures, and a very interesting account of the savings made in the oil factories from the utilization of the by-products. Mr. Anthes, a prominent manufacturer of Waterloo, also spoke. Educational interests were ably championed by Hugo Krantz, and his remarks were interesting in the extreme. With Germany as an example he related how she had taken steps when her trade was small, compared with other nations, to find out what she lacked. The establishment of technical schools and polytechnic institutions marked the beginning of a new era in her affairs of commerce, and to-day she stands in the front rank of the manufacturers. He made a strong plea for education of the practical man, and has worked for years on these lines, and the material in Canada, and the men were the equals of Germany, and Canada would prosper if that same idea that was embodied in the German manufacturing circles of training the working man first practical, then theoretical, was adopted. Sister associations were ably spoken for by E. J. Philip and A. M. Wickens, and their endorsation of the demand for legislation was strongly put, particularly by the last named. The Press were well represented, and as the hour was late their remarks were short. Messrs. Motz, Journal; Lutz, News-Record; Young, Electrical News, and Arch'd W. Smith of The Canadian Engineer, all replied to the toast. The Ladies were well cared for by D. B. Dover of the G.T.R. and G. O. Philip. Both of whom spoke as if the subject was a pleasing one. Our Host and Hostess—in the absence of A. Walper, G. O. Philip spoke in his place, and the meeting dispersed with the familiar strains of "Auld Lang Syne," and "God Save the Queen."

Amongst the guests present were: H. D. McConochie, Galt; A. F. Masters, Detroit; Otto Werner, Sebastian Englert, R Cossey, Aureleas Moses, Alfred Vice, Albert Arndt, D. B. Doar, J. P. Wegener, Conrad Gildner, J. E. Belger, John Schneider, of Berlin; R. W. Turkington, Brockville; J. H. Clappison, Hamilton; G. Byers Towers, Jas. Bannan, Jas. Bain, A. E. Edkins, Toronto; H. A. Simpson, John L. Wendell, M. D. Caldwell, A. Stockfisch, Nath. Beam, John Nihell, Gideon Beam, F. A. Pflug, Jno. R. Uttley, of Waterloo; W. Mielke, New Hamburg.

W. OELSCHLAGER.

W. Oelschlager is of German descent, and was born in Waterloo county, Ont., in 1857. He learned the machinist's trade with J. Bricker & Sons, of Waterloo. Had two years' course in Worcester School of Technology, Mass., and graduated with honors. Was employed in the following shops: Chicago, West Michigan Railroad shops, Muskegon; E. P. Allis Co., Milwaukee; Chicago, Milwaukee and St. Paul railroad shops, Milwaukee; A. O. Pray & Co., Minneapolis; C.P.R., Winnipeg, and E. E. Gilbert & Sons, Montreal; was with this firm for three years, and had charge of their machine shop for

two years, and left them in 1884 to start a shop himself in Port Elgin. Mr. Oelschlager carried on the shop for ten years, and five years ago removed his shop to Berlin. He has been a member of C.A.S.E. No. 9 for four years, and holds O.A.S.E. first-class certificate.

CHAS. MOSELEY.

Chas. Moseley, the newly elected treasurer of the Canadian Association of Stationary Engineers, was born at Chart, near Sutton, Eng. At the age of 11 he began his mechanical education by entering the machine shop of Steaven, Hooker & Co, and at 16 had charge of their steam plant. In 1884 he left England and sailed for Canada. Arriving in Toronto, he secured a position with John Fletcher, builder and contractor, as engineer. He remained with Mr. Fletcher for six years, leaving to accept a position with the Mail Publishing Co., Toronto, but after six months returned to his former employer, for whom he worked one year. Later Mr. Moseley secured the position of engineer of the North Toronto Electric Light and Waterworks, and in August, 1893, he accepted his present responsible position as chief engineer of the Incandescent Toronto Electric Light Co., on Terauley street, Toronto.

The portraits and biographical sketches of the other officers have already appeared in former issues of THE CANADIAN ENGINEER.

DRAFT OF BILL.

An Act for the protection of Life and Property in the use of Stationary Boilers and Engines, and the Examination and Licensing of persons in charge of them.

Whereas special provisions have been made by law for inspecting marine boilers and engines, and, as a result, the precautions made necessary by the owners in complying with the said law have had the effect of reducing accidents by boiler explosions to a minimum; and whereas the boiler explosions in the use of stationary engines and boilers have of late years increased alarmingly and been the means of destroying a large number of lives, and a great amount of property, through defective plant, the carelessness of owners, and the lack of knowledge of the men in charge; and whereas it is expedient in the interests of the public that the like means of prevention of such explosions and accidents should be applied to stationary boilers and engines, as to marine boilers and engines:

Her Majesty, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:

1. This Act may be cited as An Act for the Protection of Life and Property in the use of Stationary Boilers and Engines and the Licensing of Engineers in charge of them.

2. In this Act unless the contents otherwise requires.

(1) The expression "Boiler" does not include boilers used for heating water for domestic purposes or low pressure steam heating boilers, unless the pressure exceeds fifteen pounds per square inch, or railway locomotive or steamboat boilers, but means and includes all other steam boilers and every part thereof, or thing connected therewith, and all apparatus and things attached to or used in connection with any such boiler.

(2) The expression "Owner" means and includes any person, firm or corporation, the owner or lessee of the boiler, and the manager or other head officer in charge of the business of any such firm or corporation.

(3) The expression "Engineer" means any person having charge of or operating a steam boiler, under the provisions of this Act.

(4) The expression "Inspector" means any inspector of steam boilers appointed by the Lieutenant-Governor-in-Council under the provisions of this Act.

3. The Lieutenant-Governor-in-Council shall appoint an inspector or inspectors of steam boilers for the province, for the purpose of carrying out the provisions of this Act, and may fix the remuneration to be paid such inspector or inspectors, and may divide the province into districts, and appoint one or more inspectors in each district. Such inspectors shall constitute a board of boiler inspection, who shall meet from time to time as may be required, and who shall have power to formulate uniform rules and regulations for the inspection of boilers, and the examination of candidates for certificates of fitness as engineers under the provisions of this Act, and upon the approval of same by the Lieutenant-Governor-in-Council, such rules and regulations shall have the same force as the provisions of this Act.

4. No person holding the office of inspector under the provisions of this Act shall be either directly or indirectly interested in the sale of boilers or steam machinery, or any kind of supplies used in connection therewith.

5—(1) Every inspector appointed under the provisions of this Act shall, before entering upon the performance of his duties, take and subscribe an oath that he will faithfully and impartially perform the duties of his office, and also give security for the due performance of his duties in the sum of $2,000. He shall have had at least five years experience as a practical engineer in charge of a steam engine.

(2) Every inspector appointed under the provisions of this Act shall be practically conversant with the manufacturing and working of boilers, and shall also be a competent and practical engineer, especially conversant with the manufacturing and working of steam boilers, and shall hold the highest grade of certificate granted by the Ontario Association of Stationary Engineers, or a first-class engineer's certificate from the Minister of Marine and Fisheries, under R.S.C., chapter 78, section 41.

6. The inspectors appointed under this Act shall, under the direction of the Lieutenant-Governor-in-Council, make such rules for the uniform inspection of all steam boilers coming within the provisions of this Act, as will ensure the careful, thorough and systematic inspection of all boilers once, at least, in every year.

7. The provisions of this Act respecting the inspection of boilers shall not apply to any boiler insured and inspected by a duly incorporated or duly licensed boiler insurance company, legally doing business in Canada, if the owner or owners of such boiler shall, when required by an inspector appointed under the provisions of this Act, produce the certificate of inspection from such a company.

8. The inspectors shall examine all persons applying for certificates under this Act, and shall have power to issue certificates of competency according to the experience, knowledge and qualifications, subject to the rules and regulations made and approved of by the Lieutenant-Governor-in-Council, from time to time.

9. All certificates shall be exposed to view in a conspicuous place in the engine or boiler room.

10. Every engineer or fireman, or holder of a special certificate who undertakes to operate or take charge of any steam plant, requiring a higher grade of certificate than he possesses, shall be liable to a penalty not exceeding Fifty Dollars, and not less than Ten Dollars, upon the conviction of the same offence, and the inspector may revoke his certificate.

11. Every person who has charge of an engine or boiler to which this Act applies at the time of the passing thereof, shall upon the payment of a fee of two dollars to the inspector, be entitled to receive a permit to operate such steam plant for the term of one year, and every such engineer or fireman who applies for a renewal or higher grade of certificate, may procure the same by passing the necessary examination before the inspector, and shall pay for the certificate the sum of five dollars.

12.—(a) Every person to whom the provisions of the next preceding section does not apply, who presents himself for ex-

amination, shall pay the sum of five dollars for such examination. Each certificate shall have force and effect for the term of one year, unless sooner revoked for cause, and for each renewal the sum of one dollar shall be paid. The inspector shall not issue in any case a certificate to a person of intemperate habits, however skilful he may be.

(*b*) Every person who has had charge of an engine or boiler to which this Act applies at the time of the passing thereof, for the period of ten years prior to the time of the passing hereof, shall upon the payment of a fee of five dollars to the inspector, and upon furnishing proof of such service and of good character from his employers, be entitled to receive a second class certificate.

13. Every inspector appointed under this Act shall have power to revoke the certificate of any engineer in his district, if the person holding the same shall have committed any act or acts that shows him to be unworthy, incompetent or intemperate; but such person may appeal from the decision of the inspector to the Minister of Agriculture.

14. No person shall employ another as engineer, and no person shall serve as engineer unless the person serving or as employed as engineer is then licensed by an inspector as aforesaid, and any one who violates any of the provisions of this section shall be liable to a penalty not exceeding two hundred dollars, and not less than fifty dollars.

15. All moneys collected for certificates or renewals under this Act shall be paid to the inspector who issues the certificates, and who shall remit the same to the Provincial Secretary, together with a statement showing the names and addresses of the persons paying the same.

16. All prosecutions under this Act may be brought before any of Her Majesty's justices of the peace in and for the county in which the offence was committed, and in cities, towns and incorporated villages where there is a police magistrate, before such magistrate.

17. Every inspector shall keep a true record of all boilers inspected, and all repairs ordered by him, of all boilers condemned by him as unsafe, of all accidents to boilers in his district whether by explosion or otherwise, of all casualties in connection with boilers in his district.

18. Whenever any licensed engineer or inspector shall discover that the boiler he is operating has become weakened or unsafe, he shall at once notify the proprietor, owner or manager of the fact, and demand that they be repaired and made safe. If the owner, proprietor or manager shall refuse or neglect to have the needed repairs made, the engineer or inspector shall at once notify the board of inspectors of such refusal or neglect.

19. The board shall thereupon order a thorough inspection to be made, and, if said boiler proves on inspection to be unsafe, the proprietor or manager shall forthwith have the needed repairs made, and any owner, proprietor or manager who shall attempt to operate any boiler after such inspection, before having the needed repairs made, shall on conviction be fined not less than $ nor more than $

20. Any boiler operated at a pressure of fifteen pounds or less to the square inch, shall not come under the provisions of this Act, except those under sidewalks in cities or towns.

21. On the occurrence of an explosion from any boiler to which this Act applies, notice thereof shall be sent within twenty-four hours thereafter, to the inspector within whose jurisdiction the explosion took place, by the owner or by the user, or by the person acting on behalf of the owner or user.

22. The notice shall state the precise locality, as well as the day and the hour of the explosion, the number of persons injured or killed, in addition to the purposes for which the boiler is used, and generally the part of the boiler that failed, and the extent of the failure, and such other particulars, if any, as the Lieutenant-Governor-in-Council may from time to time require.

23. If default is made in complying with the requirements of this section, the person in default shall on summary conviction be liable to a fine not exceeding one hundred dollars.

24. On the receipt of a notice of a boiler explosion the inspector shall fully investigate the causes and circumstances attending the explosion, and such investigation shall be held at or as near the place of such explosion by the said inspector, in such a manner and under such conditions, as the Lieutenant-Governor-in-Council may from time to time deem most effectual, for ascertaining the causes and circumstances of the explosion, and for enabling the said inspector to make the report hereinafter mentioned.

25. The inspector making such investigation with respect to any boiler explosion shall present a full and clear report to the Minister of Agriculture, stating the cause of the explosion, and all the circumstances attending the same, as shown by the evidence, adding thereto any observation thereon, or on the evidence, or on any matters arising out of the investigation, which they may think right to make.

26. In the case of an explosion taking place on any stationary boiler for which the owner or user has not obtained a certificate of fitness, from an inspector under this Act, or from an inspector of a duly incorporated boiler insurance company, and any persons killed or injured thereby, or any property destroyed or injured, the owner or user of such boilers shall prima facie be deemed guilty of negligence, and liable for any injury occasioned by such explosion, and the onus shall be on the owners or users of the said boilers, to show that all reasonable and proper precautions had been taken to prevent such explosion or accident.

27. Provided that no part of this Act, except section 26, shall be deemed to apply or to affect the operations of steam engines or boilers, upon any farm for threshing, or other agricultural purposes.

28. For every inspection and certificate thereof under the provisions of this Act, the inspector shall be entitled to receive from the owner or user of a boiler a fee of five dollars. If two boilers are inspected at the same time a fee of eight dollars, and if three boilers are inspected at the same time a fee of ten dollars, and for each additional boiler inspected a fee of two dollars more.

MCLACHLAN ELECTRIC AND GASOLINE MOTOR CO., TORONTO.

Users of power do not need to be introduced to J. C. McLachlan, formerly of the Toronto Electric Motor Co., Ltd., and will be interested in the departure which he has made by adding the manufacture of gasoline engines, both marine and vehicle types, to the electric motors which he has successfully supplied for many years. The vehicle shown in the illustration is equipped with one of these motors and weighs complete less than 500 lbs. These engines can be applied to owners' traps. When equipped with base this motor is valuable for use as a small stationary engine. The marine type is very light, and weighs under 175 lbs. for 3 h.p. It has been installed in a launch 21 feet by 5 feet, for T. E. Cuffe, of the Empire Cloak Co., Toronto, and is said to afford the most complete satisfaction in every way. All particulars may be had of the builders, The McLachlan Electric and Gasoline Motor Co., 94 Adelaide street west, Toronto.

C. F. McGill, mechanical superintendent of the Canadian General Electric Co., Peterborough, Ont., has moved his family from Schenectady, N.Y., to Peterborough.

PRODUCTION OF ORES AND MINERALS IN THE UNITED STATES. (FIRST PRODUCTS.)

Number.	Products.	Customary Measures.	1897. Quantity. Customary Measures.	1897. Quantity. Metric Tons.	1897. Value at Place of Production. a Totals.	1897. Value at Place of Production. a Per M. Ton.	1898. Quantity. Customary Measures.	1898. Quantity. Metric Tons.	1898. Value at Place of Production. a Totals.	1898. Value at Place of Production. a Per M. Ton.
1	Asbestos	Sh. T.	840	762	$12,050	$16·00	885	803	$13,425	$16·72
2	Asphaltum	Sh. T	27,397	24,851	480,000	19·58	25,000	22,300	482,175	20·69
3	Asphaltic limestone	Sh. T.	2,300	2,168	11,450	5·28	14,000	12,701	70,405	5·51
4	Bituminous sandstone	Sh. T.	47,470	43,065	136,178	3·16	49,530	44,938	140,275	3·26
5	Barytes	Sh. T.	20,430	23,077	105,720	4·41	28,247	25,626	112,068	4·41
6	Bauxite	L. T.	20,590	20,919	51,475	2·46	26,791	27,220	66,978	2·46
7	Borate of calcium, c.	Sh. T.	19,400	17,600	398,000	n22·05	15,335	13,911	300,700	n22·05
8	Bromine	Lb.	487,149	221	136,402	617·19	480,978	221	136,351	617·19
9	Cement, nat. hydraul.	gBbls	7,990,573	1,073,742	3,976,050	3·70	8,101,078	1,110,552	3,819,905	3·44
10	Cement, Portland	gBbls	2,430,903	441,000	3,724,905	8·45	3,584,580	650,323	6,168,106	9·48
11	Chrome ore	L. T.	150	152	1,550	10·17	100	102	1,000	9·84
12	Clay products				56,487,527				58,470,513	
13	Coal, anthracite	Sh. T.	52,645,133	47,759,351	85,857,717	1·80	52,848,603	47,943,040	81,445,037	1·70
14	Coal, bituminous	Sh. T.	148,155,567	134,405,849	120,018,372	0·89	165,208,025	149,875,727	123,410,351	0·82
15	Coal, cannel	Sh. T.	56,511	51,266	153,145	2·99	49,889	45,259	134,700	2·98
16	Cobalt oxide	Lb.	19,300	k8,754	30,880	k3·53	9,040	k4,373	15,424	k3·53
17	Copper sulphate, f	Lb.	16,781,217	7,589	615,826	m85·10	28,001,501	12,720	956,897	m75·16
18	Corundum	Sh. T.	208	266	19,810	74·47	786	713	69,699	89·24
19	Emery	Sh. T.	1,900	1,724	92,000	53·36	2,066	2,032	149,840	73·62
20	Feldspar	L. T.	21,901	22,251	111,392	5·01	21,350	21,692	107,147	4·94
21	Fluorspar	Sh. T.	4,739	4,300	38,294	8·44	12,145	11,018	86,985	7·89
22	Fullers earth	Sh. T.	17,103	15,599	92,398	5·92	15,553	14,110	87,303	6·19
23	Garnet	Sh. T.	2,201	2,051	66,353	32·35	2,682	2,615	82,480	31·71
24	Grahamite	Sh. T.	1,776	1,593	52,650	n33·07	2,075	2,427	80,250	n33·07
25	Graphite, crystalline	Lb.	993,138	k450,484	m 44,691	k0·10	1,647,670	k747,322	m 148,291	k0·20
26	Graphite, amorphous	Sh. T.	1,200	1,089	11,400	10·47	1,200	1,089	11,400	10·47
27	Gypsum	Sh. T.	300,309	272,493	889,177	3·26	348,686	316,326	989,549	3·13
28	Iron ore	L. T.	18,235,400	18,527,772	30,941,379	1·67	20,655,865	20,989,359	37,593,674	1·79
29	Magnesite	Sh. T.	c1,907	1,730	c7,628	4·41	c2,355	2,136	c9,430	4·41
30	Manganese ore, i	L. T.	158,000	161,147	328,176	2·04	217,782	221,279	491,122	2·17
31	Mica, scrap	Sh. T.	2,882	2,615	o32,620	11·02	3,220	3,201	o39,857	12·44
32	Mica, sheet	Lb.	118,852	k53,911	83,296	k1·55	109,968	k49,881	91,482	k1·83
33	Molybdenite	Sh. T.	Nil.	Nil.	Nil.	Nil.	8	7	400	57·14
34	Monazite	Lb.	40,000	18	2,000	110·23	d150,000	68	e7,500	110·23
35	Natural gas				e10,000,000				e10,500,000	
36	Ocher, p	Sh. T.	42,500	38,637	468,400	n12·13	41,900	38,057	461,450	n12·13
37	Petroleum, crude	gBbls	57,124,783	7,902,016	39,372,111	4·98	51,774,465	7,248,509	42,106,522	5·81
38	Phosphate rock	L. T.	1,007,307	1,023,483	3,022,101	2·95	1,257,615	1,277,717	4,355,025	3·41
39	Precious stones				d101,000				e125,000	
40	Pyrites	L. T.	133,368	135,502	404,699	2·99	191,160	194,219	589,329	3·03
41	Salt, q	Bbls	15,822,923	2,009,635	3,698,556	1·84	18,756,894	2,382,197	4,733,664	2·00
42	Silica, brick	M.	20,283		323,561		33,440		590,251	
43	Diatom. earth	Sh. T.	3,000	2,722	30,400	11·17	1,392	1,263	11,002	8·71
44	Flint	Sh. T.	23,407	25,771	55,817	2·17	33,593	32,220	73,313	2·27
45	Sand, etc	L. T.	e750,000	762,000	e 1,125,000	1·48	e800,000	812,800	e1,178,560	1·45
46	Pumice	Sh. T.	1,700	1,542	8,500	n5·51	144	131	720	n5·51
47	Grindstones	Sh. T.	36,502	33,114	342,185	10·33	38,859	35,233	488,675	12·44
48	Whetstones				97,220				107,990	
49	Tripoli	Sh. T.	1,631	1,480	5,475	3·70	1,865	1,692	3,367	1·99
50	Slate, roofing	Sq'es.	932,124	281,679	2,829,526	f3·04	1,136,632	343,715	2,933,496	f2·60
51	Manufactures				565,105				523,856	
52	Pigment	Sh. T.	6,857	6,221	57,863	9·30	7,886	7,154	70,671	9·88
53	Soapstone	Sh. T.	16,904	15,335	169,040	n11·02	18,892	17,111	158,635	9·27
54	Soda, natural, r	Sh. T.	6,350	5,761	93,400	16·36	7,150	6,486	94,650	14·59
55	Stone, for building				e30,000,000				e32,500,000	
56	Stone, limestone (flux)	L. T.	4,247,688	4,315,651	1,868,983	0·43	5,275,819	5,360,232	2,304,900	0·43
57	Stone, lithographic	Sh. T.	Nil.	Nil.	Nil.	Nil.	112	102	n2,240	n21·96
58	Strontium sulphate	Sh. T.	40	36	200	n5·55	2	2	10	n5·55
59	Sulphur	L. T.	1,690	1,717	34,814	m20·28	2,726	2,770	59,754	m21·57
60	Sulphuric acid, f. l	Sh. T.	42,352	38,421	699,535	m18·21	47,558	43,144	970,188	m22·49
61	Talc, common	Sh. T.	10,164	9,221	90,908	9·86	9,112	8,266	78,645	9·51
62	Talc, fibrous	Sh. T.	52,856	47,933	288,685	5·02	54,807	49,721	285,759	5·75
63	Tungsten ore	L. T.	(b)	(b)	(b)	(b)	78·865	80·13	17,358	217·12
64	Uranium ore	Sh. T.	17	15	9,010	600·67	33	30	16,500	550·00
65	Wulfenite	Sh. T.	Nil.	Nil.	Nil.	Nil.	12	11	144	13·07
66	Zinc sulphate	Sh. T.	Nil.	Nil.	Nil.	Nil.	145	132	4,640	35·15
67	Zinc ore, exported	Sh. T.	9,251	8,393	211,350	23·18	11,782	10,688	229,870	23·04
68	Zinc white, s	Sh. T.	20,262	23,823	1,693,020	70·77	32,747	29,708	2,226,706	74·93
69	Est. prod. unspecified				5,000,000				5,000,000	
	Totals				407,913,912				433,659,141	

REFERENCES.

In using the statistics in the foregoing tables, reference should also be made to the detailed tables under the respective captions further on in this volume, where many explanatory notes as to the statistics will be found. The following notes refer to the four preceding tables: *(a)* Except where otherwise specified. *(b)* Not enumerated. *(c)* Amount or value of crude mineral. *(d)* Partly estimated. *(e)* Estimated. *(f)* Amount recovered as a by-product. *(g)* Barrels of 300 lb. *(h)* Barrels of 400 lb. *(i)* Includes manganiferous iron ore: this is not duplicated in the report of iron ore. *(j)* Value per square, i.e., 100 sq. ft. lapped and laid; the weights are calculated on the basis 3 squares = 2,000 lb., but these figures are only approximately correct. *(k)* Kilograms or per kilogram. *(l)* Reduced to a basis of 66° B. *(m)* Average market price at New York. *(n)* Nominal. *(o)* Value before grinding. *(p)* Includes ocher, umber, sienna, and oxide of iron. *(q)* Includes salt used for the manufacture of alkali; the barrel of salt weighs 280 lbs. *(r)* Reduced to a basis of 58 per cent ash. *(s)* Includes a small amount made from spelter. *(t)* Average value of lake copper at New York, less 0.25c. per lb. *(u)* Includes spiegeleisen, though the total value is reckoned as if the whole product were ferromanganese. *(v)* Average market price at Pittsburg. *(w)* Troy oz. *(x)* Flasks of 76.5 lb. *(y)* Barrels of 42 gal. *(z)* Includes a comparatively small amount made directly from ores. *(aa)* Not included in the preceding tables.

Abbreviations: Sh. T., short tons (2,000 lb.), L. T., long tons (2,240 lb.); M. T., metric tons (2,204.6 lb.).

UNITED STATES MINERAL AND METAL PRODUCTION IN 1898.

The statistics of mineral production in the United States, as furnished by the producers and others for The Mineral Industry, Volume VII., compiled by Richard P. Rothwell, editor of the Engineering and Mining Journal, have now been completely collected and arranged, and are presented in the accompanying tables. These show a production which, in nearly all the more important substances, is the greatest ever recorded. The United States was, in 1898, by far the largest producer of iron and steel in the world; was second only to Great Britain—and then by a very small quantity—in the production of coal; and furnished more than half of the total copper supply of the world.

In accordance with the usual practice there is added to the columns containing the customary measures, others giving the weights, in metric tons, or other measures. Comparison with foreign reports is then easy, and the statements are recorded in a form which will be of still greater value hereafter. Mr. Rothwell hopes that, in a very few years, we may be able to dispense altogether with the column of "customary measures," and that the metric measures will then be the customary ones also. The figures in the table and the brief notes which follow will fully explain the course of the mineral production during the year 1898. The total value of the mineral production of the United States in 1898 was $709,816,750, against $648,804,899 in 1897. Of the production in 1898, $314,255,620 was the value of metals against $272,178,392 in the previous year, and $433,659,141 ores and minerals, against $407,913,912 in 1897. The values given for ores and minerals include $38,098,011 in 1898 and $31,287,405 in 1897 for bauxite, manganese and iron ores, which were used for making aluminum, ferromanganese and pig iron. These duplications were deducted in the aggregate values stated above. Eighteen secondary products for which statistics were collected, derived from some of the ores included in these totals, had an aggregate value of $49,432,829 in 1898, against $41,718,420 in 1897. There was also a production of copper, lead, silver and gold from foreign ores and bullion, valued at $58,948,125 in 1898, against $47,127,174 in 1897. In the preparation of the statistics for this volume the figures previously reported for 1897 have been revised in the light of later and more minute investigation.

THE LATE J. H. KILLEY.

The name of the late J. H. Killey, of Hamilton, Ont., was very familiar to the readers of The Canadian Engineer two or three years ago, when he was a frequent contributor to its columns. Mr. Killey died very suddenly from heart failure, August 10th. Just before retiring he complained of a slight cold, but about 2 a.m. he awoke Mrs. Killey, telling her that he had a choking sensation in his throat. Within a few moments he fell back on his pillow, expiring before medical aid could be procured. He leaves a widow and three sons, the latter being Wm. Killey, of Hamilton, Ont.; James, of British

PRODUCTION OF METALS IN THE UNITED STATES.

Number.	Products.	Customary Measures.	1897. Quantity. Customary Measures.	1897. Quantity. Metric Tons.	1897. Value at Place of Production. a. Totals.	1897. Value at Place of Production. a. Per M. Ton.	1898. Quantity. Customary Measures.	1898. Quantity. Metric Tons.	1898. Value at Place of Production. a. Totals.	1898. Value at Place of Production. a. Per M. Ton.
					$	$			$	$
70	Aluminum	lb.	4,000,000	k1,814,388	m1,400,000	k0·77	5,200,000	k2,358,705	m1,690,000	k0·72
71	Antimony	lb.	1,500,000	680	107,250	157·72	2,000,000	907	165,000	181·92
72	Copper	lb.	501,370,295	227,420	t55,351,231	243·40	535,000,232	242,688	t69,129,047	259·70
73	Ferromanganese, a	L. T.	178,630	176,474	v7,489,970	45·28	218,769	217,189	v10,474,681	48·23
74	Ferromolybden'm	lb.	*Nil.*	*Nil.*	*Nil.*	.....	2,100	.....	1,050	1,102·30
75	Gold	cOz.	2,861,576	k89,022·4	59,210,786	k664·60	3,148,612	k97,883	65,032,430	k664·60
76	Iron, pig	L. T.	9,478,385	9,630,649	t91,009,633	9·45	11,660,165	11,745,128	t110,103,372	9·38
77	Iridium	cOz.	20·25	.....	600	.....	8·5	.....	255	.....
78	Lead	Sh. T.	197,718	179,389	m14,156,609	78·93	228,475	207,271	m17,272,710	83·33
79	Molybdenum	lb.	*Nil.*	*Nil.*	*Nil.*	.....	9,750	4,423	11,937	k2·70
80	Nickel	lb.	33,700	k15,285·2	m11,667	k0·76	11,145	k5,055·3	m8,815	k0·76
81	Platinum	cOz.	200	k6·2	2,468	398·78	300	k9·3	3,837	k411·25
82	Quicksilver x	Flsks	26,079	905	910,418	1,005·98	30,493	1,058	1,109,045	1,049·09
83	Silver	Oz.	56,457,292	k1,756,001·0	33,755,815	mk19·22	58,769,127	k1,827,723	34,070,245	mk18.97
84	Tungsten	Lb.	*Nil.*	*Nil.*	*Nil.*	.....	83,200	k15,059	43,160	k2·87
85	Zinc	Sh. T.	100,387	91,070	8,271,889	m90·83	114,104	103,514	10,429,106	m100·75
	Totals	.....	.....	.....	272,178,392	.....	.....	.....	314,235,620	.....

SECONDARY MINERAL AND CHEMICAL PRODUCTS OF THE UNITED STATES.

Number.	Products.	Customary Measures.	1897. Quantity. Customary Measures.	1897. Quantity. Metric Tons.	1897. Value at Place of Production. a. Totals.	1897. Value at Place of Production. a. Per M. Ton.	1898. Quantity. Customary Measures.	1898. Quantity. Metric Tons.	1898. Value at Place of Production. a. Totals.	1898. Value at Place of Production. a. Per M. Ton.
					$	$			$	$
86	Alum	Sh. T.	15,456	14,022	463,680	m33·06	18,791	17,047	563,730	m33·07
87	Aluminum sulphate	Sh. T.	40,855	42,053	1,138,875	m27·56	56,063	51,404	1,416,675	m27·56
88	Ammonium sulphate	Sh. T.	3,111	2,822	136,884	m48·51	3,589	3,256	179,450	m55·11
89	Calcium carbide	Sh. T.	1,925	1,746	134,750	77·18	(b)	(b)	(b)	(b)
90	Carborundum	Lb.	1,242,929	564	153,812	272·72	1,594,152	723	151,441	209·47
91	Cement, slag	gBbls	40,000	7,258	60,000	8·27	157,662	28,606	235,721	8·24
92	Coke	Sh. T.	12,768,891	11,583,822	23,303,920	2·00	15,897,707	14,422,387	30,505,563	2·12
93	Copperas	Sh. T.	15,702	14,245	78,660	5·52	11,285	10,238	58,105	5·68
94	Copper sulphate	Lb.	29,397,575	13,335	1,134,746	m85·10	27,057,860	12,272	922,673	m75·18
95	Crushed steel	Sh. T.	324	294	51,824	176·27	330	299	46,200	154·52
96	Graphite, artificial	Lb.	162,382	473,655	10,149	k0·14	185,647	484,209	11,603	k0·14
97	Lead, white, z	Sh. T.	105,804	95,988	9,522,360	99·20	93,172	84,525	9,391,788	111·11
98	Lead, red	Sh. T.	7,788	7,074	744,703	105·27	9,160	8,310	916,000	139·59
99	Lead, orange mineu'	Sh. T.	477	433	76,320	176·28	541	491	108,200	220·37
100	Litharge	Sh. T.	8,591	7,794	773,190	99·20	7,460	6,768	710,192	104·93
101	Mineral wool	Sh. T.	5,617	5,096	61,494	12·07	6,560	5,951	70,314	11·82
102	Soda, manufact'ed	M. T.	.....	277,072	3,912,257	14·12	.....	340,622	4,080,651	11·98
103	Venetian red	Sh. T.	2,196	1,992	40,790	20·48	3,270	2,967	64,570	21·76
	Totals	.....	.....	.....	41,718,420	.....	.....	.....	49,432,829	.....

METALS PRODUCED FROM FOREIGN ORES AND BULLION. (*aa*)

Metals.	Customary Measure.	1897. Quantities. Customary Measure.	1897. Quantities. Kgm.	1897. Values.	1898. Quantities. Customary Measure.	1898. Quantities. Kgm.	1898. Values.
Copper	Pounds	26,938,251	12,219,112	$2,973,983	36,055,852	16,354,600	$4,247,330
Gold	Troy ozs.	584,983	18,195	12,091,599	1,065,552	33,142	22,024,960
Lead	Short tons	92,117	83,568,000	6,595,577	89,209	80,929,674	6,744,200
Nickel	Pounds	4,029,390	1,859,000	1,419,260	7,127,781	3,233,142	2,459,085
Silver	Troy ozs.	40,218,776	1,250,934	24,040,806	39,781,000	1,237,560	23,472,550
Total values	.....	.....	.....	$47,127,174	.....	.....	$58,948,125

REFERENCES.

In using the statistics in the foregoing tables, reference should also be made to the detailed tables under the respective captions further on in this volume, where many explanatory notes as to the statistics will be found. The following notes refer to the four preceding tables: *(a)* Except where otherwise specified. *(b)* Not enumerated. *(c)* Amount or value of crude mineral. *(d)* Partly estimated. *(e)* Estimated. *(f)* Amount recovered as a by-product. *(g)* Barrels of 300 lb. *(h)* Barrels of 400 lb. *(i)* Includes manganiferous iron ore; this is not duplicated in the report of iron ore. *(j)* Value per square, i.e., 100 sq. ft. lapped and laid; the weights are calculated on the basis 3 squares = 2,000 lb., but these figures are only approximately correct. *(k)* Kilograms or per kilogram. *(l)* Reduced to a basis of 66° B. *(m)* Average market price at New York. *(n)* Nominal. *(o)* Value before grinding. *(p)* Includes ocher, umber, sienna, and oxide of iron. *(q)* Includes salt used for the manufacture of alkali; the barrel of salt weighs 280 lbs. *(r)* Reduced to a basis of 58 per cent ash. *(s)* Includes a small amount made from spelter. *(t)* Average value of lake copper at New York, less 0.25c. per lb. *(u)* Includes spiegeleisen, though the total value is reckoned as if the whole product were ferromanganese. *(v)* Average market price at Pittsburg. *(w)* Troy oz. *(x)* Flasks of 76.5 lb. *(y)* Barrels of 42 gal. *(z)* Includes a comparatively small amount made directly from ores. *(aa)* Not included in the preceding tables.

Abbreviations; Sh. T., short tons (2,000 lb.), L. T., long tons (2,240 lb.); M. T., metric tons (2,204.6 lb.).

Columbia, and Joseph, of Liverpool, Eng. The late Mr. Killey was born in Castletown, Isle of Man, on April 24th, 1824. He studied in the Grammar School in that town, and received a general commercial education. He had had from his earliest years a great love for machinery. His parents purchased for him "Lardner on the Steam Engine," and this he mastered before he was 12 years old. At 14 he constructed a crude model engine and boiler, and so excited was he when it was nearing completion that he could not sleep for thinking of it. His parents about this time determined on sending him to Liverpool, to one of the large foundries there, and prepared him for the foundry business by sending him for a couple of years to cabinet-making. There was great difficulty in getting the position of apprentice at Liverpool, as many parents at that time wished to have their sons learn engineering. He eventually entered the Brunswick foundry, and ended his apprenticeship in the Vulcan iron works, then owned by a cousin of the late W. E. Gladstone. Mr. Killey afterwards became foreman of a large foundry and later mechanical manager and partner in the Windsor machine works, near Liverpool. The American war, however, interfered with business to such an extent that he left England with his brother and came to Canada in 1864. He obtained employment with F. G. Beckett & Co., Hamilton, and later was foreman of the St. Lawrence Foundry in Toronto. He repaired, while in this firm's employ, the steamer "Rothsay Castle," a blockade runner, which had been brought up from Halifax by Captain Leach, after she had run one season. He was appointed engineer of this boat, which position he held for three years, until the Fenian raids were threatened. He was then appointed engineer of the gun boat "Prince Albert," which was engaged in guarding the river and lake coasts. She took troops and munitions of war from Collingwood to Sault Ste. Marie during the first Red River rebellion. Mr. Killey left the boat to build an oscillating marine engine and boiler which he had designed for the composite steamer "Adelaide Horton." The engine was built in Hamilton and the hull in Goderich. After this engine was completed, Mr. Killey began business in 1870 in a small way in Hamilton, but it soon increased to an important industry. In 1884 the business became the Osborne-Killey Manufacturing Company, and turned out steam road rollers, boilers, engines, and sewer pipe machinery. Since the winding-up of this company, Mr. Killey was associated for some time with the late F. G. Beckett, and latterly has been employed as a consulting engineer.

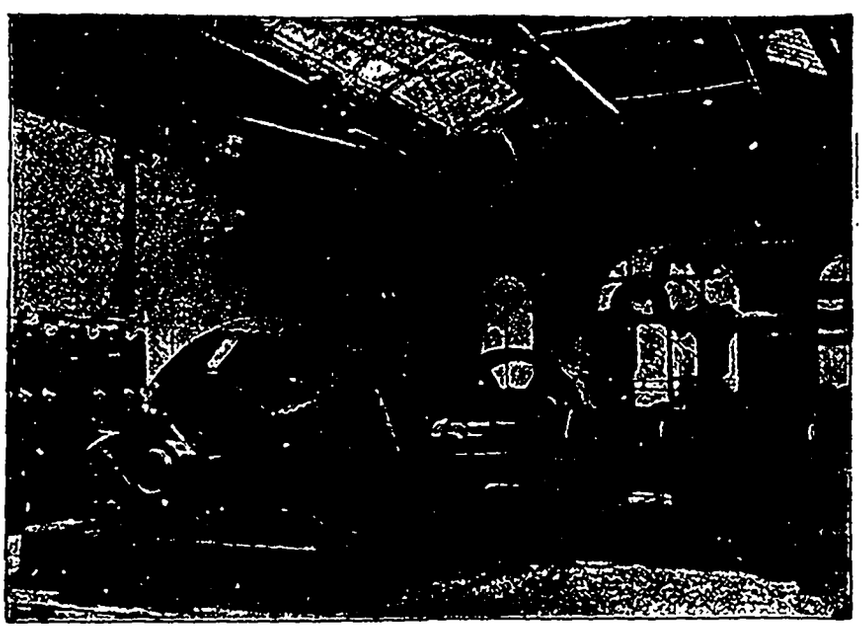
ONTARIO VOLUNTEER FIREMEN'S ASSOCIATION.

At a convention of the Ontario volunteer firemen, held August 31st, in Toronto, a permanent organization was formed, and the following officers were elected: R. C. Clarke, chief of Merritton, president; E. F. Earl, Milton, first vice-president; J. H. G. Horey, Merritton, financial secretary; Dr. Creegan, of Thorold, corresponding secretary, and William Miller, of Smith's Falls, treasurer. Executive Committee: George

Johnston, Woodstock; Geo. Turner, Thorold; W. Smith, Trenton; A. Sargent, Toronto; and W. A. Thomas, Niagara Falls. Committee on By-laws: Riddell, St. Catharines; Skinner, Niagara Falls; J. H. Luscombe, Simcoe, and Tait, Alvinston. The next meeting will be held at Niagara Falls, Ont.

ISLE OF MAN TRAMWAYS.

The Isle of Man is the gem of the Irish Sea. It is only about 33 miles long and 12 miles wide, but every acre of its green, gorse-grown hills and rugged coast line is beautiful, and the quaint Manx language and customs which still survive make it doubly interesting to the visitor. It is situated almost in the centre between England, Ireland and Scotland, and being within easy reach, by swift steamers, of Manchester, Liverpool and Glasgow, has become a favored summer resort. Douglas, the principal town, situate on a beautiful bay, has a fixed population of about 30,000, which in summer rises to about 50,000. Every steamer from Liverpool, and other ports, of which there are several daily, bring hundreds who spend a few hours, days or weeks in this lovely spot. One of the chief attractions is the beautiful glens which indent the coast line, running up into the interior of the island between the hills The Isle of Man Tramways Co., which operates an extensive system of cable and electric tramways in Douglas, has recently extended its electric line from Douglas to Ramsey, the next largest town in the island. The tramway runs around the precipitous cliffs overlooking the sea, skirting the beautiful Groudle, Laxey and Ballaglass glens. This drive, about 14 miles in length, winding in and out in full view of the sea, in an open electric car on a bright summer day, is very beautiful and most invigorating.



INTERIOR OF POWER STATION, BALLAGLASS, I.O.M

The recently completed extension of the I.O.M. tramways is a fine example of modern railway building and electrical construction. It is double tracked throughout, the roadbed is rock ballasted, and the bridges and culverts are of solid masonry. The over-head trolley is used, all the details of electric work being of the latest and best design and construction. Two large accumulator stations are used to equalize the load and assist the cars over the steep grades.

The motive power of the tramway is supplied from five power stations placed at various convenient points throughout the extensive system. The illustration represents the interior of the new power station at Ballaglass; it contains two 150 k.w. electric generators, manufactured by the Electric Construction Co., of Wolverhampton, England, directly connected to two 250 h.p. tandem compound condensing Robb-Armstrong engines, manufactured by the Robb Engineering Co., Amherst, N.S., Canada, for Dick, Kerr & Co., of London, who were contractors for the equipment. The station is also provided with two standard Galloway boilers and Ledwards electrically driven ejector condensers. Adjoining the power station is a large accumulator house, the whole making one of the most complete railway power houses in Great Britain. All the work of the Ramsey extension, including road-bed, electric lines and power stations, was done by the company's engineers.

RAILWAY SUBSIDIES.

(Continued from last issue).

For a line of railway from Paspebiac, Quebec, to Gaspe, in the said province, not exceeding a distance of 82 miles.

Lake Erie and Detroit River Railway Company, for a line of railway from Ridgetown, Ont., to St. Thomas, a distance not exceeding 44 miles, this subsidy to be payable only in the event of adequate running rights over the Canada Southern Railway, between the two points above mentioned not being granted to the first-mentioned company on terms to be approved by the Railway Committee of the Privy Council.

Kingston and Pembroke Railway Company, for the construction of branches from the Company's main line to the iron mine at Bluff Point, and to the Martele mine, in the County of Renfrew, not exceeding five miles.

For a railway from Parry Sound extending northerly towards Sudbury, not exceeding a distance of 20 miles.

Resolved, That it is expedient to authorize the Governor-in-Council to grant the subsidies hereinafter mentioned toward the construction of the railways, also hereinafter mentioned, that is to say: The Ontario and Rainy River Railway Company, for a railway from Stanley station, on the Port Arthur, Duluth and Western Railway, to Fort Francis, for a distance of 140 miles, at $6,400 per mile, not exceeding in the whole $896,000.

To the Quebec Bridge Company, towards the construction of a railway bridge over the St. Lawrence river at Chaudiere Basin, near Quebec, one million dollars, payable 40 per cent., on monthly progress estimates approved by the Government engineers of materials delivered and work done.

To the South Shore Railway Company, towards the restoration and renewal of the railway bridge over the Yamaska river at Yamaska, Que., $50,000—Re-vote.

Towards the construction of a bridge over the Richelieu river at Sorel, 15 per cent., upon the amount expended thereon, not exceeding $35,000, re-vote. $35,000.

Towards the construction of a bridge across the St. Francis river, 15 per cent. of the amount expended thereon, not exceeding $50,000.

Towards the construction of a bridge across the Nicolet river, 15 per cent. upon the amount expended thereon, not exceeding $15,000.

To the Midland Railway Company, Limited, towards the construction of a bridge across the Shubenacadie river, 15

per cent. upon the amount expended thereon, not exceeding $33,750.

To the Great Northern Railway Company towards the construction of a bridge across the St. Maurice river, 15 per cent. upon the amount expended thereon, not exceeding $16,425.

Also towards the construction of a bridge across the Riviere du Loup, 15 per cent. upon the amount expended thereon, not exceeding $15,000.

Also towards the construction of a bridge across the Lac river, 15 per cent. upon the amount expended thereon, not exceeding $15,000.

Resolved, That the subsidies granted to the Ontario and Rainy River Railway Co., the Canadian Northern Railway Company and the Edmonton, Yukon and Pacific Railway Company, are granted upon the condition, and if received and paid under the authority of this Act, to the above-mentioned companies, respectively, shall be received upon the condition, that the said companies shall not, nor shall any of them, at any time amalgamate with any other railway company, or lease its line to any railway company; nor shall any of the said railways be leased to or operated by any other company; nor shall any of the said companies make an agreement for a common fund or for pooling its receipt with any other railway company, and any such lease, amalgamation or agreement shall be absolutely void, excepting in so far as such agreement may extend to traffic or running arrangements, which have been approved by the Governor-in-Council. Resolved, That the subsidies herein before mentioned, as to be granted to companies named for that purpose, shall, if granted to companies named for that purpose, shall, if granted by the Governor-in-Council, be granted to such companies respectively; the other subsidies may be granted to such companies as shall be approved by the Governor-in-Council, as having established to his satisfaction their ability to construct and complete the said railways respectively; all the lines for the construction of which subsidies are granted, unless they are already commenced, shall be commenced within two years from the first day of August next, and completed within a reasonable time, not to exceed four years from the said first day of August, to be fixed by order-in-council, and shall also be constructed according to description and specifications, and upon conditions to be approved by the Governor-in-Council, on the report of the Minister of Railways and Canals, and specified in an agreement to be made in each case by the company with the Government, which agreement the Government is hereby empowered to make; the location also of every such line of railways shall be subject to the approval of the Governor-in-Council. Resolved, That the granting of such subsidies, and the receipt thereof by the respective companies, shall be subject to condition that the Governor-in-Council may at all times provide and secure to other companies running powers, traffic arrangements and all other rights as will afford to all railways connecting with those subsidized, reasonable and proper facilities in exercising such running powers, fair and reasonable traffic arrangements with connecting companies, and equal mileage rates between all such connecting railways, and the Governor-in-Council shall have absolute control at all times over the rates and tolls to be levied and imposed by any of the companies, or upon any of the railways hereby subsidized. Resolved, That the said subsidies respectively shall be payable out of the consolidated revenue fund of Canada by instalments, on the completion of each section of the railway of not less than ten miles, proportionate to the value of the portion so completed in comparison with that of the whole work undertaken, to be established by the report of the said Minister, or upon the completion of the work subsidized, except as to subsidies with respect to which it is hereinbefore otherwise provided. Resolved, That every company receiving a subsidy under this Act shall each year furnish to the Government of Canada transportation for men, supplies, material and mails over the portion of its line in respect of which it may have received such subsidy, and whenever required shall furnish mail car properly equipped for such mail service, and such transportation and service shall be performed at such rates as may be agreed upon between the Minister of the department of the Government for which such service is being rendered, and the company performing the same, and in case of disagreement, then at such rates as may be approved by the Governor-in-Council, and in or towards payment for such charges the Government of Canada shall be credited by the company with a sum equal to three per centum per annum on the amount of subsidy received by the company under this Act.

THE INFLUENCE OF MECHANICAL DRAFT UPON THE ULTIMATE EFFICIENCY OF STEAM BOILERS.*

(Concluded from June issue).

RELATIVE COSTS.

2,800 NOMINAL H.P. PLANT, WITH CHIMNEY DRAFT.

2 additional boilers	$ 6,167
Settings, etc., for two boilers	1,250
Addition to building, etc.	2,700
	$10,117

2,400 NOMINAL H.P. PLANT, WITH MECHANICAL DRAFT.

Fan, dampers and ducts	$ 1,500
Saving by using mechanical draft	8,617
	$10,117

Considering the matter of increased output solely in the light of comparative cost between the introduction of more boilers or the introduction of mechanical draft, and disregarding any possible cost of change in the chimney, we may again take for illustration the plant of 2,400 rated h.p. Suppose it is desired to increase its capacity to 2,800 h.p. or by 16 2-3 per cent. Then the relative costs under the two conditions will appear as here indicated.

We may now turn to that portion of our discussion which relates to the quantitative efficiency of a boiler plant. No greater waste occurs in modern steam boiler practice than that which is inherent in the employment of a chimney for the production of draft, namely, the loss of heat in the escaping gases. As the chimney depends for its action upon the maintenance of a temperature difference between the internal gases and the external air, it is manifest that with a chimney this waste can never be eliminated. It may be palliated, it is true, by the building of higher chimneys so that the same intensity of draft may be obtained with a lower stack temperature. But such means of providing for the utilization of the otherwise waste heat is expensive. In the case of a fan, however, the power expended as measured in heat units necessary to produce the same results, may, under ordinary conditions, be only about one-seventy-fifth of that necessary with a chimney. In other words the fan renders available for utilization, practically all of the heat wasted by the chimney, while it possesses the further advantage of readily creating the additional draft required when heat abstracting devices are introduced. Donkin and Kennedy in seventeen independent boiler tests found the heat lost up the stack, when no economizer was used, to range between 9.4 per cent. and 31.8 per cent. of the total heat of combustion. As it is not practicable to cool the gases to atmospheric temperature it is evidently impossible to utilize all of the heat, but the ordinary economizer should, with mechanical draft, show a saving of between 10 and 20 per cent.

The importance of mechanical draft in the adoption of means for utilizing the waste heat, is well exemplified in the introduction of retarders and of ribbed tubes. Both of these increase the resistance and almost invariably require fan draft to enable them to create the saving of 5 to 10 per cent., which may be thus secured. The facility with which the intensity of the draft, and the volume of air supplied can be regulated when a fan is employed for draft production, has always been recognized as one of the most valuable characteristics of this method. Such regulations makes possible the most perfect distribution of the air, and its reduction to the minimum amount which will produce satisfactory combustion. For the mere chemical requirements of the combustion of one pound of ordinary coal, about 12 pounds or 150 cubic feet of air is required. But under the conditions of chimney draft this amount is greatly exceeded. Donkin and Kennedy showed in the results of 16 tests that the air supply ranged from 16.1 pounds to 40.7 pounds.

*From a lecture by Walter B. Snow, before the Applied Science Graduate Society, McGill University.

As the gases pass onward through the tubes they become cooled, but those of higher temperature part most readily with their heat, and at the same time their volume and consequent velocity are reduced, still further facilitating heat transmission. On the other hand the gases of lower initial temperature transmit their heat less rapidly and the final result is that within practical limits the temperature of the escaping gases is least with the greatest excess of the air supply. The fact just presented points toward the economy to be secured by comparatively high rates of combustion, when the proper rate of heating surface to grate surface is provided. A high combustion rate manifestly requires a thicker fire, which in turn presents a better opportunity for contact between fuel and air with consequent economy in the supply of the latter. Less air results in a more intense fire, a higher furnace temperature, a greater transmission of heat to the water within the boiler, and a resultant higher evaporative efficiency. But a thicker fire requires a greater intensity of draft to overcome the increased resistance, while the relatively smaller area for passage of air necessitates a higher velocity of that air, and furthermore, the increased intensity to produce this velocity must be proportional to the square of the rate of flow. This condition is most readily met by the fan, which, under normal conditions, produces an intensity exceeding that of an ordinary chimney, and which can without trouble maintain the highest practicable rate of combustion.

The loss resulting from the formation of smoke is absolute, for it is equivalent to directly robbing the fire of a part of the fuel from which not only has no heating effect been secured, but upon which heat has actually been wasted in raising it to the temperature of the escaping flue gases. For the prevention of smoke, sharp, intense draft is necessary, properly regulated and capable of furnishing the required amount of air, both below and above the coal at the very moment when it is most needed. This result can be best secured by the introduction of mechanical draft which is ordinarily so regulated that the decrease in steam pressure resulting from the opening of the fire doors, the charging of the furnace, or the clearing of the fires, instantly causes an increase in the speed of the fan and in the intensity of the draft and the volume of air. A loss incidental to poor draft is that due to the formation of carbonic oxide. The formation of this gas instead of the complete product of combustion, carbonic acid, results from a lack of air. Sufficient air can best be secured by some means like the fan, which under automatic regulation increases both the intensity of the draft and the volume of the air when required. As a result, the pressure forces the air in sufficient quantity to all spaces between the fuel, and renders the combustion practically perfect.

By far the most important of the factors connected with the operating expense of a boiler plant is the cost of the fuel. When burned under suitable conditions, the decrease in its cost far outstrips its decrease in efficiency, so that the solution of the problem involves itself with the provision of the proper conditions. As a rule the cheap fuels, like the fine anthracites, require for their combustion an intensity of draft which the ordinary chimney is incapable of producing. The draft actually required under given conditions is clearly shown by these results of tests by Coxe:

RESULTS OF TESTS OF PEA AND BUCKWHEAT COAL.

Kind of Coal	Rate of combustion per square foot of grate per hour.	Pounds of water evaporated from and at 212° per lb. of coal.	Air pressure in inches of water.	Maximum limit to size of coal in inches.
Oneida Pea Coal.	13.63	7.56	0.375	7-8
Oneida No. 1 Buckwheat	13.58	7.94	0.5	9-16
Oneida No. 2 Buckwheat	11.40	8.60	0.625	3-8
Oneida No. 3 Buckwheat	11.34	8.65	1.04	3-8
Eckley No. 3 Buckwheat	9.44	8.75	1.125	3-16

These coals, which are among the smallest in size, were burned on a special form of traveling grate, and the air pressure was maintained in the chamber beneath. It is noticeable that with practically constant combustion rate and evaporative efficiency, the draft increases very rapidly as the size of the coal decreases.

RELATIVE EFFICIENCIES OF VARIOUS COALS.

Kind of Coal.	Water evaporated from and at 212° by one lb of Dry Coal.	Relative efficiency in p.c. Cumberland =100.	Cost of coal per ton	Fuel cost of evaporating 1,000 lbs. of water from and at 212°.	Relative efficiency in per cent measured by cost to evaporate 1,000 lbs. Cumberland =100.
Cumberland	11.04	100	$3.75	$0.1698	100
Anthracite, broken...	9.79	89	4.50	0.2297	74
Anthracite, chestnut.	9.40	85	5.00	0.2660	64
Two parts Pea and Dust and one part Cumberland	9.38	85	2.58	0.1375	123
Two parts Pea and Dust and one part Culm	9.01	82	2.58	0.1432	119
Anthracite, Pea.....	8.86	80	4.00	0.2259	75
Nova Scotia Culm..	8.42	76	2.00	0.1187	156

The comparative efficiency of various coals as determined by Barrus is indicated in the accompanying table, which speaks for itself. The evidence in favor of burning low grade fuels is conclusive. Such results can, however, only be secured by positive and intense draft. It is true that as the quality of coal grows poorer and the size of the particles less, it becomes more necessary to provide some special form of grate or stoker for its proper burning. But even without an economizer to utilize the waste heat, the burning of cheap fuel by mechanical draft will, under perfect conditions, show a decided saving, after due allowance is made for fixed charges on the special furnace arrangements and for the cost of operating the fan:

Water evap. from and at 212° per lb. of coal.	ANNUAL SAVINGS RESULTING FROM BURNING CHEAP FUEL—COST PER TON.														
	$0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
11.00											4,892	3,669	2,446	1,223	0,000
10.50										5,474	4,193	2,912	1,630	349	
10.00									6,115	4,770	3,424	2,079	734		
9.50							8,240	6,823	5,407	3,991	2,575	1,159			
9.00						9,105	7,610	6,115	4,621	3,126	1,631	136			
8.50					10,074	8,491	6,909	5,326	3,743	2,160	578				
8.00				11,180	9,478	7,797	6,115	4,433	2,752	1,070					
7.50			12,393	10,599	8,805	7,012	5,218	3,424	1,630						
7.00	15,724	13,803	11,881	9,959	8,037	6,115	4,193	2,272	350						

The possible savings with low grade fuels and mechanical draft are still further evidenced by the accompanying tables, which show for a 1,000 h.p. plant, the annual saving, based on 312 days of 10 hours each, which would result from the substitution of a cheaper fuel for say Cumberland coal, costing, in round figures, $4 per ton, and evaporating 11 pounds of water from and at 212° per pound of coal. Under these conditions the annual fuel expense would be $19,568. If the assumption be made that a coal costing $2.50, and evaporating only 9 pounds of water is substituted, the annual saving would be $4,621. The cost of operating the fan even if the exhaust steam was not utilized, and it required 1½ per cent. of the total coal burned, would be only $224, and if this were charged against the saving it would still amount to $4,397, a sum sufficient to show a most

creditable reduction in operating expenses, even if there was also charged against it any additional labor and the fixed charges on a complete equipment of the special appliances for burning the lower grade fuel. A reduction of over $125 per week, equivalent to $6,500 per year, has been made in actual practice in the case of a boiler plant of 1,000 h.p., by the introduction of mechanical draft and the burning of yard screenings with a slight mixture of Cumberland.

Of the advantages of mechanical draft which are purely qualitative in their character much might be said, but time will not permit. It must suffice to merely refer to the more prominent points of advantage. When the fan is employed for draft production, the steel plate construction, the comparative lightness, the portable character and the absence of heavy foundations, render extremely simple its adaptation to the exact requirements. Being portable it is also salable, and hence an asset of real value as compared with the chimney. It may be used either for forced or induced draft, and placed where it will occupy no valuable space. It may be operated by direct-connected or belted engine or motor, and so proportioned as to produce any desired draft pressure. In operation, the fan is both positive and flexible, independent of the weather but capable of regulation to the finest degree, and of adjustment to the necessities of the fire at any particular moment. A mere increase in the cut-off of the fan engine brings about a result only secured with a chimney at the expense of adding to its height, while a change in the fan speed alters both the volume handled and the intensity of the draft produced.

If this discussion of the influence of mechanical draft on boiler efficiency has rendered clear the factors concerned, it has with equal force shown that this influence is beneficial—in many ways markedly so. In the light of this fact the present active interest in the subject points to the future general substitution of the fan for the chimney.

THE CANADIAN BICYCLE COMBINATION.

A combination has been effected, which includes four of the leading bicycle makers in Canada, the Massey-Harris Bicycle Co., H. A. Lozier & Company, Toronto; the Goold Bicycle Company, Brantford, and the Welland Vale Bicycle Company, St. Catharines. The leading members of the new firm are: Geo. A. Cox, Toronto; Warren Y. Soper, Ottawa; W. E. H. Massey, Toronto; E. R. Thomas, Toronto, and Hon. Lyman M. Jones, Toronto. The probability is that W. E. H. Massey will be president of the company. There will be a general head office in Toronto, but the manufacturing will be done at the places where the present plants of the different firms of the company are located. The company will be a joint stock company, with a capital of six million dollars, so that the concern will have ample capital in its business; it has cost now several millions of dollars to buy these firms out. The name of the new company has not yet been chosen, but at once will make application for incorporation, either by obtaining a provincial charter, or by making special application to the Dominion Parliament for the charter. This year the output of these four firms has been more than 30,000 wheels, and with such excellent plants will not be compelled to have a new one for the manufacture of the automobiles. The firms mentioned are the only ones who were asked to deal in the matter, and it is the intention of the company to employ the same men on each staff as are now in the employ of the several companies. The new company will also build autocars.

LITERARY NOTES

Fox and Mellea, of 49 Taylor street, Springfield, Mass., U.S.A., have put a new nipple holder on the market. Some of the reasons why this "Fox" nipple holder should be used are given on a neat blotter, the title of which is "Ten Reasons," and parties interested in the cutting of pipe nipples, either plain, brass or nickel-plated, should investigate this matter.

The Toronto Brass Manufacturing Co. issue a handsome 20-page catalogue, beautifully printed and illustrated, showing display stands in great variety, papier-mache figures, etc. One of their specialties is the manufacture of brass hand railings for engine rooms, stair rails; one of their latest contracts called for 600 feet of brass railing 2½ inch diameter, for new hall in exhibition grounds, Toronto.

Catalogue No. 3 of the Toronto Electrical Works Co., Ltd., manufacturers of electrical supplies, has reached us. It is unique in its construction; perforated ends in the place of binding allow the insertion of new sheets illustrating new goods added from time to time, and also allow of the dropping out of discarded lines. A glance through shows the different lines to which they give prominence. They manufacture the "American Watchman's Time Detector," which won the only medal for its class awarded at the Chicago World's Fair. The "Toronto Time Register" is a new time check, and is of unique construction, and they claim that it is the only time register which will not allow errors to creep in through mistakes made by the time clerk. A complete line of electrical supplies and tools, pole and line fittings, telegraph instruments, battery motors, lamps, cord tips, electro-magnets, lightning arresters, blow lamps, long and short line telephones, etc., all of which are profusely illustrated and described. Catalogue sent on receipt of enquiry.

The past decade has witnessed a great advance in the art of catalogue making, particularly in the machinery trades. The modern catalogue must not only be attractive, and this seems to have been the sole idea in some recent publications, but it must above all serve in the best manner possible its primary purpose of furnishing information. Illustrations must be clear, explanations explicit, and all information concisely given. The substantial character of most machinery demands similar character in the make-up of the catalogue describing it. Bold, clear type, black ink, good cuts, simplicity in composition, and first-class paper of good weight, all have a subtle influence in impressing the reader with the idea of the high quality of the article described. An excellent example of good catalogue making, in which this is the controlling idea, is presented by the B. F. Sturtevant Co. Their publications are of two classes. First, those which are purely educational in their character, comprising treatises on various special applications of fan blowers, reprints of lectures on similar subjects, leaflets regarding the attendant advantages, etc. Second, the regular trade catalogues of the standard dimensions, 6½ inches by 9 inches, each devoted to a specific line of manufactured goods. Separate catalogues in the same class bear the same cover design, but are printed and bound in different colors with proper titles, so that they may be readily distinguished. All catalogues are designated by individual numbers, the latest being No. 110. The most recent products are immediately presented by bulletins (designated by letters), preliminary to the issuance of complete catalogues regarding the given machines. Loss of time is thereby avoided, and the new designs can be sooner placed before the public.

The Journal of the Western Society of Engineers for June contains some specially interesting papers as "Experiments to Determine the Effects of Freezing on Concrete," by W. A. Rodgers, and the "Preservation of Timber," by S. M. Rowe.

We are in receipt of a copy of the fifth edition of the Slide Rule, a practical manual by Chas. N. Pickworth, Wh. Sc., which is a valuable aid to the use of this necessary instrument

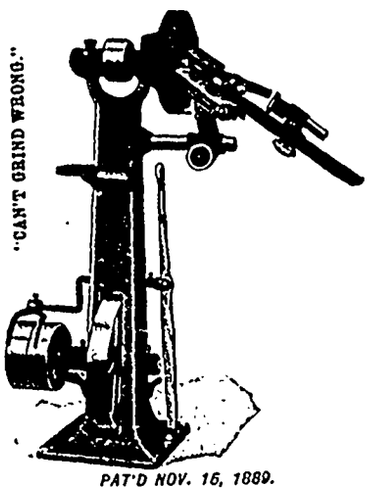
The Indicator Handbook is a practical manual for engineers, by Chas. N. Pickworth, editor of The Mechanical World. This book contains chapters devoted to the construction of the indicator, errors of the indicator, attachment of the indicator, indicator reducing gear, use and care of the indicator.

The new Canadian school songs have been composed for school celebrations by J. M. Harper, Ph.D., for many years rector of the Boys' High School, Quebec. They are "Hail to the Land," dedicated to Sir Wilfrid Laurier, and "Our Flag and Empire," dedicated to G. W. Ross, LL.D. The music is by F. C. Robinson and H. O'Connor Budden.

A feature of the National Export Exposition at Philadelphia will be an exhibit by the International Correspondence Schools, Scranton, Pa., illustrating their method of teaching by mail. The bound volumes of their instruction and question papers, as well as work done by students, including numerous drawing plates, will be shown.

THE YANKEE DRILL GRINDER.

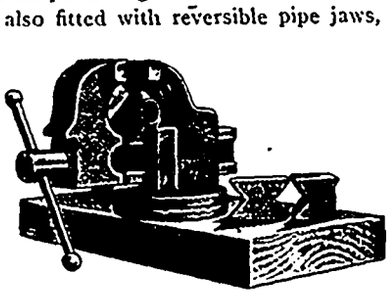
"Can't Grind Wrong." This suggestive heading has been used by the manufacturers of the Yankee Drill Grinder, with great success. As everyone knows that a twist drill badly ground will not bore true, nor will it bore a hole the exact size



of drill, it goes without saying that a grinder which does grind right is a great addition to any machine shop. The illustration printed herewith gives a good idea of the style of the machine. The Fairbanks Co. of Montreal is sales agent for Canada of this machine.

HOUGH'S EXTRA HEAVY COMBINATION PIPE VISE.

This combination vise is of inestimable value to engineers in mills, mining plants, steamboats, or to plumbers requiring a heavy vise. The makers claim that the castings used are of the highest grade, careful selection and the proper and intelligent mixing of the component materials, all tending to great strength. The workmanship is of the very best. The steel jaws firmly welded and finely tempered; the whole vise scientifically proportioned for strength and durability as well as convenience in use, and have no parts to get out of order. The particular vise illustrated is also fitted with reversible pipe jaws, giving prac-



tically two sets of jaws, as they can be turned end for end. Width of filing or plain jaws 4 inches; weight, 63 lbs. Swivel base, allowing the operator to work in any position, holds pipe from ⅛ to 2 inches, the larger vise holding ¼ to 3 inches. They also make a stationary base vise; capacity ½ to 4 inches.

The Hollands Manufacturing Co., of Erie, Pa., is not only vise manufacturer, but in their complete catalogue show planer chucks ranging from 6 inches to 30 inches capacity, "Acme" pipe tongs, Trimo & Stillson wrenches, roller and three-wheel pipe cutters, cutter wheels, pipe stocks and dies, also ratchet screw cutting stocks.

RAILWAY ENGINEERING.

Biggar, Samuel & Co.,

Gentlemen:—I received the copy of "Railway Engineering," by Prof. Smith, and while I was very pleased with the articles as they appeared in the "Canadian Engineer," I am more pleased with them in book form. I have read the book with interest, and often find it useful for reference, although I am not engaged in railroad work now. Wishing you success, I remain, yours truly, F. W. SALMON.

Burlington, Iowa, August 6th.

Industrial Notes.

E. F. Munroe is building the new town hall in Windsor, N.S., at $8,286.

Macdonald Manufacturing Co., Stratford, Ont., is about to greatly enlarge its premises.

Jos. Orr, Stratford, Ont., furniture manufacturer, is installing a new Leonard engine.

J. S. Hogg is now manufacturing peat on the patented compression system near Galt, Ont.

Workman & Ward, London, Ont., iron founders and agricultural implement builders, are about to build new buildings.

Crescent Mill and Timber Co., London, Ont., is now completing its new factory, which is almost ready for the machinery.

W. W. Ogilvie will establish a 25,000 barrel mill and an elevator of 500,000 bushels capacity at Fort William, Ont., shortly.

R. S. Portuous, Stratford, Ont., is starting up a furniture factory for export trade in buildings formerly occupied by John Becker.

W. Partlo & Son are equipping the King mill at Ingersoll, Ont., as an oatmeal mill, and will put in new machinery, including steam plant.

The Toronto Cold Storage Co., Ltd., now has its plant in operation. The capacity is 80 tons per 24 hours, and is operated by a 150 h.p. engine.

J. W. and J. B. McManus, Memramcook, N.B., have a contract for Provincial Government on Tobique Narrows bridge substructure, and two highway roads.

Willis Chipman, who was the engineer for the Petrolia waterworks system, now has a similar position for the town of St. Mary's, where a $150,000 system is being put in.

J. W. Walters has started a machine and blacksmith shop in Dawson City, Yukon, and is going to turn out engines, boilers and mining machinery. During a recent visit to Montreal he bought supplies amounting to $30,000.

The shareholders of the Hamilton Steel & Iron Company have elected the following officers and directors: A. T. Wood, M.P., president; C. E. Doolittle, vice-president; A. E. Carpenter, C. S. Wilcox, John Milne, A. M. Wilcox and Wm. Southam. Robert Hobson is secretary.

The Massey-Harris Company is completing plans for the erection of a fine club house and library for the use of their employees on the north side of King street, opposite their premises in Toronto. The building, which will probably cost from $50,000 to $75,000, will include baths, reading room, library and social rooms, with a fine hall for public recitals.

Daniel and Ira Jacobs of Winona, Ont., narrowly escaped death, near Basingstoke, Ont., by the explosion of a traction boiler. The water tank became detached from the engine, and the Jacobs stepped down on the road to connect them. A few seconds later the boiler exploded, and scattered sections of the engine over the countryside; but, rather strangely, the Jacobs were not hurt in the slightest.

The Carter-Crume Company, check book manufacturers, Niagara Falls, N.Y., has been reorganized with a capital stock of $2,000,000. The new directors are: W. Caryl Ely of Buffalo, president of the International Traction Company; J. L. Morrison, S. J. Moore, W. E. H. Massey, president of the Massey-Harris Company of Toronto; J. W. Flavelle, president of the National Trust Company of Toronto, and Robert Kilgour, Toronto. S. J. Moore will be general manager.

The Fairbanks Company of Montreal has just furnished the Ontario Rolling Mills Co., of Hamilton, with an improved furnace charging scales of the suspension pattern. In this scale all the levers supporting the load are over head, thus leaving all the working parts free for inspection, and making them all the more durable. The scale has six beams to indicate the various required amounts of different material necessary for the proper composition of the product of the furnace. The scale is built of steel and iron throughout.

The income from Woodstock's waterworks this year amounts to $9,200.

A $35,000 waterworks by-law will be submitted to the ratepayers of Medicine Hat.

J. B. and J. W. McManus are to build the Burnt Church, N.B., wharf at $13,000.

The Hamilton, Ont., Bridge Co., is to build the Appleton, Ont., bridge; price, $2,560.

R. Grant, contractor, Toronto, is building the waterworks dam, London, Ont., at $40,000.

Hunter Bros., Kincardine, Ont., have finished the bridge over the Grand River at Elora, Ont.

Campbell Reeves, Montreal, has bought a controlling interest in the Canadian Locomotive works at Kingston, Ont.

The business of the Tingley & Stewart Manufacturing Co., Toronto, rubber stamps, dies, etc., has been bought by Bernard Cairns.

Willis Chipman, C.E., is superintending the construction of waterworks for St. Mary's, Ont., for which the council recently appropriated $25,000.

Leamington, Ont., has a tax rate this year of 15 mills. The town owns the water and gas plants, and the profits from these permit of this low rate.

C. W. Cadwell, of the Cadwell Silex Stone Co., has been appointed by the Amherstburg, Ont., Quarry Co. to take charge of the whole quarry output.

The Goldie-McCulloch Co. has recently been given an order for $4,000 worth of sugar making machinery by a company doing business in the city of Mexico.

The contract for supply of lumber and timber for the construction of the Dominion Iron and Steel Co.'s works at Sydney, C. B., has been awarded to A. F. Bury Austin, Montreal.

The Montreal Rolling Mills Co., has secured a site comprising about sixteen acres from the Dominion Iron and Steel Company, near the southern boundary of their works at Sydney, Cape Breton.

McManus and Lowe, contractors, of Halifax, N.S., have the contract for the foundations of the works of the Dominion Iron and Steel Co. at Sydney, C.B., the price being $150,000. Two years will be required to complete the plant.

The drilling of artesian wells for the Waterloo, Ont., waterworks by Leaper Bros., of Hawkesville, Ont., has been successful, as not only is the flow abundant, but the water is of excellent quality. The supply from the three wells sunk will be in the neighborhood of 750,000 gallons in 24 hours, at least five times the quantity consumed at the present time.

The Trent Valley Peat Fuel Co., Peterborough, Ont., has placed an order with the F. D. Cummer & Son Co., Cleveland, O., for a Cummer Dryer. The dryer will be used for drying peat preparatory for pressing into briquettes. The dryer will have capacity for evaporating 2½ tons of water hourly from the wet peat, which would give about 60 tons of dried peat per day of 24 hours.

A prophet is not without honor, etc. The aphorism would seem to apply to City Engineer Jones, who visited London, by invitation, a short time ago, to advise the aldermen how to stop damage from flood in West London, while Brantford city council consults a Hamilton engineer to devise means to prevent West Brantford from being flooded.—Brantford Expositor.

The Alberta Railway and Coal Co., Lethbridge, N.W.T., has ordered two 150 h.p. Mumford improved boilers from the Robb Engineering Co. It has had three of them in use for about a year, and this order speaks well for the satisfaction they have given. The makers of these boilers claim they are more efficient than any other type in use, while they cost less than a water tube boiler.

The Hamilton Bridge Works Company is rushed with orders, and is said to have work enough ahead for eighteen months to come. Its premises are too limited to permit of increasing its facilities on the site now occupied, but negotiations are proceeding through R. Mackay, for a five-acre site in the northeastern part of Hamilton, Ont., where a considerable extension of the works would be made.

The Revelstoke, B.C., council has appointed S. L. Saunders chief of the fire brigade at a salary of $80 per month or the balance of 1899. The council will establish an electric fire alarm system at an estimated cost of $600.

Frederic Duclos, plumber, 78a Inspector street, Montreal, has assigned at the instance of the Star Iron Company, with liabilities of about $25,000. The chief creditors are: Dame F. Duclos, $9,000; Royal Institution for the Advancement of Learning, mortgage, $8,700; Walter Andrews, mortgage, $3,500; D. Nicholson & Co., $1,333; Star Iron Co., $859; A. Prudhomme et Frere, $614; T. H. Goulet, $520; Chas. Depocas, $600; J. Douglas, $500; S. A. Phillips, mortgage, $1,250.

The Maritime Stove Foundry Association was in session early in August in St. John, N.B. Halifax, Yarmouth, Moncton, Sackville, Amherst and St. John makers were present. A satisfactory agreement as to prices of hollow ware was reached. It was determined to increase the price of repair castings to six cents per pound and to increase the price of stoves and other foundry products five per cent., the change to take effect at once. A resolution was adopted urging retailers to form local associations to overcome the evil of price cutting.

The Hoepfner Refining Company, Ltd., Hamilton, Ont., has been granted letters of incorporation. Carl Hoepfner, of Frankfort-on-the-Main, Germany, doctor of philosophy, is at the head of the undertaking. The company purpose "to mine smelt, refine, manufacture and sell zinc, lead, copper, nickel and other metals." The share capital of the company is placed at $600,000. The provisional directors are Messrs. Carl Hoepfner, David Maclaren, Ottawa; Andrew T. Wood, John M. Gibson, John Moodie and John Patterson, Hamilton, and Nathaniel Dyment, of Barrie.

The McEachren Heating and Ventilating Co. had a very prominent exhibit of their fans, blowers and valves at the Toronto Exhibition. One feature was a handsomely decorated 24-inch fan in operation. There was a stock of blowers ranging from 30 inches to 90 inches in diameter; a boiler feed pump, and samples of the firm's new back pressure valve, ranging from 2 inches to 6 inches, and which can be used on either horizontal or vertical pipe. The firm's hot water heater "Little Wonder," was also shown in the stove building. This firm has the contract for the heating and ventilating plant of Prince of Wales College at Charlottetown, and the P.E.I. hospital of the same city. The 90-inch steel-plated fan shown at the Exhibition has been sold to the Granby Rubber Co., to be used for drying rubber.

Electric Flashes.

D. F. Whidden has bought out the Antigonish, N.S., electric light works.

The Kay Electric Motor Company has assigned to Sheriff Middleton, Hamilton.

At a recent directors' meeting the Royal Electric Co. declared a quarterly dividend of 2 per cent.

The electric light building at Wolfville, N.S., which was destroyed by fire a short time ago, will be rebuilt at once.

A project to put in an electric street railway will probably come before the Chatham, Ont., council in the near future.

The electric plant at Petty Harbor, Nfld., is now under construction. A head of 200 feet is being made available.

The Rossland Sentinel has installed in its printing establishment one of the Royal Electric Co.'s S.K.C. two-phase motors to drive the presses.

A project is mooted to connect the various small towns along the Rideau canal and lakes by means of a trolley line. A very large water power is available at Jones' Falls, Ont.

Frenyear and Hatmeyer of the Westinghouse Electric Co., Buffalo, and E. Baxter, Fort Erie, Ont., propose to build an electric line from Fort Erie to Chippewa, Ont.

It is said that the Royal Electric Co., of Toronto, has made application for a franchise for an electric railway between Barrie and Allandale, a distance of about a mile.

T. W. Clark, Bridgewater, N.S., has the contract for constructing a power house, wheel pit, conduit and tail race at Milton, N.S., for Liverpool's electric light system, at $2,750.

The several companies that control the pulp mills, the electric plant and water mains, the carbide and iron works at Sault Ste. Marie, Ont., have been consolidated and capitalized at $6.000,000.

It is stated that the two electric companies of St. Hyacinthe, Que., may soon pass into the hands of M. Dubrocard, Lyons, France. It is said that the price to be paid is in the vicinity of $175,000.

The name of the Cataract Power Company of Hamilton has been changed to the Hamilton Electric Light & Cataract Power Company, and the capital is permitted to be increased from $250,000 to $3,750,000.

An action for $10,000 damages has been entered against the Royal Electric Company by J. Cyr, father of the boy who was killed on St. Louis street, Montreal, a few weeks ago while trying to catch a bird on the branch of a tree.

We understand that the Cleveland Seed Co., Picton, Ont., has placed an order with the Royal Electric Co. for a complete electric lighting plant for its warehouse. The dynamo is of 200 light capacity, and about 100 lights wired up.

The city of Hamilton has received $3,789.55 in street railway percentage for the last three months. The city of Toronto has received $12,721.03 from the same source for the month of July alone. The city of London has just paid out $3,400 for militia expenses on street railway account.—London Advertiser.

J. C. Clark, Ayr, Ont., is promoting an electric railway from Berlin to Port Dover, Ont. No bonus is asked, only the right of way through the towns. The road starting from Berlin is to pass through Waterloo, Ayr, Paris, Brantford, Boston, Waterford and Simcoe, to its terminus at Port Dover.

A number of the electrical men employed by the Electric Light & Power Company and Bell Telephone Company met at the Victoria Hotel, Hamilton, Ont., and discussed the advisability of forming a local branch of the International Electrical Association. Another meeting will be held shortly, when the electrical workers, including linemen, etc., may organize.

The Central Manufacturing Co., Chattanooga, Tenn., has furnished materials for the power plant at Ogden, Utah, U.S., and the plant of the Telluride Power Co., Salt Lake City, U.S. The Central Manufacturing Co. makes a specialty of yellow pine cross-arms, oak and locust insulators, pins and brackets.

The Renfrew Electric Light Company is being organized with a proposed capital of $50,000, of which about one-half has been already subscribed. The new company will embrace at least one of the existing electric lighting companies, and will undertake to supply power as well as light. It is an outcome of the development of the water power of the Bonnechere river, at Renfrew.

Thos. Vaughan, a young man employed in the Royal Electric Co.'s works, Montreal, was seriously injured, August 30th. He was working at one of the dynamos, and turned the wrong switch, with the result that he received a current of 10,000 volts. He fell unconscious, but when taken to the hospital revived, and is recovering.

Users of electric lights in Parrsboro, N.S., pay 19 cents for 10, and 30 cents for 16 candle power, with an all night service. Until lately, although the streets are well lighted with 28 arc lights, enough profit was made out of the incandescent services at the prices charged to pay for the street lighting, which in many towns would cost between two and three thousand dollars.

At a recent meeting of the directors of the Lachine Rapids Hydraulic and Land Company the statement of the company's business for the half year ending June 30 was very satisfactory, showing a gain of a hundred per cent. over the corresponding period last year. The directors declared a half-yearly dividend of 2 per cent. on the paid-up stock of $1,250,000. This dividend was earned after paying 6 per cent. interest on $600,000 worth of bonds. It was also stated that W. Davis & Son, contractors, had been paid in full; and that satisfactory progress was being made at the new works.

The Hamilton street railway has been taken over by a syndicate representing the Cataract Power Co., composed of Hon. J. M. Gibson, J. Dickenson, J. Moodie, Hamilton, and J. A. Kammerer, Toronto.

The Aptus Veneer Company, Albert, N.B., has placed an order with the Royal Electric Co. for a complete electric lighting plant for its works, the plant to be in operation within four weeks of date of order.

Bennett Bros., who own and operate a flour mill at the corner of Parke and Market streets, Hamilton, Ont., are installing in their premises a 40 h.p. S.K.C. motor to drive their mill, power being supplied by the Cataract Power Co.

The Willson Carbide Works Co. has orders much in excess of its capacity. When the new works at Ottawa are completed the company expects to be better able to keep up with this enormous and growing demand for calcium carbide.

Work has been begun on the development of the Shawenegan Water and Power Co.'s plant at Shawenegan Falls, Quebec, and is being pushed night and day. The Royal Electric Co. has installed for the contractors one of their 15-light T.H. arc machines and lamps, lighting the entire work.

The Hamilton screw works of the city of Hamilton are another of the converts to electric power, having shut down their steam plant, and are now being supplied with power from the wires of the Cataract Power Co. The Royal Electric Co., of Montreal, is installing a 40 h.p. S.K.C. two-phase motor. This adds another smokeless chimney to the many now in Hamilton.

Henry T. Duck, Toronto, of the Engineering Contract Company of New York, has just been awarded a contract by the Canadian Electric Light Company of Quebec for a large concrete dam, with sluiceway and bulkheads, the foundations of power house, supports for flume pipes, tail race, etc., at the Chaudiere Falls. The contracts for the power house, the hydraulic and electric machinery and the transmission line will be awarded in a short time, and it is expected that the company will have power to dispose of in this city within some nine months. T. Pringle & Son, of Montreal, are the engineers in charge.

Liverpool, N.S., is installing a complete electric plant to furnish arc and incandescent lights for the streets, and incandescent lights for indoor use. The by-law was voted on some time ago, and an order has been given to the Royal Electric Co. for a complete electrical equipment, consisting of one 75 k.w. S.K.C. two-phase alternating current generator, with exciter and switchboard complete, also a complete switchboard and regulating apparatus for twenty-five 2,000 C.P. enclosed alternating arc lamps for the streets, as well as the necessary transformers and materials for installing 2,000 incandescent lamps, the whole plant to be in operation within six weeks.

Contracts have been let for the construction of a building to be temporarily occupied by the Edgerton Storage Battery Company, Hamilton, Ont. The building will be 75 by 125 feet, one story high. As soon as the building is in running shape another building will be erected for a main factory, and this one will be used as a storehouse. It is said the company will shortly be capitalized at about half a million dollars, and has work now ahead sufficient to guarantee its success. It is the intention of the company to use the Hamilton works for its export business. The zinc that will be used in the construction of the batteries will be supplied by the Hoepfner Refining Company.

The new steam plant power house of the Metropolitan Street Railway Co. at Bond Lake, has been equipped by the Goldie & McCulloch Co., of Galt. There are two cross compound condensing Wheelock engines, 17½ inches and 32 inches by 42 inches, and supplying 1,000 h.p. The fly-wheels are 18 feet diameter and 44 inches face. There is a battery of four boilers, each 73 inches diameter and 16 feet long. The electrical equipment is of the Westinghouse type, the order having been placed with W. A. Johnson, under whose superintendence the plant was installed. There are two 275 k.w. generators at Bond Lake, and two 250 k.w. generators at the sub-station at York Mills. The plant is arranged so that alternating and direct current can be used interchangeably.

One man was instantly killed and another seriously injured by coming in contact with a live electric wire at Sherbrooke, Que., August 26th. Louis Benoit, whose home is near Waterloo, Que., was killed, and Simeon Roy, of Sherbrooke, seriously injured. They were in the employ of the Gas and Water Company, and had been instructed to remove a certain arc lamp. Not having a crank to the windlass by which the lamps are lowered, Roy took hold of the cable which runs up the pole, and to which the lamp is suspended. In lowering the lamp in this way he pulled this wire to one side, and it came in contact with the electric light wire above. When he felt the shock he shouted to Benoit to cut the wire. The latter seized his pliers in one hand and with the other grasped the deadly wire above the place where Roy held it. The result was that the full current of 2,000 volts passed through Benoit, and Roy, who held the wire lower down, was relieved and fell to the ground unconscious, but alive. Benoit was dead before help reached him. Roy will recover.

Railway Matters.

The C.A.R. train between Montreal and Ottawa, Ont., jumped the track August 9th and seven persons, including the engineer, were killed.

Two locomotives for the Quebec & Central Railway are being built at the Kingston Locomotive Works. The boilers for these two were tested recently.

The Hull City Council has decided to give H. J. Beemer a $30,000 bonus towards the erection of railway shops, etc., in Hull. A by-law will be submitted to the people.

C. R Reid is building the stations on the Coast Railway, N.S., at Lower East Pubnico, Wood's Harbor, Upper Wood's Harbor, Shag Harbor, and Barrington Passage.

In anticipation of an extraordinarily large grain crop in the North-West and Manitoba, the C.P.R. has this season added 2,000 box cars, making 6,500 available for handling the present crop.

E. Berryman, C.E., has completed the exploration survey of the Atlantic & Lake Superior Railway Company, between Port Daniel and Gaspe Basin. The railway will reach Gaspe Basin by the valley of the York river.

A new station building at Rat Portage, and a twenty-stall roundhouse with turntable, for the Canadian Pacific Railway, together with rock excavation for extension of tracks to company's yards at Rat Portage, is now going on.

It is said that after many months of surveying and the expenditure of much money, the C.P.R. engineers have at last discovered a feasible route for a railway over the divide between the Kettle and Okanagan River valleys, and to the south of Camp McKinney.

Wm. Mackenzie has closed contracts in five-mile sections of the Rainy River railway with John C O'Neill, of Kemptville; John R. Turnbull, Winnipeg; McGillivray and Gleeson, Hugh Mann, and Luke Madigan, aggregating fifty-five miles to be finished before winter sets in. John R. Turnbull also received a contract for building all bridges and trestles between Stanley and Fort William.

Notice is hereby given that an application will be made to the Parliament of Canada, at the next session, for an act to incorporate a company under the name of the Deutsche Klondeik Gesellschaft, to construct a railway from Dawson City in the Yukon Territory, along Bonanza Creek and across the Dome to Dominion Creek, covering a distance of about fifty-five miles, with power to build branch lines, etc.

A horse and carriage containing five passengers made a trial trip across the new Victoria Jubilee bridge last month from the Montreal side, and returned. The occupants of the carriage were G. B. Reeve, general traffic manager; F. H. McGuigan, general superintendent; J. M. Herbert, superintendent of the eastern division; R. P. Dalton, superintendent of Montreal terminal, and F. H. McGuigan, son of the general superintendent.

The mammoth new round house of the Grand Trunk Railroad at Sarnia has been turned over to the company. It is one of the finest of the kind on the Grand Trunk System. The round-house, which is situated about a half mile west of the depot, is built of white brick, with stone foundation and gravel roof. The total length is about 760 feet, the depth 76 feet, and the height 20 feet. There are 30 engine stalls, each accommodating one locomotive. The foundation of these stalls is composed of four feet of brick, and two feet of cement. They have been thoroughly tested and have proved entirely satisfactory to the company's inspector. In addition to the round-house proper, there has been constructed an office and machine shop building, 56 feet by 32 feet, and a 70-foot turntable.

Mining Matters.

A single crystal, weighing over half a ton, was taken from the Tett Bros'. mica mine, near Westport, Ont., recently.

T. B. Caldwell has sold his iron mine at Calabogie, on the K. & P. railway, to the Hamilton Steel & Iron Co., Limited, Hamilton.

George E. Vickers, vice-president and manager of the Canadian-American Oil and Natural Gas Co., is boring for oil near Belleville, Ont.

Natural gas has been discovered at Clarkson, between Toronto and Oakville, Ont. But as yet the quantity available has not been determined.

The British Columbia Southern Mine, Ltd., operating the Gertrude mine in Rossland, B.C., has ordered a complete lighting plant from the Royal Electric Co.

A rich find of free gold is reported as having been made near Wabigoon, Ont., north of Dinoric, in the neighborhood of Lake Minnistuttle, by Jos. Bouston, a prospector.

Nichols & Son, of New York, have secured an option on the George McIlraith iron mining property on the fourth concession of Darling, Lanark County, Ont., and will develop it in the next few months.

It is reported that a large vein of copper has been discovered, extending from White Horse Rapids, on the Yukon, to a point on the Dalton trail forty miles from the Lynn canal. It is said to be exceedingly rich.

Near Cascade, on the Columbia and Western railroad, which the Canadian Pacific is building from Rossland into the Boundary Creek district, McKenzie & Mann, contractors, have discovered ore, running high in copper, gold and silver. Assays have shown as high as $50 to the ton.

The Coleraine Chrome Mining Company has been incorporated with an authorized capital of $300,000, and headquarters at Montreal. The incorporators are: Hanson and Ferguson, brokers; R. Wilson-Smith, Hon. A. A. Thibaudeau, W. E. Blumhart and Honore Favreau, Montreal, and Hon. A. Desjardins, Maisonneuve.

Paul Johnson, M.E., a graduate of the Royal Technical High School and Mining Academy, of Stockholm, Sweden, is to superintend the building of the smelter of the British Columbia Copper Smelting Co., at Greenwood, B.C., together with John Norborn, of the Union Iron Works, San Francisco, which company has the contract for the iron work.

The Sultana mine, Lake of the Woods, has been sold by J. F Caldwell, the sole owner, to an English company for $750,000. The mine comprises about 70 acres, with a vein about 30 feet wide on the surface, and running about $7 to the ton in gold. Its gross output for three years, with a ten-stamp mill, averaging $3,000 per week, and with the thirty-stamp mill put in last fall the earnings have been at the rate of $151,000 per year.

James P. Howley, F.G.S., geologist to the Government of Newfoundland, has recently presented an official report on the mineral exports of the colony from 1888 to 1898, inclusive, which will shortly be published. In regard to the copper ore, Mr. Howley gives a list of figures showing the export of

copper each year from 1888 to 1898; the value of which he finds to be $5,907,638. The value of iron pyrites, mainly shipped from Pilley's Island, during the same period, was $1,522,250. Chrome iron was shipped to the value of $70,890, mainly from Port-au-Port. The value of iron ore shipped from 1895 to 1898 was $200,140. The total value of all minerals exported, 1888—98, was $7,829,158. Of slate, $1,356 worth was shipped in 1898, and of the last-named article Mr. Howley states that some of our deposits are equal in quality to the best Carnarvon slate in England, and better than any used in the United States. Of the petroleum wells at Port-au-Port, Parsons' Pond and other places, Mr. Howley speaks in favorable terms. Indications of petroleum have been found over large areas on the west coast.

Personal

S. S. Glass has been appointed to the charge of the electrical and steam plant in the Victoria Hospital, London, Ont.

E. I. Sifton, manager of the Electrical Construction Company, London, Ont., was married a short time ago in that city to Miss Kate Kelley.

J. J. York, engineer, in charge of the plant in the Board of Trade Building, Montreal, has resigned, and accepted a similar position in the St. Lawrence Sugar Refinery.

Arch. Rankin, marine architect, who formerly practised in Toronto, and is now chief architect to the American Shipbuilding Co., a combination of shipping interests recently effected at Cleveland, was recently in Toronto on a visit.

J. A. Calder, of Halifax, N.S., and member of the well-known firm of Wm. Muir & Sons, spent a day in Toronto on his way west. Mr. Calder was taking estimates for a cornmeal plant he proposes to install at Dartmouth, N.S.

H. P. Archibald, engineer, formerly of Antigonish, N.S., has been appointed superintendent of the Lethbridge, N.W.T., Waterworks & Electric Light Co., Ltd., and has now taken over the charge of these works.

W. A. Peck, representing the O. W. Bullock Co., of Springfield, Mass., was in Toronto for a few days last month. Mr. Peck is a well posted traveller, and has been engaged in the tool supply trade for some years past.

W. B. McLean, a graduate of McGill College, Montreal, for the last three months employed in the drafting room of the Robb Engineering Co., Amherst, N.S., will continue his technical studies in Manchester, England.

John Bosence, locomotive fireman, Fairville, N.B., was seriously injured in a very unusual way. The water glass on the boiler exploded and the shattered tube flew, one piece striking with great force in the young man's back, entering on the right side near the border of the shoulder blade, penetrating right through the right lung and then striking a rib.

Archibald McBride, Kingston, Ont., died after a short illness August 6th. He came from Ireland 60 years ago with his parents, settled in Kingston, and has lived here ever since. During that time he was continuously employed by the Richelieu & Ontario Navigation Company, as engineer, serving on all their boats. His last boat was the "Corsican," on which he was working till within three weeks of his death. He was a brother of Robert McBride, engineer on the R. & O. steamer "Bohemian," and Samuel McBride, carpenter at the Royal Military College, Kingston.

Four of a gang of 16 men engaged in laying the foundation of a pier of the Midland railway bridge across the Shubenacadie river, Nova Scotia, were drowned August 20th in a caisson sunk to the bottom of the river. It was supposed to be air tight, the pressure of air from a plant on the shore keeping the water out. Through some blunder the safety valves were opened and the air rushed out, and the water rushed in to take its place. The men scrambled for the ladder in the narrow air shaft. Twelve ascended in safety and four perished in the rising flood. Their names were Luke Peters, James Wilkes, William Donegan and James Donahoe, of New York.

William Power, a veteran shipbuilder, died in Kingston, Ont., August 29th, after a prolonged illness. He was 78 years of age, and was born in Prince Edward Island. He was engaged in shipbuilding at Quebec, Montreal and Kingston, and many famous craft were of his handiwork.

Three research scholarships of £150 a year, tenable for two years, have been granted by the Exhibition of 1851 Commissioners to W. B. McLean, McGill University. Scholarships have been continued for a second year to W. G. Smeaton, Toronto University, and E. H. Archibald, Dalhousie University, Halifax.

W. F. Pike, M.A., Ph.D., for twenty years professor of chemistry at Toronto University, has resigned, and will remove shortly to England, where he has purchased an estate. He had a private mechanical laboratory, which he equipped at an expense of about $20,000, which was acknowledged to be the most perfectly appointed machine shop in Toronto.

While raising one of the trusses for the roof of the new Methodist church building at Fergus, Ont., John Moffat, contractor for the woodwork, was almost instantly killed. The truss was being hoisted with block and tackle, and was almost at the required height when one of the guy-ropes broke. Mr. Moffat saw what had happened, and was running to avoid the falling timber, when he was struck between the shoulders and died almost immediately.

Marine News.

P. Griffith, St. James street, St. John, N.B., boat builder, has received an order from the Fishery Department, Ottawa, to build a 20 foot gasoline launch, for use at the biological station, St. Andrew's, N.B.

A despatch from Halifax, N.S., states that the barque "Strathorne," Maitland, N.S., now at Cork, Ireland, has been sold on foreign account for $14,000. She was built in 1883, and is 1,098 tons register. This is said to be the fifth large Nova Scotian ship sold within a month to Italians. Within the past twelve months there has been a demand for wooden ships of this class, and prices have advanced materially.

There is considerable speculation going on in marine circles over the rumor from Ogdensburg that in all probability the five large steamers of the Ogdensburg line will be made passenger boats by the opening of next season. Plans, it is said, have already been approved of. This, if it goes into effect, will give Chicago direct communication with the lower lakes.

The Allan Line steamship "Sicilian" has been launched. The "Sicilian" is of 5,000 tons, and is especially intended for freight service, but will have accommodation for about 60 first cabin as well as for a number of steerage passengers.

The Lake Erie Navigation Co., Ltd., $40,000 capital, has been incorporated by E. C. Walker, Walkerville; F. H. Walker and J. H. Walker, Detroit; S. A. King, M.D., Kingsville, Ont.; W. Woollatt, Walkerville.

The item in the estimates of $350,000 for Port Colborne is "on account." The plan now in the department contemplates, the Minister of Public Works states, not only the deepening of the harbor, but the erection of berths and slips for the mooring of ships as well as the construction of breakwaters.

At a meeting a short time ago of the promoters of the Quebec, Hamilton & Fort William Navigation Company it was understood that R. A. Lucas, Hamilton, Ont., would take the place of the late Senator Sanford as one of the incorporators of the company. It is the intention to have two new boats built this year, in readiness for next spring's business.

The R. & O. Navigation Co. made a service test of the speed and coal consumption of the new steamer "Toronto" the other day. The builder's guarantee was a speed of 17 miles per hour on a consumption of 2 lbs. of coal per h.p. per hour. On the test made she attained an average speed of 17 1-3 miles per hour on a consumption of 1.76 lbs. of coal per h.p. It is said that the best record hitherto made by a side-wheel steamer having a triple expansion engine, and showing a like speed, is a consumption of 1.80 lbs.

FIRES OF THE MONTH.

August 1st. Electric light plant, Wolfville, N.S.; damage, $8,000.——August 14th. Monty's planing mill, Roxton Pond, near Granby, Que.; damage, $15,000; insurance, $4 500 - — August 14th. Monson & Boright's saw-mill, Magog, Quebec; damages, $5,000, insurance, $1,000.—— August 14th. James Robson & Son's tannery, Oshawa, Ont ; loss, $4,500.——August 18th. St. Ferdinand d'Halifax, Que., convent of the Sisters of Charity; damage, $50,000.—— August 20th. Ontario Box Co., Hamilton, Ont.; damage, $40,000.——August 24th. Searle & Co., Brantford, varnish factory; damaged slightly.——September 5th. Power house of the Niagara Falls Park & River Railway; loss on plant, $75,000; building, $10,000.

THE ASPHALT BLOCK.

BY C. BAILLAIRGE, C.E.

The new asphalt block pavement, so-called, is new to Canada, though known and used in a few places in the United States for some time. It is now being laid along the Grande Allee, or St. Louis road, Quebec, extending from the Gate to De Salaberry street, a run of 3,700 feet; and the width being 47 feet from curb to curb. The area, including crossings, will be some 20,000 yards, which at 25 bricks to the yard (the blocks being 12 x 4 x 4 inches), will require half a million blocks. The writer was not slow to recommend their use; as, before he ever heard of them, he had urged on the city council in his yearly reports, an addition of grit or crushed quartz to the powdered rock asphalt, to suit it to grades where the ordinary sheet asphalt would be dangerous. An English engineer named Livingstone had also, after an exhaustive visit to United States, reported favorably on the use of the asphalt block; his report appearing at length in The London Surveyor, an engineering journal highly thought of by the profession.

The asphalt block we are using is made at Hastings on the Hudson, some 30 miles from New York, by the Hastings Paving Company, 66 Broad street, New York. The block or brick, as it may be called, is made up of some 87 to 90 per cent. of crushed quartz, granite or trap rock, reduced to the consistency of coarse sand or fine gravel, in a matrix or binding mixture of Trinidad asphalt, heated to a temperature of 250° to 300° F the two thoroughly mixed and forced into and out of steel moulds several inches in thickness to stand the stress, under a pressure of 5,000 lbs. to the square inch. This statement is exact, the writer having visited the company's premises and witnessed the process; while he also saw the paving being laid by the company at 183rd street, New York.

There is no doubt but what the mixture of gritty matter with the asphalt or bitumen is the only thing capable of rendering the material suitable to certain grades of roadway. A portion of 183rd street, New York, falling towards the Hudson, has a grade of nearly 1 in 7 or 8, and will, I believe, prove to be too abrupt a one for such material; granite setts being better adapted to such inclines as in Mountain, Palace, Canotterie, Dambourges and Genevieve street hills, Quebec. Neither is the scoria brick suited to such slopes, as witness the upper portion of Mountain Hill, Quebec, where against the written opinion of the city engineer, they were laid, instead of continuing the stone paving to the north side of the electric railway track, at the corner of the postoffice and presbytery, where the outer rail at curve had to be laid to grade of inner rail at least, and should be even higher to guard against derailment by centrifugal action.

The paving on Grande Allee is laid on a bed of sand about half an inch thick or more, overlying a foundation of 4 inches of concrete This is laid on the old bottom on which the tamarack blocks were laid some 12 years ago. This foundation is composed of two thicknesses of inch boards at right angles, each to the other. The boards are still in a sound state of preservation, as wood generally remains when removed from atmospheric influences, and especially when in or under water, or in wet or moist soils; while wood laid in dry sand or loam does not endure beyond a few years comparatively. I should have preferred, nevertheless, having the wood removed and replaced by so much concrete; but the extra cost would have been some 25 to 30 cents a yard or more, and reasons of economy prevailed, as it was held that the boards having already stood good for twelve years would hold out indefinitely; timber underlying old macadam having been taken up in other parts of the city, which had been there for over 50 years, and still as sound and clear of discoloration as the day it was laid.

The 4-inch concrete, as stated, was laid direct on the wooden flooring, where the height of the electric track allowed of no intermediate material, but where the rails are laid at a higher level to rectify grade of roadway, the concrete is laid on a 2 to 3 inch bed of broken stone—that is, of the old macadam picked from between the tracks and rails and spread over the boards, after removal of the old wooden block pavement—the portion thereof occupied by the tracks having been taken up two years ago, when they were laid, and the levelling made up of broken stone.

And just here it may be well to state with regard to the life of a wooden pavement of round tamarack blocks, that while that laid on the Grande Allee, twelve years ago, as stated, was found to be in a dilapidated condition from dry rot, blocks are now to be found in the sample room, city engineer's office, city hall, Quebec, which on the occasion of laying water and drainage in Couillard street, were taken up after being there for more than thirty years, and which though worn down by traffic some 2 to 3 inches, or whole height of block reduced from 8 to 6 and 5 inches, were found to be, and are to this day as perfectly sound as when laid some fifty years ago. The reason for this is that the Couillard street blocks were cut and laid green, or with the sap in them, and which under the influence of moisture from rain and the subsoil retained their sap, keeping the wood green and wet, and thus preventing dry rot; whereas, due to the grub epidemic of 1885 to 1889, the worm feeding on the needle of the tree, killed the tamarack, and this sapless wood being used on the Grande Allee instead of the live material, decay set in and dry rot ensued. The life of a wooden pavement is quoted at only seven years, except when creosoted or infiltrated with some antiseptic, while I had in my sample room, already mentioned, specimens of Australian hard woods, "Tallow" wood, "Mahogany," "Blue Gum" and Jarrah, which to test their comparative endurance under similar circumstances of traffic and exposure, were laid in one and the same street at Sydney. They were taken up after being there eleven years, and show only from 3/8 to 5/8 of an inch reduction in height during the interval, and are still absolutely sound to the very heart, though slightly discolored.

Returning now to the asphalt block, which may either be laid on a bed of sand overlying the concrete, as stated, or preferably on a coating of half an inch of cement mortar; the blocks are laid close jointed, and are well fed to the layers, at the rate of 10 to 15 yards per man per hour (100 to 150 yards per day of 10 hours), but exclusive of closers along curb stone, which require another man or two to cut them to length and lay The overlap of the brick as laid in New York is 4 inches (1-3 of the whole block), and thus the opposite joints occur at only every third course; but as laid here, the lap is 6 inches (half of the block), the joints thus breaking at every second or intermediate course instead of at every third, engineers differing as to which is preferable. The whole is intelligently carried on under the foremanship of — Watson of New Haven, on recommendation to F. Parent, the contractor, by the Hastings Company. The next operation is ramming down, which is done by two men with a heavy beetle (some 90 lbs.), while a third drags a half-inch plate of steel about 10 inches wide and a foot and a half long, thus always embracing more than a brick in length and two in width, and this is moved backwards and forwards along the pavement in a way always to overlap the last portion receiving the impact or the already consolidated surface.

Following this is the sanding of the joints, for though the blocks are said to touch, there are always interstices of 1-16 to 1/8 of an inch due to roughness of surface, which allows fine dry sand to percolate the joint and fill it. This sand filling was a matter of anxiety to me, as I feared that during rainy weather water might get at the foundation layer of sand and cause the blocks to settle; but no such settlement has occurred anywhere, even after a continuous and heavy two days rain. This non-percolation of surface water into the joints between the bricks I attribute to the bricks' antipathy for water, the oily and greasy nature of the bitumen being antagonistic; or may be water percolates the broader of the joints to a certain depth only, due

to the repulsion referred to, and then acts as a bridge over which the rain water passes on and down the roadway.

When thoroughly sanded, or supposed to be, to all appearances, the paving is opened to traffic. Then a slight tremor of the bricks causes the sand to settle in the joints and the sanding process is repeated to satiety; the sand requiring to be screened fine and absolutely dry (sun or fire dried), without which it will not run into the narrower interstices. It is said, though I was not long enough in New York to notice the thing, that under traffic the edges or arris of the brick gives, due to its plastic nature, and that thus the joint becomes filled in and absolutely impermeable to water.

The cost of the blocks is some $60 per 1,000, delivered at the mill or factory. Thus for transportation to Canada, some $2 per ton has to be added for freight, or $17 per 1,000, the blocks weighing about 8½ tons to the thousand. Again, there is 20 per cent. duty to pay, a toll at Rouses Point of say $1 to $1.50 per large load, wharfage, harbour dues, etc., cartage to site of paving at say 100 blocks or 4 yards sup., per cart load (1,700 to 1,800 lbs. with us). Now add taking up and removing old pavement, grading, levelling, concreting, sand foundation and laying, and a minimum is arrived at, allowing 10 per cent. profit, of about $3.37 per yard sup. of finished paving; while the tenders for the work ranged up to $4.27 per yard.

Certain precautions are to be observed in the delivery or rather before delivery, or until the blocks have sufficiently cooled down to allow of handling, piling and rough usage in barging and unloading. The bricks to prevent sticking or adhering should be sanded between the layers, and especially on board the barge, where during the hot weather of July and August, and due to superincumbent weight, they are liable to cling together, but can be easily separated with the chisel and hammer. I have also found some of the blocks (very few) to be slightly curved, as if under pressure of overlying load, urged to hug the curved outline of the containing vessel.

The blocks, to save handling and hauling, are piled along the sidewalks on either side. It requires about three or four laborers, according to width of street, to keep the pavers or layers supplied. The brick cuts well, and square, and easily under a blow or two of the hammer, with a chisel 4 inches wide on edge, or wide enough to cover the whole breadth of block.

Between the track rails a row or course of bricks is first laid longitudinally within the rail on each side. This border course is laid to enter an inch, or as far as it will go under the upper flange or projecting head of the rail; tilting it the while to about the camber required (a quarter of an inch), when four stretches just fills the remaining space between the opposite border courses, and the underlying sand bed is, by the use of a mold or template run along the track, resting upon the rails, cambered up in a way to cause the paving between the rails to crown at level, or a quarter or half inch over it, as may be desired; while the border courses so tilted and put in under the top of rail afford the space necessary for the car wheel flange to run in; and again, the sloped groove or depression thus left along the rail, instead of being square, which would catch and hold the wheels of vehicles, allow the wheel to move out sideways without, as in the case of the square groove, tending to haul the paving after it.

Where the fish plates and connecting wires occur (at every 30 feet or length of rail), some of the border bricks inside the rail have to be cut longitudinally, which is easily and neatly done by jumping the chisel along the brick, back and forth, as in splitting a stone parallel to its length, or along the line of proposed fracture.

When the roadway is double tracked, the space between the tracks is filled in flush with top of rail, or, as outside the tracks, a quarter of an inch higher to allow of settling by ramming and under traffic; and as laid here, it takes just three and a half bricks or stretches to reach from rail to rail. This space is also cambered up by a sand template to half an inch additional above the concrete; as any pavement laid flat always looks hollow, and any such hollow in a roadway looks as bad as would a hollow floor or deck, instancing at the same time a want of forethought by the engineer or architect against settlement. To ensure uniformity of curve or camber in cross section of roadway from the curb to curb or curb to rail, when the paving goes on along one side of the street, while the other remains open to traffic, the best, easiest and quickest mode is to measure down from a line held taut across the roadway and resting on curb and curb or curb and rail. It requires two hands to hold the line, but where only one is available, the string at one end can be tied to a peg or to a brick left hanging in rear of curbstone, or in rear of rail before the track is paved or sidewalk laid. This line is successively held at distances of 3 to 4 feet along the roadway—when ordinates or vertical offsets are measured down from it to level of top of concrete—the ordinate along the rail being 4½ inches, or the thickness of the brick plus that of the sand-bed (less, if you wish, a quarter of an inch to allow for settlement by ramming and traffic); at or along the curb, the ordinate is say 9 to 10 inches, including depth of paving and height of curb there; over half way or thereabout (the eye will do) between these extreme points another or third offset is taken, and two more, a fourth and fifth at points again half way (by eye) between the others.

To regulate height or level of pegs to be driven for top of concrete, Mr. Watson has an ingenious mode of offsetting by means of a stick with a notch in it at 4½ inches from level of string, one at 9 inches, and three others at intermediate heights as required and calculated in advance, or measured from a template cut to camber of roadway. He then sets and drives his peg home, or until top of it is just at proper level to suit offset. These five offsets have of course to be repeated for as many pegs on the other side of the roadway, when in turn that side is being paved, and the paved side handed over to traffic.

To form the sand-bed, strips or templates ½-inch thick are laid at distances along the road of 8 to 10 feet; when two men, one at each end of a straight edge, move it and the sand with it along the templates in a direction parallel to rail and curb and back and forth until the sand is worked down to proper level. I had omitted to say that the paver or layer, instead of, as usual, standing on the unpaved portion, keeps on the portion already laid; as standing on the sand-bed when prepared as above stated would altogether jeopardize the regularity of the work.

This asphalt block pavement is certainly an improvement on the sheet asphalt as far as durability is concerned, it being 4 inches thick, while the sheet is but one to one and a quarter inch. Again, the grit in it suits it to ordinary grades where the sheet would prove slippery and dangerous. Neither will this asphalt block be suitable for heavy traffic or for quick or steep grades or inclines, where nothing but granite setts should be used. The sheet has been laid, against my advice, in such narrow and trafficy streets as St. Paul and St. Peter, Quebec, where on account of wheels travelling constantly in same line, the asphalt will soon be worn into ruts and hollows. The sheet is suitable for residential streets, and especially where there are no rails, as in some of the streets at Westmount, Montreal, where, after, they say, nine years laid, it shows no sign of failure; but in St. James, Notre Dame and other streets, where the traffic is comparatively heavy and tracks exist, the asphalt begins to give a quarter of an inch at a time along the rails under the erosive action of the wheels of vehicles, and then it goes on crumbling, a fraction of an inch at a time, until wide ruts are formed, which have to be repaired.

The Hastings Company also manufacture hexagonal blocks for sidewalks. They make them about 2¼ to 2½ inches thick, which is too heavy and expensive. I have advised the company to reduce these to 1¾ inch, or even 1½ inch, as sufficiently thick to stand foot passenger traffic for years to come. We are about laying a quantity of sidewalks in Quebec with these, which on account of the greater measure of grit in them will prove preferable to the "mastic," as laid hot and rolled or smoothed with wooden pallets. The latter becomes somewhat disagreeable to walk on during hot weather, and especially while the sun shines hot upon it, when it almost instantaneously softens to the consistency of putty or of soft or kneaded clay puddle, and the foot actually sinks into it, perceptibly, or say a sixteenth of an inch or so, though it immediately hardens again the moment the sun is obscured.

METAL IMPORTS FROM GREAT BRITAIN.

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

	Month of July.		Seven Months to July.	
	1898.	1899.	1898.	1899.
Hardware	£2,190	£1,695	£12,502	£11,145
Cutlery	11,301	3,497	30,798	29 617
Pig iron	928	2,023	7,086	7,072
Bar, etc.	383	2,373	6,042	8,089
Railroad	—	36,533	6,972	57,228
Hoops, sheets, etc.	7,772	16,620	24,047	55,455
Galvanized sheets	8,236	5,071	32,071	35,474
Tin plates	11,946	20,997	83 598	98,091
Cast, wrought, etc., iron	1,839	6,877	15,208	24,412
Old (for re-manufacture)	499	344	3,574	2,003
Steel	5,001	13,079	32,643	43,626
Lead	4,126	5,860	16,058	27,329
Tin, unwrought	1,550	2,925	11,223	12,442
Alkali	3,547	2,056	24,419	18,658
Cement	2,270	3,534	12,153	16,236

SAND FILTRATION OF PUBLIC WATER SUPPLIES.*

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

(Continued from last issue).

The layer of gravel serves to support the sand and to conduct the water horizontally to the under-drains. The excessive thickness used in some of the old filter beds is not at all necessary, 12 or 15 inches being quite sufficient. It should consist of three or four layers of graduated sizes, the top one being fine enough to support the sand without any liability of the layers getting mixed. Around the openings into the underdrains the separate stones should be carefully placed so as to avoid any possibility of movement when the water begins to flow. If necessary the gravel must be thoroughly washed before being put in place.

In arranging the underdrainage system of a filter, which includes the gravel bed, the object to be aimed at is to cause the water to sink vertically through the sand, and as nearly as possible at a uniform rate in all parts of the bed. In order to effect this it is evident that the resistance to horizontal motion in the underdraining system must be everywhere nearly the same. Attempts have been made to calculate the proper size of the underdrains, using formulae for the flow of water through gravel and sand of various sizes. A discussion of the matter will be found in the Report of the Mass. State Board of Health for 1892, and also in Allen Hazen's book on the "Filtration of Public Water Supplies," pp. 32-41. With round tile drains, and a daily filtration rate of 2.57 million gallons per acre, Mr. Hazen suggests the following limits to the area which pipes of the different sizes should be allowed to drain:

Diam. of drain.	To drain an area not exceeding	Corresponding velocity of water in drain.
4 inches	290 square feet.	0.30 ft. per sec.
6 inches	750 square feet.	0.35 ft. per sec.
8 inches	1,530 square feet.	0.40 ft. per sec.
10 inches	2,780 square feet.	0.46 ft. per sec.
12 inches	4,400 square feet.	0.51 ft. per sec.

and a cross-sectional area for the larger and main drains of at least 1-6000 of the area drained. With the rate mentioned this would give a maximum velocity in the drain of 0.55 feet per second. These underdrains are variously constructed of open jointed channels of stone or brickwork, or of tile pipes with perforations or open joints. There is no advantage in spacing the laterals more than about 16 feet apart, as the extra quantity of coarse gravel necessary would cost more than the saving in the pipe. In some filters the underdraining has been accomplished by means of a double bottom of open brickwork supported on arches or other arrangements of the same material. The lateral drains usually rest upon the bottom of the basin, but the main drain is often placed lower. If the top of the drain is higher than the coarsest layer of gravel, that part should be closed to prevent the entrance of the fine gravel. In several of the old filters vertical ventilating pipes extend from the under-drains above the surface of the water on the bed. These are for the purpose of allowing the escape of air from below, so as not to cause disturbance by passing through the sand. They are not used in the latest filters, as it was found that they were of no advantage, but rather a source of trouble, through the formation of channels between them and the sand, which allowed water to pass without filtration.

The basin which encloses the filtering materials must of course be water-tight; and in that respect the same care must be experienced in its design and construction as would be necessary in the case of any reservoir for holding water. Its depth will depend upon the thickness of the bed and the height to which the water is to be allowed to rise, but does not usually exceed 10 or 12 feet. The bottom is usually level, or perhaps with slight depression for the lateral drains. The walls may be either vertical or sloping, depending upon the material used. Taking into account the necessity of uniformity in the filtration rate at different points of the bed, vertical sides are probably preferable to sloping. Local circumstances will as a rule, determine the best method of construction and the material to be used. The latter may include stone masonry, brick, concrete, earth embankments, puddle, etc. Concrete is a very satisfactory, and in most cases an economical material to use for any part of the structure.

If a roof is required it should consist of groined arches, supported on pillars, preferably of brick. Care is necessary to obtain a solid foundation for the latter, as the form of roof will not admit of much unequal settlement. A good plan is to form the bottom of flat inverted arches, which will give a firm and even support for all the pillars; and the lateral underdrains will then lie along the hollows midway between the rows of piers. With a roof of this kind, vertical side walls will be more economical than sloping ones. But the plane surface between the wall and the bed must be broken by projections, in order to prevent the liability of unfiltered water passing along the junction; which remark also applies to the piers. It is to prevent this same contingency that the gravel layer is only carried to within 2 or 3 feet of the walls, its place being filled by the sand which here composes the whole depth of the bed. Around the inlet and outlet chambers there should be no gravel within 5 or 6 feet of the walls.

Manholes must be constructed in the roof for the admission of light and air. Also a "run" for entering and removing the sand scrapings, etc. With piers spaced 14 or 16 feet on centres a light and strong roof can be built of concrete at a very moderate cost. When the roof is finished it is covered to a depth of two or three feet with earth surmounted by a layer of loam, which may be seeded down or laid out in flower beds, etc. For open filters the sides may be of earth embankments, made water-tight by a layer of puddle or concrete. If of the former, a paving of brick is necessary, which must be of sufficient strength to withstand the action of the ice where it is exposed.

Before proceeding with the methods of operating a filtration plant we will discuss it with reference to these important features, the inlet, outlet, underdrains, etc. With a given flow of water through the bed, the vertical distance H represents the head required to force this quantity through the surface film, the sand, gravel and underdrains. It is variously termed "loss of head," "head on the filter," "filtering head." The depth of water in the majority of European filter beds is usually from 3 to 4 feet, with the full depth of sand. In some of these filters it was allowed to rise and fall according to fluctuations in the removal of the effluent. Such variations in depth, however, are found to have an injurious effect upon the surface layer, and on the efficiency of the filtering process; in the newer plants, therefore, they are provided against by an apparatus on the mouth of the inlet pipe, by which the water when it reaches a certain height automatically closes the inlet. These consist usually of some form of balanced valve worked by a float. In connection with an open filter, such an arrangement must be protected from frost. The inlet opens into a small chamber at the side of the bed, from which it is separated by a wall. The water flows over the wall on to the bed, and is prevented from disturbing the surface of the sand by paving it for a short distance from the chamber. Sometimes the water enters by overflowing an open masonry channel extending across the surface of the bed. The loss of head, corresponding to a given rate of flow of water through the filter, will depend upon the extent to which the surface film has formed, and the friction in

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

the sand, gravel and underdrains; but under any given conditions it varies (within practical limits) directly as the rate. In some of the old filters, the outlet was connected directly to a clear water basin, or pump well; and the difference in level between the surface of the water in the filter and of that in the well was, of course, equal to the loss of head. Fluctuations in the draft upon the well produced corresponding fluctuations in the filtering head, and therefore in the rate, which was thus automatically adjusted to the demand. In others, however, some sort of apparatus was placed between the filter and the clear water basin by which the rate could be kept constant. This is now considered to be of the greatest importance for the reason that bacterial tests of the effluents have shown that marked deterioration invariably follows fluctuation in the rates. This is probably caused by the mechanical disturbances produced in the sand-bed and surface film. For details of such tests, see Report Mass. State Board of Health for 1894.

In the newest plants, therefore, some kind of an arrangement is always provided for the regulation of the flow. Since the rate varies directly as the loss of head, it is immaterial which is regulated. Some of these devices, therefore, regulate the flow directly, while others accomplish the same result by the indirect method of regulating the loss of head. In order that the former may be kept the same from one day to another, the latter must be gradually increased as the period of service of the bed extends, so as to correspond with the increasing resistance of the surface layer. This is effected automatically in the device which was designed by Lindley for the filters at Warsaw. The apparatus is contained in a water-tight chamber, connected on one side with the filter, and on the other with the clear water basin. The rate at which the water can pass from one to the other depends upon the depth to which the slits in the sliding pipe extend beneath the surface of the water. This is adjusted by weights at the other end of the chain which passes over a pulley. Thus the rate can be kept constant; and as the resistance of the bed increases the level of the water in the chamber will automatically adjust itself to produce the necessary differences in level or loss of head.

In the method of regulation devised by Gill for the Tege works of the Berlin water supply, the outlet from the middle chamber is through a weir; and the depth of water on its crest, and, therefore, the discharge, is indicated by the height of the float read on the scale. This is kept constant by means of the gate. The corresponding loss of head is shown by the difference of the readings on another scale. Keeping the water in the filter always at the same level, a constant rate can only be maintained by the gradual falling of the level in the right hand chamber and a consequent wider opening of the gate.

As to the limit beyond which the loss of head should not be allowed to go, the general opinion seems to be that it should not be greater than the depth of water on the bed, though the Lawrence experiments have not shown any bad effects from exceeding this limit. As a general thing it may be stated that, everything else being equal, the higher the rate the poorer the quality of the filtrate. But with fairly low rates this deterioration is slight, so that entirely satisfactory results can be obtained with rates up to 3 or 3½ million gallons per acre per day. Probably higher rates could be safely employed if very great care were exercised in the operation of the filter. The relative effects of high and low rates from a financial point of view are discussed further on.

When the clogging of the filter bed has become such as to require a loss of head greater than the prescribed limit, the inlet is closed and the water allowed to drain away until it has sunk some distance below the surface of the sand. When this has become sufficiently firm, workmen enter the bed with planks wheelbarrows and broad flat shovels. With these they carefully remove the surface layer and pile it up in little heaps, which they afterwards remove with the barrows. The depth removed varies from ½ to 1 inch, and averages about 8-10 of an inch. The surface of the sand is then raked to loosen up the packing caused by the boots of the workmen, and after smoothing down any irregularities the planks are removed and the filter is ready for another period of service. The refilling begins from below by admitting through the underdrains filtered water from another bed in action. The object of this is to drive out the air from the pores of the sand, where its presence in the form of bubbles would cause considerable unnecessary friction. When the water has risen a few inches above the surface of the sand, the lower connection is shut off, and the refilling is completed by means of the surface inlet. Before filtration proper begins the water should be allowed to stand on the bed for several hours; or the first million gallons or so should be wasted. The amount wasted can be reduced by beginning the filtration at a low rate, and gradually increasing it to the maximum. When the scrapings have reduced the sand-bed to the minimum allowable thickness, the total amount removed, which has in the meantime been thoroughly washed, is replaced at one time. Before doing so the surface of the permanent layer, which is never removed, should be loosened up by being spaded over to a depth of six inches or so. If this is not done, there is a liability of sub-surface clogging at its junction with the clean sand. When the filter is started again, it is, except for the permanent layer, in the condition of a new filter, and so requires extra care in operating it, and the filtrate should be wasted for a much longer time than is required after the scrapings. Piefke of the Berlin waterworks places this period at six days. Considering the labor necessary, and the time the bed is out of use, this replacing of the sand is an expensive operation, and should not occur oftener than can be avoided. In most plants the usual period is about once a year.

Sometimes it is possible to obtain new clean sand at less cost than is necessary to wash the old. But this is rarely the case; hence an important part of the equipment of a fair-sized filtration plant is the apparatus for the washing of the sand. The simplest of the methods employed for this purpose consists of a broad shallow box, which is set in an inclined position. The dirty sand is thrown into this box, and a jet of water played upon it from a hose. The water overflows from the lower end of the box and carries the dirt with it. This is continued until the water runs off clean. The more elaborate methods employ mechanical means to force the water through the sand. Drum-washers, operated by horse or steam power, are largely used in Germany. They are set in an inclined position, and the sand, with streams of water playing upon it, is forced from the lower to the upper end by means of revolving spiral blades. Various other methods more or less on the same principle are employed.

The "Ejector" washer is probably the most efficient of all the methods employed. It consists of a series of conical hoppers arranged in a row. At the bottom of each hopper is an ejector through which a stream of water passes under a pressure of 15 or 20 lbs. The dirty sand is thrown into the first and largest hopper. From this it is ejected through a vertical pipe into a trough, from which it falls into the next hopper. Here the same thing occurs; and the process is repeated until the water, which is continually overflowing from the hoppers, comes off clear. The whole arrangement must be enclosed in a masonry pit, from which the dirty water is conducted by drains. Six or eight hoppers are required for each machine, which will have a capacity of from 5 to 6 cubic yards per hour. Sand washers of this type are used in the new filters at Hamburg, and are to be used in the plant now under construction at Albany, N.Y. Details of the latter are given in Engineering News, February 10, 1898. The volume of water required in sand-washing varies, according to the method used, from 12 to 20 times that of the sand; the ejector machines apparently requiring the most. The question of cost will be referred to under maintenance.

(to be continued).

The annual summer class in practical surveying in connection with the faculties of applied science of McGill University, began September 1. Carillon, P.Q., is the headquarters of the class this year, and here a series of practical surveys of prospective railways and a continuation of the partial survey of the Ottawa river are being carried out. Upwards of forty-five students, who intend entering upon the courses of architecture, mining, and civil and electrical engineering, are attending the class, which will continue until the session of the Faculty of Applied Science opens. C. H. McLeod, professor of surveying and geodesy; J. G. G. Kerry, lecturer in surveying, and R. S Lea, assistant professor of civil engineering, are in charge of the work of the class.

Price Bros. & Co.'s saw mill at Amqui, Que., was burned down Sept. 5. The loss will amount to about $100,000.

Abraham Leyer, contractor, of Montreal, has assigned at the instance of Ovid E. Galarneau, with liabilities of about $20,000.

Bylaws to raise $18,000 for a new central school and to raise $4,000 to extend the waterworks system were both carried in Owen Sound recently.

The industries at Deseronto, Ont., are in a very flourishing condition, both the cement works and the new charcoal iron smelter being ordered many months in advance.

Darling & Pearson, architects, Toronto, have been asked to prepare plans for a large hotel in Muskoka, Ont. This hotel will accommodate 500 people. Hamilton capitalists are interested.

The flour mill and shingle mill of Mills Bros., Merrickville, Ont., was destroyed by fire Sept. 5th, The flour and oatmeal mill belonging to H. Easton was also burned, and Watchorn & Co.'s woolen mill was damaged.

Inspectors Noxon and Christie, and Architect Heakes of the Ontario Government staff, are preparing plans for the reconstruction of the Penetanguishene Reformatory into an asylum. The Government has decided to build a new reformatory in Oxford county.

A bylaw was passed at Vancouver, B.C., recently, giving council power to raise a loan of $150.000 for the purpose of extending and improving the city sewage system. At the same time a bylaw to raise a loan of $20,000 for the purpose of acquiring certain lands fronting on English Bay for a public bathing beach and recreation grounds was lost.

The city of Winnipeg has decided to purchase a softening plant for its new waterworks, the plant to cost $17,430 and the installation work $12,500, or a total of about $30,000. The Pittsburg Testing Laboratory, Pittsburg, Pennsylvania, has been awarded the contract for the plant by the fire, water and light committee subject to the approval of the council.

The Ottawa Electric Company has forwarded to Ald. Campbell, acting Chairman of the Civic Railway and Lighting Committee, the following letter, which sets forth the liabilities which the city will have to assume in case of its purchasing the entire plant and equipment of the company: "In compliance with your request I beg to submit the following to enable you to arrive at the amount that the city would be required to assume to take over the business, franchises, etc., of this company, as set forth in our letter of April 27th last. I might add that the figures are taken from our statement of April 30th last, the date of last closing of books:—Capital stock, fully paid up, $765,000; debentures bearing interest at 5 per cent., $320,000; accounts owing, bills payable, $155,940.41; total, $1,241,740.41. I might further add with reference to the item of $155,940.41, that this is about offset by such assets as accounts due to the company, merchandise, stores, etc., on hand. Trusting that this information is satisfactory. (Signed) D. R. Street, Secretary-Treasurer."

—Dr. Andrew MacMeans, of Mexico, a native of Toronto, and a graduate of Trinity University, was in the city recently, spending a few days. Chatting with a Toronto World reporter, Dr. MacMeans said: "I paid my first visit to Mexico ten years ago, and was highly pleased with the progress that country was making, in fact my expectations were surpassed. The vast improvement Mexico has made in the last quarter of a century is almost phenomenal. Twenty years ago there was hardly a railroad, to-day the country possesses over 12,000 miles, and 18 miles of street railway. He further states that the exports of Mexico are the imports of Canada, and the imports of Mexico are the exports of Canada. There is a very great hatred in Mexico for the United States, and everything coming from that country and Canada should profit by this.

—The discovery of the extent and importance of the hematite or limonite deposits in the Michipicoten district seems to promise an enormous development in the iron-smelting industry of Ontario. A realization of the immense area and valuable nature of the deposits has been obtained by the receipt of a 43-lb. sample of brown hematite at the Bureau of Mines, accompanied by an explanatory letter from Prof. A. P. Coleman, Provincial Geologist, who has been spending some time in the Michipicoten region. The ore specimen in question contains 60 per cent. of iron, and it was taken from a deposit on the claim of Mr. E. V. Clergue, of Sault Ste. Marie, which is about ten miles north of Michipicoten Post.