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The Canadian Engineer

VOL. VII.—No. 12. TORONTO AND MONTREAL, APRIL, 1900. {PRICE 10 CENTS $1.00 PER YEAR.

The Canadian Engineer.

ISSUED MONTHLY IN THE INTERESTS OF THE

CIVIL, MECHANICAL, ELECTRICAL, LOCOMOTIVE, STATIONARY MARINE, MINING AND SANITARY ENGINEER, THE SURVEYOR, THE MANUFACTURER, THE CONTRACTOR AND THE MERCHANT IN THE METAL TRADES.

SUBSCRIPTION—Canada and the United States, $1.00 per year; Great Britain and foreign, 6s. Advertising rates on application.

OFFICES—62 Church Street, Toronto. and Fraser Building, Montreal

BIGGAR, SAMUEL & CO., Publishers,
E. B. BIGGAR, R. R. SAMUEL
Address—Fraser Building, MONTREAL, QUE.

Toronto Telephone, 1892. Montreal Telephone, 2589.

PHILADELPHIA AGENT: H. E. BURNETTE, 2036 N. 13th Street.

All business correspondence should be addressed to our Montreal office. Editorial matter, cuts, electros and drawings should be addressed to the Toronto Office, and should be sent whenever possible, by mail, not by express. The publishers do not undertake to pay duty on cuts from abroad. Changes of advertisements should be in our hands not later than the 1st of each month to ensure insertion.

CONTENTS OF THIS NUMBER:

THE BOSTON GAS WORKS.

BY CHAS. BAILLAIRGE, C.E., QUEBEC.

It may be interesting to the general public to say that during the late visit of the Canadian engineers to Boston on invitation of the engineers of that city, we visited the gas works of the New England Gas and Coke Co., which are so far ahead of anything else of the kind in any other city, both as to extent and novelty of arrangement, as to be well worthy of special mention.

I shall merely deal here with the economic features of the labor-saving appliances introduced to reduce the cost of production to 30 cents the 1,000 cubic ft. The coal used is of course of the bituminous or gas-producing kind. It is brought from Cape Breton, and costs the company but $2.63, delivered alongside the wharf at Boston. It consists solely of what is called slack or screenings of every degree of fineness up to and not exceeding an inch or less in size. A clam shell dipper from an elevated staging dips down into the hold of the vessel, scoops up a chaldron or more of the material, raises it to a height whence it is delivered from the clam shell into a trolley car. This car ascends along an inclined trolley way to a further height, which brings the coal immediately over the nest of retorts or furnaces into which it is to be delivered for caking or baking.

The retorts or furnaces are in nests of 50, and there are eight such nests or 400 ovens in all with a travelling feeder to each gang or batch of furnaces. Some idea may be had of the comparative size and capacity of the plant when it is known that while ordinary gas plants, like ours in Quebec or other Canadian and American cities, as well as those to be found elsewhere about the world, are but a few feet in length (6 to 10 feet), a couple of feet in width and as many in height, holding as they do a few barrow loads of coal; the Boston retorts are 30 feet long, 8 to 10 feet high, and 3 feet wide. Each of the eight nests is therefore, including the separating walls between them, some 200 feet in length, and on each side of this hive of furnaces runs an elevated rail along which the traveler passes, stopping on its way opposite the retort to be loaded. Its gates, three in number, form as many bin-like pockets in the wrought iron feeder, and after the corresponding hatchways to the oven have been removed, are simultaneously opened, delivering the coal or slack, as grain from an elevator, into the retort which has just been emptied of the residual coke of a previous charge and is ready again and red hot to receive the next supply; and when that has been baked for 28 hours and all the gas expelled, repeat the process day and night without cessation the year round.

These nests of retorts are mounted high or as if on stilts to allow of tunnels running longitudinally beneath them with parallel lines of piping, two to three feet in diameter with corresponding conduits above the retorts, the latter to receive the two kinds or qualities of gas manufactured; the so-called poor brand for culinary and heating purposes to be sold at 50 to 60 cents the thousand feet, and the richer sort for illuminating purposes at say a dollar or less the thousand feet.

Both of these gases have to be purified or cleared of their tar, sulphate of ammonia and other impurities, for which purpose they pass through the lower of the tubes thus mentioned on their way to large-sized buildings, where the gases are received in scores of large and tall iron cylinders and cooled in contact with cold water jets and coils which cause the residuals to condense, distil and run away into receptacles for the purpose, the one vessel or several of them delivering always into another or others at a lower level, and so carrying out the principle of labor-saving manipulation, by raising the coals on their delivery from the vessel to such a height that all other operations may be automatic and performed by gravity alone except where electric or steam power is made to intervene to lift the slack to its destination and work the travelers where the motion is horizontal. I have already said that the furnaces are raised above ground level, and they are so raised or built at a height sufficient to allow of their delivering their coke (which is what is left of the coal after the gas has been expelled therefrom by roasting or heating in air-tight receptacles), at a height still sufficient for final delivery into the railway cars for commercial purposes.

The operation, which is the most novel, striking,

and so to say, sensational of the whole process of gas making, is as follows: Along each side of the row or range of furnaces is a line of railway. At each end of each retort is an iron door. When, as already stated, the coal has been cooking in a red hot or incandescent state for 28 hours, more or less, according to quality, the door at the rear end of the furnace is opened; a powerful hydraulic ram moving on wheels along the rear track, just alluded to, thrusts a strong iron plate adapted to a movable axle or horizontal plunger against the rear face or end of the mass of coke to be expelled. This prism of red-hot coke, if nothing were provided at the opposite or front end to receive it, would of course fall to the ground, the front portion as pushed forward breaking off from that behind it in the same way as the protruding portion of a glacier breaks away from the parent stock and falling into the sea floats away in the shape of so many icebergs. It would then have to be removed by shovels and hand labor and thus slowly charged into the railway trucks ready to receive it. But anything like such delay would jeopardize the whole process of cheap gas production. No, there is no such slow-going process of manipulation tolerated here; everything has to be done in a minute or two, and so it is—the speeding of the coal on its way from the vessel to the works is the delay of a minute or two—the feeding of the retort is done in a minute or less, and now the emptying out of its contents has to be as speedily performed. The ram alluded to thrusts out its thirty-foot arm and pushing hand in a minute of time, or not much more, and to receive the falling mass, a railway truck, platform or box car is made to run alongside, receives the red-hot mass as it disintegrates, into an iron cradle or receptacle of the full length of the car and say some 8 feet in breadth, tilted up high on the receiving side and at such a height from the ground on the opposite side as to be able, while passing alongside an empty railway truck on a siding, to dump its contents thereinto by a simple and partial motion around its rotating axle, as with a dumping cart or snow van; the red-hot coal coming from the furnace having water thrown upon it as it falls into the first car, and from the one into the other, to reduce its heat and render it bearable by the manipulators who have a hot time of it during the process.

The gas holder at these works is over 198 feet in diameter; its height is 229 feet, partly above and partly below ground, as usual, working in four lifts in the way that the first eye tube of a telescope pulls out the second, and the second the third. Its capacity is five millions of cubic feet. The works are now using daily about 1,500 tons of coal, the output being some 4,000,000 feet of rich gas, 5,000,000 feet of poor gas, 1,100 tons of coke, 75 tons of tar, and 20 tons of sulphate of ammonia.

The mains are now laid, the larger or principal ones for the conveyance and subsequent distribution of the poorer gas for heating purposes, and when turned on and used for domestic cooking and heating, ashes and the ash bin will become a thing of the past, and no more space in cellars or tenements will have to be reserved for or taken up by the usual yearly requirements of from 10 to 20 tons of coal. Nothing thereafter but the essence of the coal will be used and the gas for heating will be turned on or off as for illuminating purposes. It is a foreshadowing of my conclusion of ten or twenty years ago, that it must come to this in the end.

For THE CANADIAN ENGINEER.

BROCKTON, MASSACHUSETTS, SEWAGE DISPOSAL WORKS.

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

On Friday, February 2nd, 1900, several members of the Canadian Society of Civil Engineers, accompanied by Mr. Barnes, city engineer of Medford, went to Brockton, Mass., to visit the sewage works. We were met at the station by Mr. Felton, city engineer, who went with us to the works. Brockton has a population of about 40,000, the average quantity of sewage per day being between 600,000 and 700,000 gallons. The sewage is pumped to a height of thirty feet, the main being three miles in length. The separate system is in use. The sewage is treated by intermittent filtration, the municipality owning about thirty acres. About fifteen acres are used at present of which seven and one-half are under-drained. The filter beds are one acre each. At present they are experimenting with stale sewage, the sewage being allowed to stand in the mains for some hours, acting somewhat as a septic tank. The result appears to be very satisfactory. The effluent, which is discharged into a cranberry marsh, through which flows a small creek, had every appearance of being more pure than the water in the creek. There is a well-equipped chemical laboratory at the filter beds. Mr. Felton explained that they were now furrowing the beds as being more satisfactory.

The annual cost of labor, including the services of a chemist, will this year be about $2,500 or $2,600. Only two laborers are employed, who live close to the beds. At present corn is grown and last year about $300 worth was sold. Fruit trees have also been planted and appear to be flourishing. At the time of the visit the weather had been very cold and ice had formed on the surface of the beds, but the working of the beds was not interrupted in the slightest degree. At Brockton, experience shows that the stale sewage is easier to filter than the fresh. The rakings from the sludge beds are now eagerly sought for by farmers in the vicinity.

SOUTH AFRICA, ITS PEOPLE AND TRADE.

CAUSES OF THE BOER WAR.

ARTICLE V.

(Continued from last issue).

When the question of sending a Canadian regiment to help Britain in South Africa was discussed lately, one of our politicians asked, "Why should we entangle ourselves in Great Britain's foreign wars, and why should we spend our money and blood in those far-away places?" In the first place, this is not a foreign war. From an Imperial standpoint it is very much a domestic war. It is not merely a matter of the ill-treatment of our fellow-subjects in the Transvaal, but whether we are to abandon our fellow-colonists in the Cape and Natal to a misrule comparable only to that of the Turks in Armenia—whether, in short, we are to lose or hold our Empire in South Africa. The Cape, be it remembered, is the halfway house to India, to our possessions in China, to Australasia, and to the smaller islands of the Eastern Hemisphere. If it had not been for the possession of the Cape and the ability of Great Britain to send reinforcements thence to India, during

the great mutiny, she would have lost her Indian Empire then. If it was vital to Britain then, the Cape is doubly so now, when Australia has become a daughter nation, and other Eastern lands have increasing claims upon her. South Africa is, in fact, the key of the Empire in the Eastern, as Canada is in the Western, Hemisphere. Moreover, knowing what the military ambitions of the Transvaal are, and what that state would certainly do the moment Britain became engaged in a foreign war, could we, as members of the British Empire, tamely watch our sister colonies of Natal, the Cape, Rhodesia, etc., overrun and reduced to the slavery which would be their lot under Boer rule? If we did our own turn would come, and the Empire would be dismembered limb by limb.

To descend to a lower plane, Canada has a strong commercial reason for seeing British ideas prevail in South Africa. Our manufacturers are now beginning to seek foreign markets, and under the rational rule of Great Britain, a large trade development awaits Canada there. South Africa is the counterpart of Canada. We consume large quantities of goods she has to sell, such as merino wool, hides, and sub-tropical products, while she imports largely of manufactured goods, such as furniture, boots and shoes, textile fabrics, stoves, hardware, machinery, and other manufactures, which we wish to sell. South Africa is essentially a non-manufacturing country, and the United States, having studied the conditions there through its consular agents, has already built up a big and rapidly-increasing trade. Not many years ago the exports of the United States to all Africa amounted to but a few thousand dollars annually. In 1898, the shipment of United States goods to British and Portuguese South Africa alone, amounted to over $16,000,000, the increase over 1897 being a growth of over $1,480,000, or at the rate of nine per cent. These exports consisted of foodstuffs, books, cotton goods, leather goods, and a long list of manufactured articles, such as agricultural implements, bicycles, hardware, sewing machines, typewriters, carriages, furniture, canned goods, lumber, etc. In almost every one of these lines, Canada is able to compete with the United States. Here and there, it is true, some Canadian manufacturer has already entered the market, but, as a rule, the Canadian exporter is still asleep to the possibilities of that land. It is time we woke up to this, for the trade connections ought to be as close as the political fraternity, and the sending of the Canadian regiment will tend to strengthen the bonds, both in a commercial and political sense. Further reference to the trade of South Africa will be found in the section of "miscellaneous facts."

As for our duty to Great Britain, as citizens of Canada, when we reflect that in the past twenty years the Mother Country has spent over $55,000,000, according to J. Castell Hopkins, on the defences of Canada, we owe it to our own self-respect to see that at least some of this is repaid. As citizens of the Empire, does it not seem a duty to defend it when any vital part of that Empire is threatened?

What will be the outcome of the war? In all probability the union of the present colonies and states in a confederation, in principle like that of Canada, but differing in details, to accord with the varying conditions. When the British and Dutch have got together, after the present conflict, they will see, by a study of their past history, that the policy of mutual hate, distrust and intolerance, is a policy that must mark their land with ruin; but the policy of good-will among the white races will make South Africa what its climate and latent resources fit it to become—one of the most delightful in the world. This much is certain, that in the settlement to be made, the British Government will not revisit upon the Boers the injustice under which the Uitlander population has groaned for the past eighteen years, but will see that there shall be absolute equality of rights among the white races, and fair, just treatment of black and white from the Cape to the confines of British Central Africa.

MISCELLANEOUS FACTS RELATING TO SOUTH AFRICA.

The following miscellaneous information, relating to South Africa, will be of interest to the reader in studying the present conditions:

Mr. Garrett, a well-informed Capetown journalist, estimates the white population as follows, distinguishing the Dutch from the British in the same table:

	Dutch.	British.	Total White Population
Cape Colony and Bechuanaland	265,200	194,800	460,000
Basutoland	300	350	650
Orange Free State	78,100	15,600	93,700
Natal and Zululand	6,500	45,500	52,000
Transvaal	80,000	123,650	203,650
Rhodesia	1,500	8,500	10,000
Total	431,600	388,400	820,000

John Noble's "Handbook of the Cape and South Africa for 1893," gave the area and white and colored population of South Africa, as follows:

	Area sq. miles.	White population.	Colored population
Cape	221,311	376,987	1,150,237
Natal	20,461	42,759	512,817
Pondoland	3,869	100	200,000
Zululand	8,900	548	145,330
Amatongaland	5,300	.....	80,000
Basutoland	10,293	578	218,324
British Bechuanaland	60,777	5,284	55,122
Bechuanaland Protectorate	386,200	500	110,000
Brit. Mashonaland (Rhodesia)	150,000	2,500	250,000
Orange Free State	48,326	77,716	129,787
Transvaal	113,642	160,000*	649,560
Swaziland	8,000	500	63,000
	1,037,070	667,472	3,564,183

For the trade tables which follow, the writer is indebted to the "British and South African Export Gazette," an ably conducted paper, published in London in the interest of South African commerce.

The aggregate trade, both imports and exports, of South Africa in the past five years, amounted to about £220,000,000 sterling. This includes an approximate calculation of the 1898 figures. Of this total, the imports of oversea goods represented a sum equal to £108,855,340, and these were imported into South Africa through its several ports in the following proportions:

Ports of Cape Colony	£ 77,623,922
Ports of Natal	21,348,222
Ports of Delagoa Bay	9,883,196
Quinquennial total	£108,855,340

Of this handsome total Great Britain's share in the export of

* A white population of 300,000 was generally credited to the Transvaal up to the time of the recent troubles, of which from 70,000 to 90,000 was accorded to Johannesburg.

purely British and Irish goods and manufactures was represented by £62,801,203, and that of the British possessions by £5,799,783, or together £68,600,986, the balance, in round numbers, of £31,000,000, being the contribution of all other countries. The progressive yearly accretions by which these totals have been reached are shown by the following tabulations:

GREAT BRITAIN'S QUINQUENNIAL SHARE OF SOUTH AFRICAN TRADE.

1894	£ 8,766,828
1895	11,167,995
1896	14,798,430
1897	14,648,162
1898 (approximate)	13,419,848
Quinquennial total	£62,801,223

QUINQUENNIAL SHARE OF BRITISH POSSESSIONS.

1894	£ 605,561
1895	997,558
1896	1,261,504
1897	1,235,160
1898 (approximate)	1,700,000
Quinquennial total	£5,799,783

QUINQUENNIAL SHARE OF FIVE PRINCIPAL FOREIGN COUNTRIES.

1894	£ 1,414,565
1895	2,188,247
1896	4,432,428
1897	4,503,366
1898 (approximate)	5,500,000
Quinquennial total	£18,028,606

The relatively large proportion of a little over one-third of the total trade of South Africa which falls to foreign countries is explained by the fact of the heavy imports in recent years of grain, foodstuffs, and live and dead meat, necessitated by the drought and rinderpest and the devastations of locusts, which have afflicted her agricultural and herding industries for several years past. The extent of this huge oversea buying of British and foreign goods would manifestly be impossible unless South Africa possessed purchasing "media" for their acquisition. These are furnished her by her rich and practically inexhaustible stores of native gold, diamonds and other minerals, wool and other raw products.

The imports into the Cape Colony amounted approximately to £16,845,955 at the end of 1898, having made an average advance of over £5,000,000 since 1894—in fact, if compared with the figures for 1897, an actual advance of £7,000,000. In the same quinquennium Natal's imports showed progress from £2,316,596 to approximately £5,127,887, or an enhancement at the handsome rate of 121 per cent. This was even more than the relative progress of either the South African Republic or the Cape Colony, the latter gaining only 49 per cent., and the former 61 per cent. on the earliest year. It is noteworthy that the former's total—£54,332,227—is nearly exactly half of the aggregate of South African imports, and shows the overweighting factor the Republic forms in the commercial expansion of the sub-continent. The appended comparison of the percentages of progress of the trade of the past quinquennium of India, Canada, Australia and the colonies of the Cape Colony, Natal, and Rhodesia, and the South African Republic is given by The Gazette:

QUINQUENNIAL PROGRESS OF OTHER BRITISH POSSESSIONS AS COMPARED WITH SOUTH AFRICA.

	Rate of Quinquennial Progress.
South Africa—	
Natal	121.0 per cent.
Rhodesia	94.0 per cent.
South African Republic	61.0 per cent.
Cape Colony	49.0 per cent.
Other British Possessions—	
Australia, Tasmania, New Zealand, Fiji	40.0 per cent.
Dominion of Canada	8.0 per cent.
India (including Burmah, Straits Settlements, and Ceylon)	per cent. 0.2 per cent.
Average for South Africa	71.0 per cent.
Average for other British Possessions	16.0 per cent.

The ratio of progress in imports alone of South Africa compared with those of our chief colonies and dependencies—India, Australia and Canada—is not less instructive. As against a total for South Africa of £108,000,000, Canada has only an import volume of £26,000,000* to show, and Australia of £97,000,000; while the vast continent of India only surpasses South Africa by her £157,000,000 of imports in the five years.

W. Bleloch, in a paper recently read before the Geological Society of South Africa, confirms the theory first propounded by Dr. F. G. Becker, of the United States Geological Survey, that the Witwatersrand gold-bearing rocks are due to the formation of a series of sub-shore deposits banked up by ocean currents and waves against a sloping shore. At first sight this is only of interest to geologists and mining experts. If, however, it should be confirmed by subsequent tests, it will have far-reaching effects upon the Rand gold mining industry, and equally upon commerce. For instance, payable reefs should exist under the major portion of Johannesburg itself, whilst the Main Reef series would be found underlying the overlaps of more recent beds from Vlakfontein to Venterspost, thereby opening up an enormous area of country for mining purposes, and extending the life of the Rand as a gold producing centre far beyond the 100 or more years already predicted for it by the world's leading experts. It is estimated by Frederick H. Hatch, in the "Engineering Magazine," of New York, that within the next five years the number of stamps in the gold mining district of the Witwatersrand will be increased to over 12,000. The average duty of a stamp here is 1,500 tons per year, or a total of 18,000,000 tons, which, at the present grade of 9 to 10 dwts. of fine gold, or 40s. per ton, would give £36,000,000 sterling per annum.

The coal deposits of the Transvaal are estimated at 235,000,000,000 tons, or 37,000,000,000 tons over those of the coal beds of Great Britain.

Since the first edition of this pamphlet was issued, the writer has received a copy of a New York publication, giving a summary history of the Transvaal. The compiler of this history, which is evidently derived from Boer sources, says that "in 1881 the suffrage in the Transvaal was open to anyone who had lived in the republic two years; but when the British part of the population, which had been voting and holding offices, refused to take part in the defensive war against the Kafirs, on the plea that they were British subjects, and so could not be drafted into service, the Boers, who then far out-numbered the foreigners, passed a law making a renunciation of all other sovereigns a pre-requisite to citizenship in the Transvaal."

This statement of the case, which contains as many inaccuracies as could possibly be crowded into a single sentence, is another illustration of the way in which the Boer authorities have tried to make black appear white to the uninformed outside world. Without going into all the misconceptions in this statement, it will be sufficient to point out that when the Boers undertook their most unjust and unprovoked war against the Swazis, an independent tribe dwelling beyond the Transvaal boundary, they proceeded to commander British sub-

*NOTE.—The author has to thank Mr. George Hague, General Manager of the Merchants Bank of Canada, for calling attention to a mistake in the above figures by which the *S. A. Gazette* has done a great injustice. Mr Hague says, "In that admirable little pamphlet—(I hope you have sold thousands of them), there is a curious mistake about the imports of Canada. These imports are given as £26,000,000 for five years, whereas the actual imports for one year only—the last of the quinquennial period—amounts to that sum. The total for the five years is over $520,000,000, or £107,000,000, and the rate of increase is not 8 per cent. but 37 per cent. The Transvaal imports include the prodigious sums spent in cannon, rifles and other war material.

jects and other Outlanders. The British subjects in particular stoutly objected; "No," they said, "as long as we are denied the rights of citizenship, we shall refuse to fight the battles of the Transvaal. Give us the burgher's rights, and we shall gladly fulfil the burgher's duties; but while we are denied the franchise, we are *not going* out to fight under the status of galley-slaves." This was the only attitude that a self-respecting man could take, yet the Boer Government actually forced a number of British subjects to go to the front and serve without compensation, and the outrage would have been carried to greater lengths if the British Agent had not made an emphatic protest in the name of the Imperial Government. In the face of these facts, the Boer Government has tried to twist this question completely round and to make it appear that the franchise was afterwards refused because British subjects would not fight for the Republic; whereas, it was just because they were denied the burgher rights that they declined to do military service, especially in a war undertaken to despoil an unoffending tribe.

While most of the habitable areas of North and Central Africa are not favorable to Anglo-Saxon colonization, but are only capable of government on the plan of British government in India and Egypt, almost every region of South Africa possesses a climate in which European settlers thrive, as the experience of British and Dutch for over a hundred years has amply shown. There are several varieties of climate in South Africa, but generally speaking, their nearest parallel on the American continent is to be found in Northern and Southern California and Colorado. Along the coast of Natal and the eastern coast of the Cape we have all the sub-tropical products, such as bananas, pineapples, oranges, tea, coffee, cotton, etc., while in the midland regions of Natal and the Cape we find some of these products, with peaches, pears and many of the fruits and grains of the temperate zone; and again, on the plateaus and plains of Upper Natal, the elevated lands of the Cape, the Free State and the Transvaal, we find the fruits, vegetables and grains of England or Canada. Again, in the lowlands of the Transvaal and neighboring states we have a warmer climate, and some tropical products, like the middle and lower districts of the Cape and Natal. Being in the southern hemisphere South Africa has its summer when Canada has its winter, and instead of spending Christmas round the fireside the Natalians and Cape Colonists celebrate that season by picnics and outdoor festivities. Although two or three crops of vegetables and of some kinds of grain can be raised in a year, and vegetation never ceases, except in prolonged droughts, there are properly only two seasons in most parts of South Africa—the rainy and the dry

—The report of the annual meeting of the Association of Ontario Land Surveyors, containing portraits and biographical sketches of the new officers, has been crowded out of the present issue, but will appear in May.

—The numerous manufacturers, especially those in the machinery line, who have for years had increasing cause of dissatisfaction with the drift of things at the Toronto Exhibition, have all reason to thank J. O. Thorn, of the Metallic Roofing Co., for taking up their complaints and fighting for their interests against that clique in the board of directors who are responsible for the moral degeneration of Canada's great show. Many individual complaints have been made to the "Canadian Engineer" that the circus and peanut departments have received the lion's share of attention, while the reasonable requirements of the manufacturer have been ignored. A large number of foreigners will come over to Toronto from the Pan-American Exhibition at Buffalo next year, and there is yet time to make the reforms needed for a really good exhibition in 1901. If those of the exhibition directorate who really care for the future of this institution could see the stacks of letters Mr. Thorn has received, they would cease their silly attempts to laugh down these complaints, and would come down from their kopjes at once. We do not suppose there is any general desire to depose Mr. Hill. He is an energetic and capable exhibition man, and with a different set of men to work with would no doubt make the reforms needed to redeem the character of the show. As an example of the feeling of manufacturers in this matter we understand that nearly all the makers of agricultural implements have agreed to withdraw from the exhibition altogether, though we suppose they would reconsider this step if the directors made a "right-about face."

THE USE OF BOILER COMPOUNDS.*

BY ALBERT A. CARY.

(Concluded from last issue).

Next, turning to the sulphates of lime and magnesia, we find them very soluble, dissolving in water direct, without requiring the presence of carbonic acid or any other foreign agent. The amount of sulphate of lime which can be dissolved in one United States gallon of water at different temperatures may be appreciated by examining the following table:

At 32° Fahr. 120 grains per gallon.
At 95° Fahr. 148 grains per gallon.
At 212° Fahr. 127 grains per gallon.
At 250° Fahr. 9 grains per gallon.
At from 260° to 302° Fahr. it is practically insoluble.

This latter temperature (302 degrees) corresponds to 55 pounds gauge pressure, and, therefore, when water is thoroughly boiled at this temperature, practically all of the sulphates will be precipitated. The crystals of sulphate of lime will be found to be long and needle-like, and also very heavy and possessing cement-like qualities, so they fall rapidly, and, mixing with the precipitated carbonates, they bind them together into a hard, resisting mass, difficult to remove with even hammer and chisel, if they form a considerable proportion of the scale. It is here where the active agent in the compound is supposed to take effect, and by referring to the reaction given above—in the formulae (a) and (b)—when the carbonate of soda is used, it will be seen that the sulphates of lime and magnesia are changed into carbonates, which are precipitated and form a scale varying from a more or less porous, friable crust to a "mush" or mud. The sulphate of soda which is also formed by this reaction is extremely soluble, remaining in solution at nearly all boiler temperatures and forming no scale, unless allowed to concentrate, and this is prevented by "blowing off" occasionally.

The tannin matters, referred to above, are obtained from various vegetable sources containing tannic acid, such as certain kinds of sumac, gallnuts, catechu (or cutch) bark, etc. Tannin is generally combined with soda to form the tannate of soda for use with boiler waters to keep the deposit soft or in suspension. Its action is supposed to be as follows: The tannate of soda decomposes the carbonates of lime and magnesia as they enter the boiler, and tannates of lime and magnesia are precipitated in a light, flocculent, amorphous form and are long kept in suspension by the circulating currents of water, until they finally are deposited in a loose, mushy mass in that part of the boiler where the circulating currents are the weakest, or possibly in the mud drum. When the above reaction takes place the carbonate of soda is formed, which reacts with any sulphates that may be present, as has already been described. The use of tannic acid in the boiler cannot be recommended unreservedly, as it will attack the iron as well as the carbonates (although, of

*Reprinted from the American Machinist.

course, more slowly), and anything that will corrode the boiler itself certainly cannot be desirable. To test this, anyone can obtain a few cents' worth of tannic acid from the druggist, and by dissolving the crystals in a glass of water and adding some iron filings, a very fair quality of ink can be made, due to the action of this acid on the iron.

In practice, the reaction of caustic soda ($Na_2O_2H_2$) with the sulphates seems to be more active than when the carbonate of soda is used, the probable reaction being as shown thus:

Sulphate of Lime	and	Carbonic Acid	and	Caustic Soda
$CaSO_4$	+	CO_2	+	$2NaOH=$
		form		
Caustic Lime	and	Carbonic Acid	and	Sulphate of Soda
CaH_2O_2	+	CO_2	+	Na_2SO_4

The carbonic acid used in this formula results from the precipitation of the mono carbonates from the bi carbonates, as has been explained.

The secondary reaction from the result just arrived at is as follows:

Caustic Lime	and	Carbonic Acid
CaH_2O_2	+	$CO_2=$
	form	
Carbonate of Lime	and	Water
$CaOCO_2$	+	H_2O

The use of caustic soda may be considered less desirable than the use of the carbonate of soda for several reasons. In the first place this present in excess will cause violent foaming in the boiler, and with this foam often the light precipitated matter in the boiler will be carried along steam pipes into valve seats, gauge glasses, etc. It will also attack and cause corrosion of the brass fittings, and it is also dangerous to handle, owing to its caustic qualities, burning the flesh painfully wherever it comes in contact. An excess of carbonate of soda may also cause foaming in the boiler, but not as violent as when caustic soda is used.

Sal ammoniac (i.e. ammonium chloride) (NH_4HCl) is most undesirable for use in a boiler, due to the liberation of hydrochloric acid (HCl) following its introduction into the boiler. This acid leaves the boiler in a vaporous form, with the steam, corroding boiler, piping and nearly everything it comes in contact with. There are other "compounds" falling under this classification, of known chemical composition, which are more satisfactory than those named above, such as bi-sodium phosphate and tri-sodium phosphate, the latter being obtainable in both a hydrous and anhydrous state. The latter is less bulky and its reaction with the sulphate of lime is shown by the following formula.

2 Parts		3 Parts
Tri-Sodium Phosphate	and	Sulphate of Lime
$2Na_3PO_4$	+	$3CaSO_4=$
	form	
		3 Parts
Phosphate of Lime	and	Sulphate of Soda
$Ca_3(PO_4)_2$	+	$3Na_2SO_4$

The phosphate of lime, after this reaction, falls, forming a slushy mud, making at the most a very weak crust, while the sulphate of soda remains in solution, as previously described. The fluoride of sodium is another "compound" of known composition, which has also proved satisfactory, especially when much sulphate of magnesia is present; its reaction with the sulphate of lime being as follows:

2 Parts of		
Fluoride of Sodium	and	Sulphate of Lime
$2(NaF)$	+	$CaSO_4=$
	form	
Fluoride of Lime	and	Sulphate of Soda
CaF_2	+	Na_2SO_4

The fluoride of lime precipitated in the boiler behaves much like the phosphate of lime just described, while the remaining sulphate of soda is found in solution, as stated above.

Our second division of compounds includes a class of materials which are gradually falling into disuse, due to their proved undesirability. They thicken and foul the water in the boiler and coat its surfaces with non conducting material, and occasionally the precipitated scale making matter, along with this class of compound, will obstruct the passage of heat through the boiler plates, so as to cause bagging and burning. In this class we find slippery elm, ground bones, horns and animals' hoofs, potatoes, dextrine, and starch, animal fats and animal or vegetable oils. As rapidly as the scale-forming crystals are precipitated from the feed water, they fall into this sticky cooking fluid and become coated with its filth, and they finally fall to the place of deposit, where they remain in a mushy, separated state until the organic matter chances to be burned out, when they will form into a loose, friable scale.

A surface blow-off or skimming device is most essential to reduce the evil, when this class of compound is used, and the bottom blow-off cock should also be opened very frequently.

We now come to our last division of this subject. The principal substances used for this third class of compounds are petroleum and kerosene. Petroleum oil has much more of the enveloping quality described under the last (or third) classification than the kerosene. Besides producing this effect on the scale matter, both have an active rotting effect on the scale already formed, the kerosene in this case being superior to the petroleum. Crude oil should never be used, but a carefully refined oil, which has been deprived of its tar or wax, should be selected for this purpose, as these cause the formation of a tough, impervious scale productive of bagged sheets and collapsed flues. Petroleum or kerosene should be fed to the boiler with the feed water, drop by drop, through a sight-feed apparatus similar to those used to feed oil to the cylinders of engines. There are several forms of this apparatus on the market. Under no consideration should large amounts of these oils be fed to a boiler at one time, as it must be remembered that the more volatile portion of the petroleum will be quickly distilled off in the hot boiler, leaving the least efficient portion behind, while the more volatile kerosene will be vaporized very quickly, before it has time to thoroughly mix with the water.

Where hard scale has formed in a boiler, it is most effectually treated by giving it a coat of petroleum or kerosene, to partially dissolve or rot it. These may be applied with a brush or squirted on, but an easier method of application is to first fill the boiler with water above the line of scale deposit and then pour the oil on the surface of this water, and let the water gradually run out of the bottom of the boiler, thus leaving the oil behind clinging to the whole interior surface. As stated above, kerosene is the most effective in destroying the tenacity or coherence of this deposited scale, but this method of using either oil is not without attending danger, on account of the explosiveness of the vapor given off, so great care must be taken to have no lights in the vicinity of the boiler under such treatment, as men have been seriously injured by this lack of prudence. The treatment of feed waters inside of the boiler has been a practice of many years' standing, but in the light of recent progress is not to be commended. A boiler certainly has all that it can reasonably be expected to do when it is generating steam, without being called upon to perform the functions of a chemical laboratory. Everyone knows that when a new boiler is started it "steams lightly" and is most economical in its use of fuel, but generally after it has been in service for some time harder firing is necessary and larger fuel bills appear. Following this reasoning, I would ask if it is not far more sensible to keep the boiler constantly up to its original state of efficiency by preventing the scaling and corrosive agents from entering it, rather than accepting such evils and trying to correct them after they have occurred?

The external method of treating feed water, chemically or mechanically, is being adopted by many progressive plants in this country; and in this, I am sorry to say, Americans are far behind the English, French, Germans, Belgians and Austrians, in whose countries the external treatment has been largely and most successfully practised for many years. There are, of course, plants where the internal treatment of feed water is an enforced necessity, owing to surrounding conditions or lack of funds necessary to install apparatus for external treatment, but as such apparatus has invariably proved to be an excellent investment, it should receive careful consideration from all steam users.

Before closing I feel that I must add something in the way of warning to the users of boiler compounds. Owing to the unfortunate fact that boiler users have, as a general thing, been too busy to give this important matter of scale and corrosion a proper amount of study, they have become the victims of

more imposters than exist in almost any other branch of trade. The boiler quack comes along with his remarkable boiler compound, fluid or special apparatus, and without the slightest knowledge of the character of the impurities held in your boiler feed water, he offers his panacea with a long list of letters of recommendation, written often by the heads of concerns who are far better acquainted with the financial end of their business than with the steam plant equipment. These gentlemen generally depend upon what their engineer or other employees tell them. The writer knows of not a few cases where the unscrupulous vendors of certain compounds share their profits with these engineers, firemen or other influential employees, which they can well afford to do, as the stuff they sell seldom costs a fifth of what they get for it. These unscrupulous people, their methods and their wares have been "shown up" from time to time in the technical and trade papers, and they have not escaped the well-directed fire of the Hartford Steam Boiler Inspection and Insurance Company.†

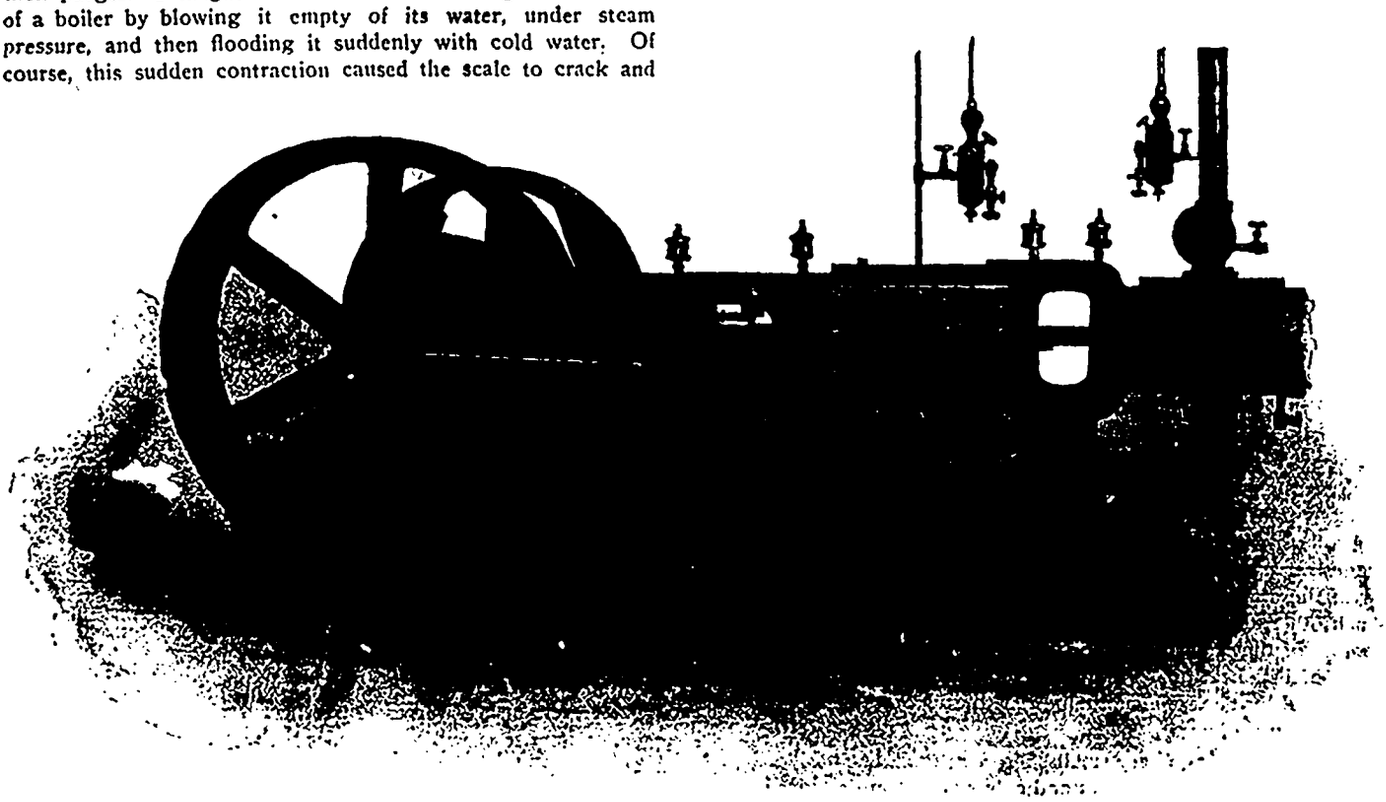
They are often very tricky manipulators, able to give an apparent exhibition of the wonderful disincrusting power of their purges. I caught one at one time cracking the scale out of a boiler by blowing it empty of its water, under steam pressure, and then flooding it suddenly with cold water. Of course, this sudden contraction caused the scale to crack and fall off, but a boiler maker had a nice little job afterwards in making the boiler tight. In another case I found that one of these manipulators had about ruined a boiler by first giving it a dose of muriatic acid before introducing his "compound." These are but two examples of the many tricks resorted to.

The best advice I can offer on this subject is: Never use any boiler compound, fluid, powder or whatever else it may be called, unless you know positively just what it is composed of and how it will affect the impurities in your boiler water and the boiler itself. Many of these quacks pretend to have made a chemical analysis of the water to be treated. This is frequently a mere farce, as the same old compound is trotted out on all occasions. Some submit to their proposed victim what purports to be an analysis, of their feed water. Many a time a subsequent bon-fide analysis, made by competent chemists, has proved to me the absolute worthlessness of these first supposed analyses. In the treatment of boiler waters always start with a careful analysis of the water, made by a competent chemist experienced in this line of work. Next, let an expert in this line of known reputation, and one who is not in any way interested in any method of treatment, suggest the best method of treatment; or should you think of using any "compound," fluid or powder that has been offered for treatment of your boiler water, let this chemist analyze it. If you are dealing with straightforward people, they will tell you the exact composition of their material, which the chemist can verify easily, after which the chemist or expert is prepared to advise you properly.

†See "The Locomotive," Vol. V, page 59, and Vol. XV, page 90.

THE M'EWEN AUTOMATIC ENGINE.

The first McEwen automatic engine was placed on the market in the spring of 1891, and during the eight years which have passed since then, hundreds of these engines have been manufactured and put in operation. They can now be found in operation in all parts of the United States and throughout the Dominion of Canada and for almost every conceivable kind of service. Its makers claim that no engine ever placed on the market has been more uniformly successful in operation, or has better withstood the test of time. While the design of this engine is practically the same to-day as when it was first placed on the market, improvements have been made on the minor details which have kept it fully abreast of the times. Originally designed particularly for simplicity and strength these very important qualities have been carefully kept in view in making later improvements. The character of the workmanship has been steadily improved, and the McEwen engine, as built by the Waterous Engine Works Co., at the present time, is as carefully and thoroughly constructed as any first-class, high-speed engine built anywhere in America. The engine is claimed to have fewer parts than any other engine of this type built anywhere in the world, and for qualities of strength, durability, economy and smoothness of running, it is unexcelled. On the one point of regulation the McEwen engine from the start established a standard, which, in spite of the many imitations by competitors, is said to never have been reached by any other engine in the world. All parts of these engines are made interchangeable, every piece being made to gauge, so that, if for any reason any part needs renewing, it can be supplied from stock, with the assurance that it will fit. All bearing surfaces are unusually large, and are carefully scraped and fitted to surface plates. Every piece is required to pass through the inspector's hands after every operation before passing to the next workman. Under this system it rarely happens that any defective work reaches the testing block, and here, as during the progress of the work, the inspection is rigid. Every engine is carefully and systematically tested before shipment, under conditions as nearly as possible approaching its future working conditions. The valves are set and carefully adjusted by means



THE M'EWEN AUTOMATIC ENGINE.

of the indicator and the regulation by means of an accurate tachometer. The bearings are all carefully adjusted and the engines operated for at least a whole day under loads varying from zero to one hundred per cent. overload.

The McEwen engine is a high-speed engine designed especially for extremely close governing under the severest and most rapid fluctuations of load—such as are met with in the driving of electric generators for electric lighting, electric railway service, mine haulage, electric crane work, etc. The accompanying illustration shows a compound McEwen engine, built by the Waterous Engine Works Co., Brantford, Ont.

ROLLER AND BALL BEARINGS.*

BY J. B. DETWILER, BRANTFORD, ONT.

The subject is a very extensive one and is the cause of a great deal of correspondence in our leading mechanical and scientific journals. No department of mechanical design or construction has received more careful consideration than that of roller and ball bearings. Very rapid strides have been made recently in the perfecting of roller bearings, making their employment more common. We read of roller bearings having been used 25 years ago, but with little success, owing chiefly to the way they were constructed, and it is only within the last few years that they have been so constructed as to make them practicable. For many years the only successful application of rolling motion to bearings was the ball bearing so universally adopted in bicycles, and although these bearings have been found most satisfactory when subjected to light loads, all attempts to apply them to heavy loads have so far resulted in failure, arising chiefly from the balls indenting the races upon which they run. As soon as this takes place, the balls begin to lose their friction reducing properties. If a semi-circular trough be constructed which accurately fits a ball and one end of the trough be raised, it will be found that the ball will move by sliding and not by rolling; thus is indentation carried to the extreme. Another defect in the ball bearing is that the balls are allowed to touch each other, and as the touching point of any two balls are revolving in opposite directions, there must be a certain amount of friction. The same error in the construction of roller bearings was made until cages were introduced. These cages serve the double purpose of keeping the rolls in alignment with the axis of the shaft and of keeping them separated from each other, doing away with the friction caused by the touching points of the rolls running in the opposite directions as is the case of ball bearings. Judging from the various size of balls used in bearings, one might be led to suppose that ball bearings knew no law.

A few years ago very small balls were used, but they proved very unsatisfactory, for cones and cups were soon destroyed and had to be renewed. The same error was made in roller bearings, and when the cages were introduced, and less rolls used in the same size bearing, larger rolls had to be used to bear the same load. Those who advocate the use of small balls, and the same argument holds good with rolls, argue that as the balls bear on a point, and as more small balls can be placed in a bearing of a given size than large ones, there are more points of contact, and the result, a more durable bearing. The error in this argument is, in assuming that a ball or a roller bears on a point, which is not the case, excepting when working under a very light load, but when the bearing is loaded, the rollers or balls are slightly compressed and the very slightest compression causes the point of contact to enlarge. If a large roller or ball is compressed, to the same extent, the point of contact will be greater than in the case of the small roller or ball, because the larger the sphere the flatter the curve. Tests have been made to prove beyond doubt that the carrying capacity of rollers and balls is as the squares of their diameters, in other words one ½-inch ball or roller will carry as heavy a load as four ¼-inch ones. The writer has made tests with loading ¼-inch rollers in bearings until the weight was sufficient to elongate the rolls by rolling them out, and thus reducing the size, and in a very short time rendering the bearing useless.

The question is very often asked, how much do roller bearings reduce friction, or how much less power does it require to run a shaft fitted with roller bearings than one fitted with ordinary bearings. While there is very little reliable information on this point, experiments have shown that friction increased little if any, with the increase of pressure, and that the friction increased considerably less than the proportion of the square root of the speed. In tests made by Geo. F. Symons it was shown with bearings 2½-inch in diameter that the friction developed was from .0025 to .005; these figures were obtained under comparatively light loads. In comparing ball bearings with babbitt bearings, it was found that under 200 lbs. pressure to the square inch, and 800 revolutions per minute, babbitt bearings 2½-inch in diameter lubricated with 20 drops of oil per minute, and having a ½-inch lateral play, heated badly. Under the same pressure ball bearings were running at 2,600 revolutions per minute, or more than three times as fast, without signs of heating. The American Machinist of October 17th, 1895, gives the following: "The first was in the shop of Brown & Sharp, where a set of rolls used for rolling sheet steel, cold, were first operated for some time with ordinary bearings, previous to the change, a 6-inch belt running over a 24-inch pulley on a machine had been found inadequate to drive it, and a 4-inch belt had been placed over it. The two belts arranged in this way had driven the machine, but it had been found impossible to run more than a few hours at a time on account of the heated bearings. After putting in the roller bearings it was found that a 1-inch belt would drive the machine when doing the same work, and we recently saw a 2-inch belt driving the machine, and were informed that it was regularly used, running on the same pulley. It had been found unnecessary to stop on account of hot bearings, and the speed had been increased 25 per cent." There is here shown such an enormous advantage in the use of rollers, as to make the plain statement of the facts seem like a fairy tale, but we can vouch for its accuracy in every particular. It shows that a very great advantage may be gained by roller bearings in some cases, and also shows that a very large proportion of the total driving power applied to rolls when used on such work is consumed in overcoming frictional resistance in the machine. The pressure required to slightly reduce the thickness of a strip of hard tool steel 6 in. or 8 in. wide is, of course, very great, and the actual foot pounds of energy required to do it, must be small. The consequence is that the great pressure upon the bearing causes corresponding frictional resistance in them which consumes practically about all the power applied to the machine, and this gives to the roller bearings a chance to make perhaps the very best possible showing. In a machine where the actual work to be done required more power, and the frictional resistance less, proportionately, the showing might be expected to be very different. Such a case, and one more nearly representing the average condition under which comparisons will be made, is to be seen at the establishment of the Gilbert Clock Co., at Winstead, Conn., where there are 600 feet of line shafting, having 104 bearings of the usual type, lined with babbitt metal, and these bearings were replaced by roller bearings. The shafting is driven by a 40 h.p. water wheel and, according to the brake or dynamometer tests made 25.02 h.p. of this was absorbed by the frictional resistance of the line shaft when using the old bearings as against 18 h.p. with the roller bearings, thus saving 7.02 h.p. or 17.55 per cent. of the whole power developed by the wheel, and 28 per cent. of the original friction of the shaft. Fourteen Mossburg roller bearings were on June 29th, 1897, applied to a 3-inch shaft, 80 feet long, running 200 revolutions per minute, and subjected to careful and repeated tests which showed a saving of more than 50 per cent. in power required to overcome the friction of the shaft running in babbited bearings. The shaft had been thoroughly tested when running in the ordinary babbited boxes, and found to consume by friction, when running at full speed, 6.21 h.p., and to come to a standstill in two minutes after being disconnected from the source of power. Similar tests were made after the shaft had been fitted with roller bearings; the power required to overcome the friction being found to be only 3.01 h.p. and the shaft revolved ten minutes after being disconnected from the source of power. The bearings have been in use six months, running 22 hours every day, and are in first-class condition, showing little wear, and giving very little trouble. From an article taken from The Canadian Engineer, on roller bearings, by W. Bayley Marshall, C.E., we learn the result of the following test A passenger train of six carriages fitted with roller bearings throughout, has been running for

*A paper read before the Mechanical Superintendents' Association.

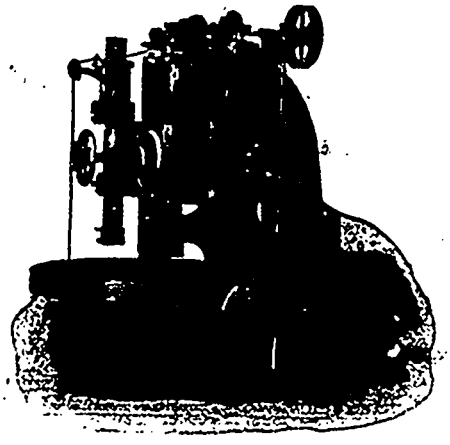
two years between Brighton and Kemptown with a total mileage of 70,000, and has shown a saving of from 12½ to 15 per cent. in the consumption of fuel, which saving has been obtained under most disadvantageous circumstances, inasmuch as the engine has to be kept in steam for about 16 hours per diem, whilst its actual running time is under seven hours. The tramway car, fitted with ordinary bearings, and weighing 2 ton, 15 cwt., was let loose from a point 56 feet up an incline with 1 foot 6¼-inch rise; it ran down this incline, and 57 feet on the level line at foot of same, or a total distance of 113 feet, the force expended was therefore 6,160 pounds, falling through 1.521 feet or 9,364 ft. lbs., the average frictional resistance was 9,364 divided by 113, or nearly 83 pounds, equal to 30.5 pounds per ton. A similar car fitted with roller bearings being let loose from the same point ran the full length of the level line available, namely 320 feet, and had not then quite come to rest. The total distance traversed being 376 feet The force expended was about 9,364 feet pounds, average frictional resistance was 9,364 divided by 376, equals 24.9 pounds, or about 9 pounds per ton of load, a saving of 72 per cent. Relative starting effort of a tram-car on a gradient of 1 in 20; ordinary bearings, 100; roller bearings, 77; saving 23 per cent. on a gradient of 1 in 80; ordinary bearings, 100; roller bearings, 50; saving 50 per cent. on a gradient of 1 in 140; ordinary bearings, 100; roller bearings, 39.6; saving 60.4; results which require no comment.

Perhaps one of the most interesting among the general application of these bearings is that of the big bell at St. Paul's Cathedral, London, Great Paul, which with its head stock and other moving parts weighs nearly 25 tons, and which gave considerable trouble when mounted on ordinary bearings. The following results are instructive. When mounted on ordinary bearings the bell came to rest after the swinging effort had been discontinued, within one minute, when on roller bearings 6 minutes 55 seconds, showing that the frictional resistance of the latter was only about 1-7 of the former; a result remarkably in accordance with the starting effort tests given under the head of tramways.

With reference to the question of heating, it is an interesting fact that there has not been a single case of a hot bearing in all the experience so far gained with roller bearings. Although it is somewhat early to predict what the cost of maintaining these bearings will be, the results so far show that if they are constructed of suitable material, it will be extremely low. It has been found that polished and pressed steel or cold rolled steel is the best material for the rollers, and the boxings lined with steel have been proven by the writer to be far superior to cast-iron boxings. In all cases, if at all convenient, the boxings should be of the oscillating type to ensure perfect alignment.

SLOW SPEED MOTORS DIRECT CONNECTED TO MACHINE TOOLS.

One of the most important applications of electricity now-a-days is its employment to distribute power from the prime mover to the various machines to be operated. In this way a

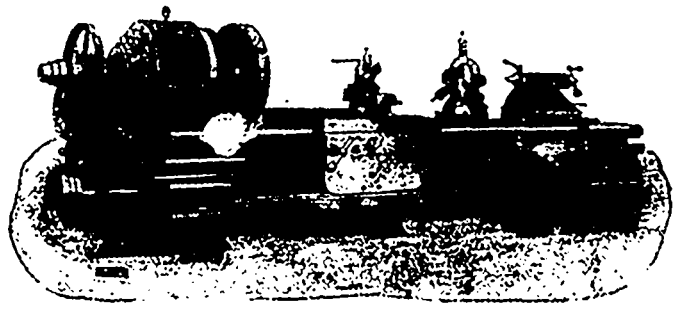


MOTOR DIRECT CONNECTED TO BORING MILL.

plant can be enlarged at small expense by the addition from time to time of motors as the machines required to be driven are installed. There are now many factories in this country which are equipped with slow speed motors directly attached to the driving shaft of all sizes and types of tools, the motors being part of the tools themselves. These motors do not at all interfere with the operations of the cranes now found in every well-appointed factory by preventing them from dropping the piece into the tool itself. Great advantage is claimed to exist in cases in which electric driving by direct connected motors are used on machines required to be driven intermittently.

Among the advantages of direct connected motors is that of cost, as the price of a motor depends as much on its speed as on its horse-power. For instance, there is quite a difference in the price of two motors of equal horse-power, one geared to the tool and running at say one thousand R.P.M., and the other mounted directly on the driving shaft of that tool and therefore running at the same speed, which may be as low as one hundred R.P.M. In the case of the geared motor its speed is too high to attach directly to the tool, and hence reducing gears have to be used, which is a somewhat uneconomical and noisy method of driving, besides requiring more floor space for the motor. The makers of slow speed motors urge that the cost of these gears or the speed-reducing devices must not be lost sight of in making the comparison.

Some of the advantages claimed to be obtained by the use of direct connected slow speed motors are: All expense for power ceases the instant the switch is opened and the motor stopped; the tool can be located anywhere irrespective of lines of shafting;



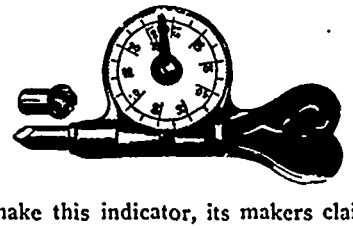
MOTOR DIRECT CONNECTED TO 26 IN. ENGINE LATHE.

a much higher rate of output for the tool and machinist is possible; these motors occupy the space and take the place of the driving pulley on the tool; they are compact, protected from injury, moisture and dust; tools thus equipped can generally be run after the engine has shut down by connecting through a switch to the mains of a local central station; special tools equipped with direct connected motors may be moved readily to the piece they are to do the work on; the exact amount of power used by each tool can be accurately measured at any time by the use of instruments indicating electric current; the life and usefulness of a motor is greatly increased by running it at a slow speed; the use of electric transmission permits the generating units to be large, and to be concentrated near the boilers at that point most convenient for handling the supply of fuel.

The Jones & Moore Electric Co., Toronto, is Canadian agent for the Bullock type of slow speed motors.

SPEED INDICATORS.

Woodman's and Hudson's patent improved speed indicators, manufactured by the R. Woodman Manufacturing and Supply Co., 63 Oliver street, Boston, Mass., U. S. A., are now attracting a great deal of notice. The attention of dealers and others using and selling machinery is invited to the qualities which

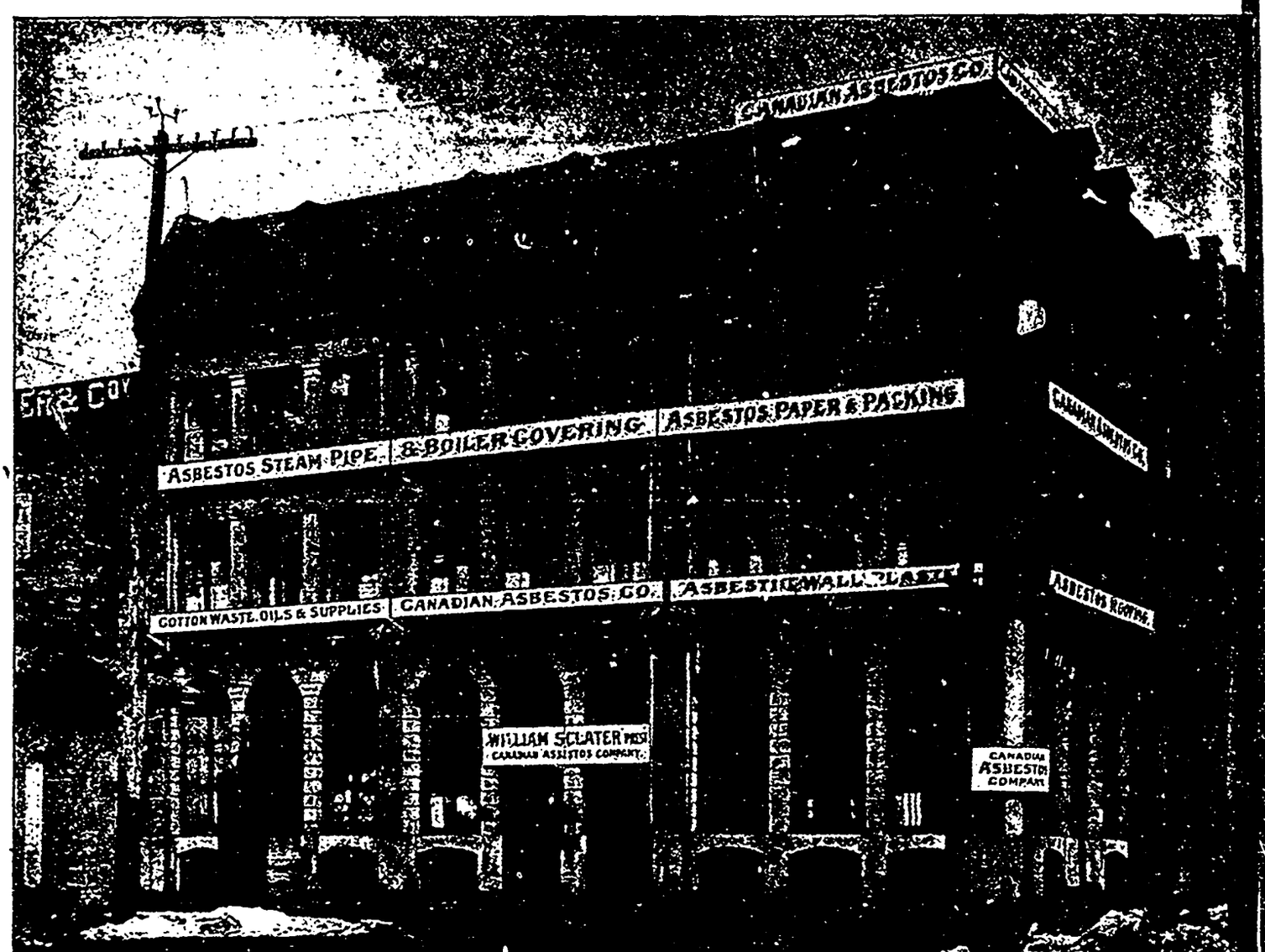


combine to make this indicator, its makers claim, preferable to any other in use. It is adapted to pointed or hollow centers and has a raised sight on dial so as to count by touch, which is of great importance, especially in dark places, as it is only necessary to look at your watch and count the number of revolutions the dial makes, which, with the fractions, will be the exact speed

of the machine. It is accurate, reliable, of convenient size, neatly finished, and suited to carry in the pocket. The spindle is made of best tool steel.

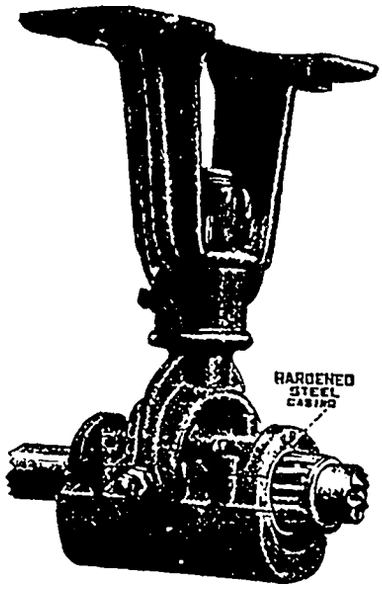
THE CANADIAN ASBESTOS COMPANY.

The Canadian Engineer was the first technical journal to call attention to the advantages of "Asbestic" (asbestos) as a wall plaster and a fire-proof material for interior work in buildings, and it is satisfactory to know that time has fully justified the predictions made for it when introduced about four years ago. We learn from the Canadian Asbestos Co., of Montreal, who are sole manufacturers of this material, and whose principal warehouse is here illustrated, that 10,000 tons of asbestic were sold last year, and the output is increasing year by year. The original factory at Danville, Que., which was destroyed by fire the other day, is being rebuilt on a large scale and will be equipped with new machinery. The company now have 350 local agents throughout Canada, while asbestic plaster is used in the most modern structures now being erected in the United States and Great Britain. It has been called for in the reconstruction of the western block of the Government buildings at Ottawa, the hospital in that city, the Donalda College, Stanley Flats, Karn Hall, Her Majesty's theatre and many large private buildings in Montreal and other cities, while among the new buildings now under construction in Montreal in which it is being used are the publishing houses of La Presse, The Montreal Star, S. Greenshields, Son & Co.'s wholesale dry-goods warehouse, Henry Morgan & Co.'s new wing, the St. Jean Baptiste church at Mile End, the municipal and school buildings of Westmount, etc. Among the shipments to distant points which the Canadian Asbestos Co. now have in hand are five carloads of asbestos and roofing paper to Dawson City, Yukon. Th catalogue just issued by the company gives illustrations of som of the large structures in Great Britain, Europe and the United States for which asbestic has been adopted, while some remarkable tests are recorded showing the fire-proof, cold-proof, sound proof and other qualities of asbestic. The same catalogue describes more or less in detail the other products of the company, such as asbestos cement for furnaces, retorts, stoves, etc., asbestos roofing and building papers, asbestos packings, lubricating compounds, mill board, asbestos cloth, fire-proof curtains, ropes, asbestine fire and waterproof paint, boiler coverings, and other engineers' and ship's supplies. The demand for goods of which asbestos is the raw material is so great that this company is about to open out another mine in the province of Quebec to which reference will be made in a later issue. As dealers in raw as well as manufactured asbestos the company supply the principal United States asbestos manufacturers. Our readers may remember a record shipment made by the company last autumn to one of these United States firms, the shipment consisting of 38,000 bags, or five train loads. This is the largest order for asbestos ever filled by any firm in the world. Wm. Sclater, whose jovial face is familiar to nearly every dealer in these lines of goods in Canada, and who may be called the pioneer in the trade, is president and managing director of the Canadian Asbestos Co.; B. Shepherd is vice-president and B. Marcuse, who was one of the founders of the original asbestic factory at Danville, is secretary-treasurer.



Ogdensburg, N.Y., capital is to put a large light draught boat on between that place and Montreal this season. Passengers and freight will be carried, and it is hoped the single boat will grow into a line.

BRANTFORD ADJUSTABLE DROP HANGER WITH PATENT ROLLER BEARINGS.



This illustration gives a good idea of the patent roller bearings, with outer steel casing, made by Goold, Shapley & Muir Co., Ltd., Brantford. Their advertisement in this issue will be of interest to manufacturers and others who wish to keep posted in mechanical ideas.

ACETYLENE FOR COOKING.

There has been a general impression that acetylene gas does not compare with coal gas or water gas for heating or cooking purposes, but it is the opinion of W. J. Stinson, of the Acetylene Manufacturing Co., of London, Ont, that this impression is because of the crude burners or stoves used in the experiments. In a letter to The Canadian Engineer Mr. Stinson supplies the following interesting information on this subject:

"I may say that I have been experimenting with acetylene, along the line of heating, during the past two years, and have acetylene gas stoves in operation with the most satisfactory results. We have not heretofore pushed this branch of our business to any extent, owing to the scarcity of carbide, but now that we may reasonably expect an abundant supply, we anticipate a very large demand for combination machines for both lighting and heating. The following tests as to cost are typical of a great many that we have made. We have tried to be as fair as possible, and to give no advantage to either acetylene or city gas. The results are what the general public is interested in, and we have tried to put these comparisons in practical form.

"An oven full of slow-baking fruit cakes, etc., was baked in a Detroit Jewel gas stove, in one hour and ten minutes, with a consumption of thirty-one (31) cubic feet of city gas, which at $1 per M. cost three and one-tenth (3 1-10) cents An exact duplicate of this oven of cakes was baked in one of our regular acetylene ovens, such as we supply to our customers, in one hour and thirty minutes, with a consumption of three and one sixth (3 1-6) cubic feet of acetylene gas, costing two and one-half (2½) cents, with carbide at four (4) cents per pound. A given quantity of water was raised from freezing to boiling point, in five minutes by the consumption of two (2) cubic feet of city gas, costing one-fifth (1·5) of a cent. The same quantity of water was raised from freezing to boiling point, in four and one-half (4½) minutes, by the consumption of one-third (⅓) of one cubic foot of acetylene, costing one-fourth (¼) of one cent. We have made dozens of similar tests, all giving practically the same results. The above estimates have been made on the basis of carbide costing four (4) cents per pound, and city gas costing $1 per thousand feet. City gas is higher than this in most cities and calcium carbide will soon be very much lower than at present. You will notice that in baking acetylene has a very decided advantage, while in the water boiling test, city gas has the advantage. We can probably account for this difference by stating that we use, on our acetylene stoves, a somewhat better oven than is usually found in connection with gas stoves. It needs but a slight reduction in the price of carbide to place acetylene away ahead of coal, water or oil gas, as far as economy is concerned, but economy is not acetylene's only advantage. By its use the disagreeable smell found in connection with the ordinary gas stove is entirely done away with, as acetylene gives off no odor when being burned, either as a lighting or a heating flame. An ordinary gas stove is a more or less smoky, dirty, greasy affair, but an acetylene stove does not smoke, neither is it a grease or dirt producer. The general public admit the decided advantages of acetylene as an illuminant, and it is but a matter of a very short time until it will be looked upon as the ideal heat producer as well."

CANADIAN SOCIETY OF CIVIL ENGINEERS.

THE VISIT TO BOSTON.

The trip to Boston, which was planned as part of the programme of the 14th annual convention of the Canadian Society of Civil Engineers, will long be remembered by all who had the good fortune to take part in it After the annual business meeting, reported in last issue, the excursionists gathered at Bonaventure station, where by the courtesy of the Grand Trunk Railway Co, and the Pullman Palace Car Co., a special train with three sleeping cars was in waiting to take them to the New England capital. The Central Vermont and Boston and Maine gave the society free running privileges over their lines, and the party arrived in Boston on Thursday morning, February 1st. They were met at the station and cordially welcomed by a deputation from the Boston Society of Civil Engineers, who escorted them to their headquarters at the Hotel Brunswick, where the formal welcome was made by the president of the Boston Society, C. Frank Allen, professor of railway engineering in the Massachusetts Institute of Technology. On behalf of the Canadian society, Prof. Bovey, president-elect, thanked the Boston society for their hospitable welcome.

The first event in the list of Boston excursions was a visit to the Massachusetts Institute of Technology, the visitors being piloted by Desmond Fitzgerald, its professor of civil engineering; Gaetano Lanza, professor of mechanical engineering; Geo. F. Swain, Hayward professor of civil engineering, and C. Frank Allen, professor of railroad engineering. This great institution has grown from small beginnings till it now has four large buildings in which are taught civil and mechanical engineering, mining engineering and metallurgy, architecture, chemistry, electrical engineering, biology, physics, chemical engineering, sanitary engineering, geology, naval architecture and general studies. The various engineering and technical departments are equipped with machinery and testing appliances, many of which are of the most modern description. This school gives the degree of B.Sc., and has 1,200 students. The institution has ten technical libraries, having an aggregate of 47,000 volumes, while it receives 850 technical and trade papers, the largest collection, it is believed, in the world.

In the afternoon the party visited the new south terminal station of the Boston and Albany, and New York, New Haven and Hartford railroads. The station buildings cover 13 acres, the main building being 850 feet long by 725 feet wide. The train shed is 602 feet by 570 feet, and has 28 tracks in the main floor. Beneath this and below tidewater is a subway for suburban service. The switches and signals are operated by the electro-pneumatic system. There is a 2,000 h.p. steam plant for generating electricity and operating the air compressors, ice-making and air-brake testing plants, and a plant for hot air and hot water heating. There is also a plant for making and compressing the gas used in the cars, the capacity being 120,000 cubic feet per day. The station cost $15,000,000, of which $6,000,000 was spent in buildings and plant. Geo. B. Francis, the resident engineer, and A. B. Corthell, the assistant engineer, acted as guides in this interesting visit.

The evening was pleasantly taken up with a lecture under the auspices of the Boston society, by Frederick P. Stearns, chief engineer of the Metropolitan waterworks, on the new waterworks system now under construction. The lecture was illustrated by stereopticon views, and was most instructive. The water supply of the metropolitan area of Boston is derived from a chain of ponds, basins and streams extending from a point about ten miles outside the city to a distance of 50 miles north

west, and running into the highlands around Nashua, where the latest new source of supply is the south branch of the Nashua river. The water sheds of these basins and streams have an area of 212 square miles, with a total daily supply in the driest known years of 384,000,000 gallons. Greater Boston, for which this supply is intended, has a population of 1,100,000, and some 28 cities and towns can be admitted to the benefits of this supply. To prepare for the acquisition of the latest extension to these works—the Nashua reservoir—6½ miles of railway had to be taken up, 360 houses, including six school houses and four churches, removed, with inhabitants numbering 1,711. The surface soil for this reservoir was stripped at a cost of $3,000,000, including the draining out of some swamps, and the new water basin formed will contain 63 billions of gallons, having a water surface area of 4,195 acres. In building the dykes for these reservoirs the ordinary surface soil was largely and successfully used as puddling material in combination with masonry dams. One feature about these reservoirs is that no attempt has been made to construct square or circular basins, but the conformation of the land is left as if nature, and not the hand of man, had planned the whole scheme. The effect is very picturesque, and this chain of lakes will soon be one of the most charming sights for the people of Boston. After Mr. Stearns' lecture the visitors were taken to the rooms of the Boston society, where they were regaled by ice cream, light refreshment and drinks, and were shown the society's valuable library.

On Friday morning the party were taken under the guidance of Alexis H. French and W. Warren Cummings, to the works of the New England Gas and Coke Co. at Everett, a suburb on the Mystic river. The superintendent, Louis J. Hirt, accompanied the party and explained very clearly the process of manufacture. As this is dealt with in an interesting article in another part of this issue by Charles Baillairge, one of the Canadian visitors, we need only add that all were pleased with the visit and enjoyed the luncheon prepared for them by the company at the close of the inspection of the works. After luncheon Mr. Heckman called the party to the front steps of the office, and took the photograph reproduced in the accompanying engraving.

31¼ and 48 inches, diameter of pump plungers, 37 inches, stroke of pistons and plungers, 60 inches; revolutions per minute, 30; horse-power, 400; contract price, $45,500 each, exclusive of foundations. Steam will be furnished by three vertical fire tube boilers. Each boiler will be 8 feet in diameter, 25 feet high and will contain 378 2-inch tubes. Thickness of shell, 25-32 of an inch. Heating surface 2,146 square feet.

The next point visited was the Natatorium, at Brookline, which is considered one of the best examples of municipal bath houses in the United States. Messrs French, Bryant, Forbes and Fletcher showed the visitors through this admirable institution, which we hope to be able to describe somewhat in detail in another number. The evening was devoted to the annual dinner, of which a report was given in last issue.

On Saturday morning the first event on the programme was a visit to the State Board of Health experimental station and filtering plant at Lawrence, but owing to the early hour at which the train started only one member was on hand. He had a car to himself on the journey, and was honored by a deputation and several cabs on arrival at Lawrence station. We hope to be able to give an account of his trip in next issue.

The members who remained in the city paid a visit to the Boston library, of which every citizen is justly proud. This great institution has its own steam and electric lighting and power plant, its own bindery and printing office, from which its catalogues, bulletins and special lists of books are issued. This library grew out of a gift of $100,000 made about 50 years ago by Joshua Bates, an Englishman, of London, who had lived some years in Boston, now the institution has in its main building 530,000 volumes, and the ten branch libraries have a total of 170,000 volumes besides, while 17 other stations are used to facilitate the distribution of books to the citizens.

During this day parties of the visitors made excursions on their own account, which included visits to the Boston Electric Light Co.'s central power house at South Boston, the Boston Elevated Railway Co.'s power house in Albany street; the freight sheds of the Boston-Maine system, Brockton Sewage Works, etc.

One of the most interesting and enjoyable of the many excursions was that to Harvard University, where President

CANADIAN SOCIETY OF CIVIL ENGINEERS.
From a Photo by J. W. Heckman, C.E., taken at the office of the New England Gas and Coke Co., at Everett, Boston.

In the afternoon the visitors were taken to the Chestnut Hill reservoir and new pumping station, where Charles W. Sherman and W. J. Sando acted as guides. There are four engines, representing different types and designs, the latest of which is a slow running engine of large capacity, designed to pump 30,000,000 gallons per day. A new low-service station is now being completed and will contain three vertical engines of 35,000,000 gallons capacity per day each. The dimensions of these pumps are as follows: Diameters of steam cylinders, 17,

Eliot and several of the professors accompanied the Canadians around these historic buildings. They were shown how the students lived, and were treated to one of the every day students' lunches in the classical Memorial Hall. After lunch President Eliot gave the visitors an interesting sketch of the history of Harvard, and then showed them the remarkable collection of glass flowers—unique of its kind—of which we should like to speak at another time. Very instructive, too, was the visit to the observatory where Profs. Pickering and Bailey, so well

known in the astronomical world, showed the visitors some of the 10,000 photographic negatives of the heavens, which are stored up as books of the stars.

To the several professors of Harvard and the Massachusetts Institute of Technology, and to Leonard Metcalf, secretary of the Excursion Committee; to S. E. Tinkham, secretary of the Boston Society, and to Howard T. Barnes, Edmund S. Davis, H. Bissell (chief engineer of the Boston and Maine), H. A. Carson, of the Boston Transit Commission, and many others the visiting members of the Canadian society are under a heavy debt of gratitude for the trouble and time they took in showing them the engineering sights of Boston, and the visit will long remain one of their most pleasing memories. On returning to Montreal hearty votes of thanks were passed to the Grand Trunk and the other railways to whose kindness they were indebted for the transportation to Boston and return. The details of the trip were as usual admirably managed by the secretary, Prof. C. H. McLeod, who never spared himself when the comfort of the members was in question. The society is indebted to Mr. McNab, of the engineering department of the G.T.R., for the suggestion of this trip, which proved to be the most instructive as well as the pleasantest of all the society's excursions.

REGULAR MEETING, MARCH 15TH.

At the meeting of the Canadian Society of Civil Engineers, held on March 15th, the lecture on the Transmission of Electrical Power, by Prof. Owens, announced for the evening, was not delivered, owing to the absence of the lecturer, who was unavoidably detained in Quebec. In place of the lecture a short paper by Mr. H. J. W. Finch, Stud. Can. Soc. C.E., on the Canadian Pacific Railway Transfer Slip, Vancouver Harbor, British Columbia, was read. This slip is one used in connection with the transfer of coal from Vancouver Island to the mainland, and is situated near the C.P.R. wharf at Vancouver. The cars, twelve at a time, are carried on barges. The transfer slip is a pile structure. Connection is made between the fixed flooring of the slip and the barge by means of a counterbalanced apron, 33 feet long by 30 feet wide.

CANADIAN MINING INSTITUTE.

The annual general meeting of the Canadian Mining Institute was held at the Windsor Hotel, Montreal, on the 7th, 8th and 9th of March, the following members being in attendance: B. T. A. Bell, Ottawa; W. Johnstone, Crow's Nest Coal Co., Fernie, B.C.; R. Jeffrey, Toronto; C. Fergie, Intercolonial Coal Co., Westville, N.S.; Geo. McDougall, Montreal; A. H. Stevenson, Montreal; J. Stevenson Brown, Montreal; R. Meredith, Montreal; H. W. de Courtenay, Montreal; Geo. E. Drummond, Montreal; Eugene Coste, Toronto; J. W. Evans, Sudbury; A. C. M. Hay, Rat Portage; C. Morgan, Toronto; H. Wylde, Halifax; N. M. Campbell, Montreal; David G. Kerr, Marmora, Ont.; P. Kirkgeear, Deloro, Ont.; Prof. W. G. Millar, School of Mining, Kingston, Ont.; Dr. W. L. Goodwin, director School of Mining, Kingston; W. Blakemore, Montreal; Archibald Blue, director Bureau of Mines, Toronto; A. Boas, Montreal; R. S. Hopper, Montreal; R. Blackburn, Ottawa; Major-General Sir Henry C. Wilkinson, Regina, N.W.T., and London, Eng.; S. Simpson; Dr. J. B. Porter, F. W. Maclennan, W. H. Ogilvie, S. F. Kirkpatrick and A. R. Archer, McGill University, Montreal; T. Denis, A. P. Low and A. E. Barlow, Geological Survey, Ottawa; Dr. Frank W. Adams, McGill University, Montreal; R. W. Brock, Geological Survey, Ottawa; Prof. A. Courtenay De Kalb, Kingston; C. C. Hanson, Montreal; J. B. Smith, Montreal; J. B. Tyrell, Dawson City; J. Obalski, Quebec; A. W. Fraser, Ottawa; Chas. Brent, Rat Portage; J. F. Higginson, Buckingham, Que.; J. D. Craig, Kingston; S. N. Scott, Kingston; J. D. Maclennan, Kingston; E. L. Fralick, Kingston; F. G. Stevens, Kingston; F. Gilbert, Kingston; F. H. Hopkins, Kingston; Thomas Bacon, Kingston; S. S. Fowler, London and British Columbia Gold Fields, Nelson; Major R. G. Leckie, Sudbury; John Blue, Eustis Mining Co., Capelton, Que.; Jas. Reed, Reedsdale, Que.; F. T. Peacock, Montreal; D. Brainerd, Montreal; R. G. McConnell, Geological Survey, Ottawa; F. Cirkel, Ottawa, and J. M. Clark, Toronto.

Wednesday morning.—In the absence of the president, John E. Hardman, the chair was taken by Geo. E. Drummond, who, in a short opening address, stated that since last year many things had happened of great interest to the mining community; and that, though two or three occurrences had taken place in the mining world which were liable to discredit Canada in the eyes of investors, yet, as a whole, the mineral development of the country had been satisfactory.

Secretary Bell moved that the minutes of last year's meeting be accepted as read, they having been printed and in the members' hands already. He gave the names of twenty-three gentlemen who were proposed as new members of the institute. These were unanimously elected. The financial statement, he said, showed up very well, and proved that the growth of the Institute, both in numbers and in influence, was highly satisfactory. Several members of the Institute, he said, were now helping the cause of Great Britain in South Africa; and the previous day he had received from Thos. Brown, a letter, dated Cape Verde Islands, regretting his inability to read a paper before the Institute this year, but expressing the hope of being able to do so for the next meeting, on the subject of "The Effects of Lyddite." Since last meeting, five members of the Institute had died, viz., J. McGregor, W. G. Nelson, Morris Buck, J. T. Tuck and A. H. Budden. The papers read at the previous year's meeting had been published and met with a cordial reception, having been republished in several American and European technical journals. He stated that he had had several interviews with the Minister of Customs, and had succeeded in obtaining an Order-in-Council placing gold dredging appliances on the free list. The Quebec Legislature also had passed an Act exempting mining property from municipal taxation for a further period of ten years. He then gave a brief resumé of the mineral development of Canada during the past year. It was very hard to give a just idea of the output, owing to the fact that the Provincial and Dominion Governments all had different standards, and their fiscal years ended at different periods. It would be a good idea to suggest that there should be some uniformity in these matters. Every mining man would agree with the statement that in Nova Scotia the returns of mining matters were arranged in a disgraceful manner. Fifteen million dollars, he thought, would be a conservative estimate of the amount of gold produced in the Yukon last year. In British Columbia, according to W. F. Robertson, the metallurgist, there had been a very material advance, though on certain lines no doubt it had been unsatisfactory. On the whole, however, there had been healthy, legitimate progress. Ontario's minerals showed an increase of 17 per cent over previous year. The nickel industry showed signs of rapid progress, and will probably before long become a great one. Of Quebec, about the same might be said, and mica was showing up well. Electro-metallurgy, was responsible for considerable progress at Buckingham, as it was by that process that phosphorus was being obtained direct from the apatite, with ferro-manganese for a by-product. Mica had been found to be the best substance for annealing steel, also for boiler coverings. In Nova Scotia, the conditions were encouraging, and the coal output had largely increased, owing to the finding of larger markets. The Dominion Coal Co. at Sydney would make a great showing after a while. In gold there had been a slight falling-off. Many of the mines had been bonded and were being held by the owners without working. The following would be a rough but conservative estimate of the net value of the Dominion's mineral production for the past year: Northwest, $18,000,000; British Columbia, $11,000,000 to $12,000,000; Ontario, $8,500,000; Quebec, $3,000,000; Nova Scotia, $8,000,000; or, roughly, a total of about $48,000,000.

Dr. Goodwin, in seconding the adoption of the secretary's report, said it showed many encouraging signs. Not only did old industries hold their own, but several minor industries were beginning to come into play.

It was resolved that the Institute should, as a body, contribute $250 towards the Canadian Patriotic Fund, and that in addition a subscription should be opened at the meeting to receive individual subscriptions. In moving this resolution, the secretary announced that $100 had been already received from the Canadian Copper Co., and $100 from the Acadia Coal Co., for patriotic purposes.

W. Blakemore remarked, in connection with this subject, that no body of men were more dependent upon the protection of the British flag than mining men, and it was fitting that they

should show their feeling in this matter. Archibald Blue said that not only had the Canadian boys in South Africa shed an honorable lustre over the whole Dominion, but that the war would help this country in a material way as well In future, not merely would the money requisite for the development of Canada be more easily obtainable, but interest in us had been so quickened that emigration would look this way also. One of the lessons of the present war to the people of Great Britain would be the value of sending their men to the colonies. Had a larger proportion of the families who had left the Mother Country to settle in the United States and foreign countries gone instead to South Africa, Canada and Australia, there would probably be no South African question to disturb the world's peace to-day The British connection was a great thing for the Dominion, and more especially for mining men, whose duties often took them to undeveloped countries. It was unanimously resolved to remit the dues of those members who were upholding the honor of the flag in South Africa.

Secretary Bell said that the Institute was now in a position to say who should, and who should not be members. He had no wish to make it a close corporation; but he certainly thought it ought to be a purely technical or business society, so that when a man should be able to say he was a member of the Canadian Mining Institute, it would mean something, and prove that he had the right, by experience and education, to really call himself a mining engineer. He thought that members of the Institute should be persons engaged in the direction and operation of collieries, metal mines, blast furnaces and metallurgical works, mining, mechanical, electrical or civil engineers; geologists, metallurgists or chemists; and such other persons who from their connection with the profession of mining the council might see fit to elect. And that Associate members should be persons not eligible in the foregoing, but such as the council should deem worthy of admission; and that they should enjoy full privileges of membership. This brought up the question of "amendments to by-laws and constitution," and a committee was appointed to enquire into and decide upon the matter.

Wednesday Afternoon.—A. P. Low read a paper on the Iron Ores of Hudson's Bay, in which he told the history of his explorations in that district. The first mention of Labrador ores had been made by Dr. G. R. Bell in 1877. With every extensive exploration, he said, large new areas of valuable iron ores had been discovered, and with further efforts no doubt other areas would be found, some of which might prove sufficiently accessible to become of great commercial value. At present, the lack of railroad facilities rendered the ores of Ungava Bay and the interior useless. The coast deposits could perhaps be shipped down on lighters, but the season for navigation was probably not more than three months and a half. Another question was that of fuel. No coal had been found in that country There was a large mass of driftwood on the islands near the coast of the bay, but he did not know whether this would answer for smelting purposes, and wood for making charcoal would need to be transported a great distance. There was plenty of water power for electric smelting. The chances were, however, that these deposits would remain one of the undeveloped resources of the country for a long period.

Archibald Blue said he had been on Lake Temiscuing, and found that there was a streak of jasper running across under it, with iron in close connection. On Lake Boya a very interesting discovery had been made, the diamond drill having shown that hematite extended below the bed of the lake for 188 feet, which would represent an enormous amount—some 12,000,000 tons. Deposits of lead hematite had been found to extend several miles from there. There was a probability that the jasper region extended all the way from Lake Superior to Lake Temiscuing, and this region ought certainly to be explored. He would like to know more about the transportation question, in connection with the ore areas of which Mr. Low had spoken.

A. P. Low replied that if a railway were run from Ottawa, in continuation from the Gatineau Valley Railway, the haulage of the ore would be about 400 or 500 miles by railroad from the southern end of James' Bay, to which the ore could be brought down on lighters during the summer.

Secretary Bell asked what sort of navigation was there on the bay? Mr. Low replied that there was deep water right up to the shore Hudson Bay was open to ordinary navigation from the middle of June up to November, but Hudson Strait would not be open probably before the middle of July.

The next paper read was one by R. E. Chambers, of New Glasgow, N.S., on the Iron Deposits of Bell Island, Conception Bay, Newfoundland, in which the writer stated his opinion that perhaps one could hardly adjudge at their true value the Newfoundland deposits. For high grade quality and economical working they were remarkable.

Chas. Fergie, Westville, N.S., then gave some results in the use of a rotary pump as against that of the straight line type.

Arch Blue read a paper entitled, Are there Diamonds in Ontario? Briefly touching on the manner in which it had gradually dawned upon Canadians that Ontario was a great mineral country, the writer stated that nickel, copper, gold, iron, graphite and mica might be said to occur abundantly. One highly important mineral, it was true, Ontario did not possess to any extent, and that was coal; was it impossible, however, that fuller exploration would eventually prove that Ontario possessed carbon in its purest or gem form, viz., the diamond? Corundum was there in quantity; and where this existed, there was always a hope that sapphires and rubies existed also. Small sized diamonds had been found in the States of Wisconsin, Ohio and Michigan, and these had been imbedded in the glacial drift. Now the materials of this drift had come down during the Ice Age; and in Ontario, many stones and gravels had been discovered identical in composition and structure with those in the drift in which these diamonds had been found imbedded. From the geological formation of the Keewatin district, he thought that it was there that diamonds should be looked for, and with considerable prospect of the search being rewarded with success.

Dr. Goodwin brought to the attention of the Institute the fact that recently some materials had been discovered of greater hardness even than diamonds. Mr. Barlow stated that Dr. Lawson had remarked, several years ago, that he had but little doubt that diamonds would eventually be found in the districts north of Lake Superior. A. P. Low remarked that the diamonds referred to in Mr. Blue's paper were supposed by some to come from the Hudson's Bay region, though he was at a loss to know from what part. They might possibly occur on the islands near the east coast, where there were Cambrian or Huronian rocks, capped with a considerable thickness of black shales, on the top of which there were several hundred feet of trappe. In St. James' Bay was a mass of gneiss rock, composed largely of garnet, with hornblende also in the composition; and this somewhat resembled the sort of rock found at Kimberley, where the diamonds came from. Eugene Coste said that probably the diamond was a constituent of the plutonic rocks, just as magnetite was, and he did not think that in looking for diamonds it was necessary to confine one's attention to carbonaceous shales. A much better place to search was where the plutonic rocks were driven upwards, and denuded, and showed their inner parts, like the neck of the Kimberley mines.

Wednesday Evening.—The proceedings opened with a short paper by C. E. Morgan on Mining Pumps. C. Fergie remarked that there was not a single pump in the market really made to work with compressed air, though in 50 or 75 per cent. of the mines air was the motive power used. R. W. Brock, of Ottawa, read a paper on West Kootenay Ore Bodies. J. Burley Smith, referring to the writer's mention of the limitations of prospectors, said that the duty of a prospector generally was to look for surface indications; the work of tracing the vein was properly the duty of the mining engineer. A. W. Stevenson said he had no particular wish to criticize, but judging from the manner in which some mining properties were being developed, it would be just as well to take the whole mountain, and, starting from the top and going downwards, to mill the whole thing. And perhaps it would not prove so much more expensive than the operations in current use, either. W. Blakemore referred to the vast amounts expended in developing properties which were absolutely worthless, the idea being perhaps to show a little work, and then sell out at a profit. In many cases it would have cost no more money to really develop the properties in question, than had been already used merely in putting them in shape for selling. If it had been spent in an honest attempt to do the best possible for the property, the money would not have been wasted, and at the same time there would be much more encouragement for investors of capital in this country.

W. G. Millar, of Kingston, gave an address on Corundum, which, said he, existed throughout a large area in Ontario, the quality of which could not be excelled. The uses of this mineral

were constantly being extended. Some forms of metal, it had been found, were not readily acted on by emery alone, and now manufacturers were beginning to mix corundum with their emery, in order to improve the latter's abrasive qualities. It had also been found to be better than emery for sharpening circular saws, as it did not spoil their temper. Perhaps also other uses would be found for it in pulp mills. It had been at first thought that its place would be taken by carborundum; but experience had shown that the latter in some respects was by no means equal. It had been stated by some that in North Carolina there were such enormous quantities of corundum that the prices would be reduced; but on going down to that state and investigating, he had found that the quality was inferior. The corundum of Ontario could be extracted from the rock easily; in North Carolina, however, much of it had to be treated with acid, which was a very costly process.

Archibald Blue stated that a company had been formed to develop the corundum industry in Renfrew and Hastings counties, at first with a capital of $250,000, which afterwards they had decided to increase to $1,500,000. Steps were now being taken to put up a big plant, and it was expected to place the article soon on the market. Much correspondence had been received from Great Britain, United States and Europe, so it looked as though there would be a large market awaiting it, so soon as it could be produced in quantities. One other possible use for corundum not mentioned, he said, by Mr. Millar, was as an alloy for aluminum. He did not know whether any satisfactory process had yet been discovered to this end; but he felt sanguine that some persevering man would ere long succeed in finding a way to use it in the production of aluminum. Should this be done, it would add immensely to the value of the ore in this country. Prof. Dick Callum remarked that the only difficulty in the way of this consisted in making it sufficiently fine to combine. Dr. Adams said the rock is which corundum occurs varied greatly in color—from light to dark. In the places where it occurred at all, it was usually very abundant, and he had no doubt but that it would prove a highly profitable industry, provided the prices keep up satisfactorily.

Thursday Afternoon.—The next session of the Institute took place on Thursday afternoon, many members having expressed the wish to seize the opportunity of being in Montreal to attend to private business in the morning.

J. M. Clark read a paper on the Mining Laws of Ontario in which he gave a short history of the mining laws of that province and a synopsis of their present condition. It was very desirable, he thought, that the whole question of company law should be simplified and put into a more satisfactory condition. It was a matter for congratulation that the mining laws in Ontario were largely statutory, the power to interfere with min ing matters except by special parliamentary legislation being very restricted. Eugene Coste said, no doubt the mining laws of Ontario were by no means perfect, but, on the whole, they were fairly satisfactory. It was a matter for congratulation that in that province there was an attempt at having a system of mining laws, not very subject to Orders-in-Council. In this respect it was a great contrast to the way in which the Yukon country had been governed from Ottawa. In the Yukon, it could not be said that there was any mining law, it was governed by mining regulations, made in the Department of the Interior, signed by the Minister, and changed every day or every week or so. The variability of these regulations had been the cause of that country, and Mr. Fawcett, the gold commissioner, had acknowledged he did not understand them himself.

Mr. Fraser said that in mining as in all other legislation so far as his experience went, the all-important point was that it should be clear and definite, and of as permanent a character as possible, without changes from year to year, if they could possibly be avoided. Many of the men engaged in mining operations—prospectors and others away out in distant regions—were not familiar with the changes that were taking place; they had neither the time nor the opportunity to study these changes, and for these reasons the legislation should be as definite and permanent as possible. He was glad to bear testimony to the just character of the Ontario mining laws. They were a credit to the province, and showed an evident desire on the part of its legislators to meet any difficulties that might arise regarding its mining interests.

J. C. Gwillim, of Ottawa, contributed some Notes on the Atlin Gold Fields. The Atlin region, like some other gold fields, he thought, had been over-rated, the placer district being confined to seven or eight creeks in a region about ten miles by twenty. Last spring, the population had reached perhaps 5,000, but now it could hardly exceed 1,500, many people having moved to Cape Nome and other fields. This country was more easily accessible, and the climate more favorable than in the region further north. Labor fetched about $5 per day, and provisions were about twice as expensive as in the outside world. The great drawback was the British Columbia system of mining laws, which limited the claims to a length of 100 feet, thus not giving room to deposit the debris and continue working. Many claims had been deserted when only half worked out. No doubt the future would show what could be done by hydraulic mining on a large scale.

Eugene Coste said the mining laws were a disgrace to the province, and went on to give some instances of the manner in which the British Columbia Government, in its desire to keep out aliens and foreign companies had really legislated against the development of the country even by Canadians.

Eugene Coste followed with a paper on the Natural Gas Fields of Ontario, in which, after giving a minute account of the operations of boring in several gas wells in that province, with an account of the various strata through which the drill passed in each instance, he went on to explain his theory of the formation of natural gas. He claimed that the gas-producing strata were not of organic origin, but the result of volcanic activity in past ages. Dr. Goodwin wondered whether there was any evidence of the formation of hydrocarbons in any stratum where organic origin was clearly altogether out of the question. Several facts, he thought, pointed to the chemical theory of the origin of hydrocarbons.

The report of the committee appointed to look into the proposed amendments to the by-laws and constitution was presented, from which it appeared that they had come to the conclusion that the whole subject was very much larger than had been anticipated. It was resolved to leave the matter over until the next annual meeting, and a committee, consisting of Archibald Blue, Dr. Goodwin, S. S. Fowler, Mr. Hay, J. Burley Smith, W. Blakemore, Mr. Hopper, Mr. Fraser and B. T. A Bell, were appointed to thoroughly investigate the matter and report at that time.

It was ordered that the papers should be printed in the annual report. A notice of motion was presented to provide for the establishment of a reference library and headquarters for the Institute in some central locality (probably Ottawa), as provided for in the constitution.

Thursday Evening.—Dr. Porter, of McGill College, gave a very interesting lecture illustrated by views of mining operations, exterior and interior, in Canada, United States and Great Britain. A. P. Low also presented some fine views, taken while on his expedition to the Hudson's Bay country, showing forth the habits of the native Indians and Esquimaux

R. G. McConnell, of Ottawa, read a paper on the Gravel Benches of the Klondike, which provoked a lengthy discussion Eugene Coste stated that when he was in that country last September, the Government had not spent a cent in making roads from Dawson City to the Klondike. The cost of transporting goods was enormous—about one cent per pound per mile. It was a shameful thing, that the Government, which charged a royalty of 10 per cent. on the gross output of the mines of the Klondike should not have built one mile, or one inch, of road. To the men who went up in that frozen north country, it was cruelty, and Mr. Sifton and the Ottawa Government, he thought, ought to be brought before all the Cruelty Prevention Societies in the country for the way in which, for four years and more, they had allowed this to go on, and that after making money out of the country For in a speech in Manitoba recently Mr. Sifton boasted that he had made the Yukon pay for itself, and had made $679,000 profit besides. In answer to a question from the chairman, he stated that there ought to be no great difficulty in building roads. The chief difficulty was to put the Government into a frame of mind to get started in earnest. Secretary Bell said that so long as a 10 per cent. royalty should be exacted by the Government, British capitalists would refuse to invest money. For all practical purposes the Klondike was a dead issue. Mr. Ogilive, he went on to say, had stated that there was $50,000,000 in sight in the

Klondike. Now, Mr. Ogilvie was a good man in his own line, but no competent mining engineer would ever commit himself to such a statement as that. The cost of getting into the country was enormous. More money had been taken into the Klondike than had ever been taken out of it. J. B. Tyrrell agreed that the 10 per cent. royalty was too onerous, and a very serious drawback in the eyes of capitalists, who believed that the margin might be close. Besides the royalty, there were so many other percentages—the banks charged 3 per cent. for assay and 2 per cent for export drafts. Each man, also, had to pay for a miner's license, all of which was a handicap to the country. Then, again, the probability was that only honest men paid the royalty, the rogues finding a way out of it, thus creating a premium on dishonesty. The exemption of the first $5,000 only made it easier to do this. He trusted that the Government would take the matter up thoroughly, and put it on an altogether different and more satisfactory basis. According to reports of the United States Mint, the output of the Yukon during the past year was about $16,000,000, though royalty had only been paid upon $9,000,000 to the Canadian Government. A better system would be for the Government to establish an assaying office and buy the gold outright on the spot, giving certificates for the same, redeemable in cash when the owner should reach the outside world. If the Government charged, say, 3 per cent. upon the assay, all expenses would be more than met—and it was not desirable to make a large profit, so long as the country should be self-sustaining. Such a system would mean that all the gold produced would be recorded. At present, claims on the product of which the royalty had not been paid, were liable to forfeiture. This was a defect which would be removed if a record were kept of the entire output. This could easily be done, as all gold going out of the country had to go either up or down the river, and gold was too heavy to be carried on the person. With regard to the prospects of placer mining in the Yukon, he believed it would last for twenty years yet. Many times the amount which had been taken out remains yet to be found. He was speaking of known properties only—but in addition to those, there was a large section of country which had not been touched. At the same time, he would not advise anyone to go out with the idea of prospecting for individual claims. It was necessary to have capital; and those who invested judiciously would make money. The conditions in Dawson City were improving, and life and property were as safe there as anywhere, and it was now possible to obtain fresh meat, vegetables, milk, etc., so that living was tolerable.

It was resolved to prepare a petition to the Government praying that the royalty on gold extracted in the Yukon district should be reduced from 10 to 2 per cent. Friday morning was occupied in formulating the result of the election of office-bearers.

Friday Afternoon.—The scrutineers reported the result of the election of officers of the Institute as follows. President, S. S. Fowler, Nelson, B.C., vice-presidents, C. Fergie, Westville, N.S., and Jas. McArthur, Sudbury, Ont., secretary, B. T. A. Bell, Ottawa, treasurer, J. Stevenson Brown, Montreal, Council, for British Columbia, E. B. Kirby and Bernard Macdonald; for Ontario, Major Leckie and R. G. McConnell; for Quebec, Jas. F. Lewis and J. Burley Smith, and for Nova Scotia, G. F. McNaughton and H. S. Poole.

The point was brought up as to whether newly elected members, whose subscriptions had not been paid, should be empowered to vote or not. It was resolved to refer this question to the committee for Amendment to By-laws and Constitution.

The new president, on taking the chair, gave a short address thanking the Institute for the honor which had been conferred on him, and briefly referring to the condition of British Columbia's mining industry. While, of course, he said, the output from British Columbia was not so large as from some States to the south of them, yet it was very satisfactory, and was increasing all the time.

Arrangements for holding the summer meeting (probably at Sydney, C.B.), in connection with the American Mining Engineers were left to the council to decide. On the motion of B. T. A. Bell, seconded by J. Stevenson Brown, a vote of thanks was accorded to the retiring officers.

Major R. G. Leckie, of Sudbury, then read some Notes on the Nickel Question, which provoked an animated discussion. Canada, he said, had a good opportunity to maintain her hold on the world's nickel market, providing the industry were properly encouraged, instead of being suppressed by hostile legislation. J. M. Clark referred to the system of export duties, against which all political economists, he said, were loud in condemnation. He was utterly opposed to any such system as that proposed by the Ontario Legislature in a recent Order-in-Council, placing an export duty on nickel and copper ore exported from Canada without being first refined. Mr. Holland emphasized the remarks of the previous speaker in his condemnation of the course of the Ontario Government. That the nickel and copper interests should be vested in the Crown, and that an export duty should be placed on the ore was a most ridiculous proposition. No such legislation had ever been heard of in a British colony. If the desire of the Ontario Government had been to cripple the nickel industry of the country, they could not have devised a better scheme. He then read a series of letters from Dr. Monn, the inventor of a new process for extracting and separating nickel and copper from the ore, and who was prepared to establish large works in Ontario, providing he was not discouraged by hostile legislation. The letters went to show that it would be impossible for him to carry out his scheme, with the possibility existing of any such Order-in-Council being passed. Secretary Bell said he sympathized with Mr. Archibald Blue, a Government official, in his presence during the passing of so many strictures on his own Government; but he thought it was certainly a fair subject for discussion. It would be a serious matter if Orders-in-Council were to be passed crippling the production of asbestos, mica, and other minerals in Canada; yet, the same reasons which had been urged in favor of the Order-in-Council respecting nickel, might be urged—and just as wrongfully—against those products also. The old argument that we had a monopoly of these minerals in Canada was fallacious. It was a fact that most of the persons who had argued in favor of this new Ontario legislation were not Canadians at all, and had no interest in the Ontario nickel industry. The Canadian Copper Co., though an American corporation, was a credit to the country, and it was sad to think that just as soon as their project was becoming profitable they should be crippled in this manner. It was not right to treat American and foreign investors shabbily; and it was right that they should be allowed to make money here; this was our only argument to induce them to come to Canada again.

Archibald Blue said he could not help feeling that there was some misunderstanding among members of the institute respecting the objects of the Order-in-Council, which had been so warmly discussed. It was certainly not the purpose of the Ontario Legislature to do anything to cripple any industry in the province. Secretary Bell moved a resolution to the effect that the Order-in-Council passed Nov. 23rd, 1899, by the Ontario Government prohibiting the export of copper and nickel, except in the condition of refined nickel and copper, would prove fatal to the industry, that the imposition of an export duty on nickel matte by the Dominion Government would make it impossible for the Canadian producer to compete with foreign countries, and that a copy of this resolution should be forwarded to the Premier, the Commissioner of Crown Lands for the province of Ontario, the Minister of Finance and the Minister of Trade and Commerce, together with a reprint of the discussion which had taken place. This motion was seconded by Mr. Holland, but was subsequently withdrawn on the understanding that the matter should be fully threshed out by the council, and dealt with as that body might see fit. The other papers on the Syllabus were taken as read.

The proceedings terminated in the evening with a very enjoyable smoking concert, the music being delightfully rendered by members of the Zingari Club, Montreal.

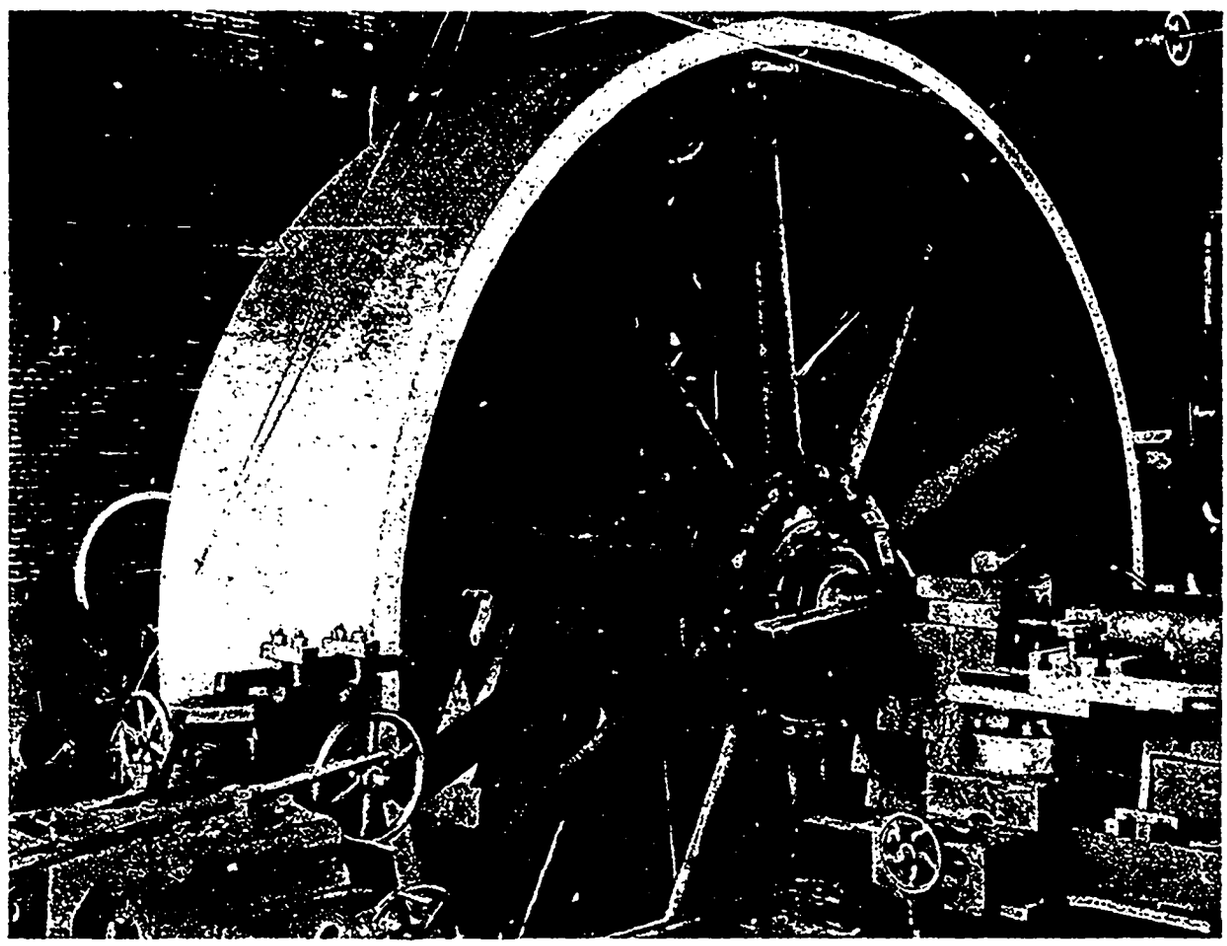
—Every good oil paint and red lead coating will protect the water reservoir from rust, and when it is perfectly dry will not give the water any noticeable side taste. The only drawback is that the oil coating does not last long. For this reason a cement coating is considered superior to oil paint. Cement dries perfectly in a few hours, and if it is made right lasts at least as long as oil paint, while its cost is next to nothing. In the Experimental Brewery at Berlin (says the Nordd Bangew Anzeiger), the lime and warm water receptacles are painted with cement, and after four years' use, the coating has not required renewal.

LARGE COMPOUND ENGINE.

The Laurie Engine Company, of Montreal, has just shipped the Ogilvie Milling Company, of Winnipeg, one of its 1,000 h.p. Corliss tandem compound condensing engines, the general dimensions of which are as follows, viz: High pressure cylinder, 24-in. in diameter; low pressure, 48-in. in diameter, with a stroke of 48-in. The main shaft is 18-in. in diameter, the journal being 16 inches diameter and 32 inches long. The general design is what is known as the heavy duty type. The frame casting which carries the main bearing weighs 12 tons. The fly wheel pulley is 22 feet in diameter and 6 feet 2 inches across the face, the rim of which is made in ten sections with two sets of arms (ten in each set), with four heavy flanges forming the two hubs. The wheel weighs about sixty tons.

The Laurie Engine Company's method of constructing these large wheels is different to the general practice in that the parts are never assembled until the wheel is put into the lathe for turning. The sections are machined on all four angles (and completed ready for going together) on a special milling machine designed for the purpose. The arms and flanges are faced, turned and drilled to jigs, making all the parts perfectly interchangeable, so that when the wheel is put together in the lathe it is simply a matter of bolting the parts together, there being no fitting to do whatever. The securing together of this particular wheel required 240 low-moor iron bolts, each 2¼ inches in diameter. This wheel is illustrated herewith. The steam cylinders are both steam jacketed, and fitted with the company's improved double eccentric valve motion. The receiver between the cylinders is furnished with superheating tubes of seamless drawn brass.

The condenser plant is of the surface type, the condenser being of the rectangular type with 2,000 feet of cooling surface. The pumps (air and circulating) are of the vertical, crank and fly-wheel type, driven by a 14-inch Corliss cylinder. The whole engine is designed with a view to obtaining the highest possible economy. It is built extra heavy throughout (weighing about 350,000 lbs.) and reflects great credit on the builders.



Fly Wheel of Laurie Engine Co.'s New Engine Built for Ogilvie Milling Co.

BLUE PROCESS PAPER.

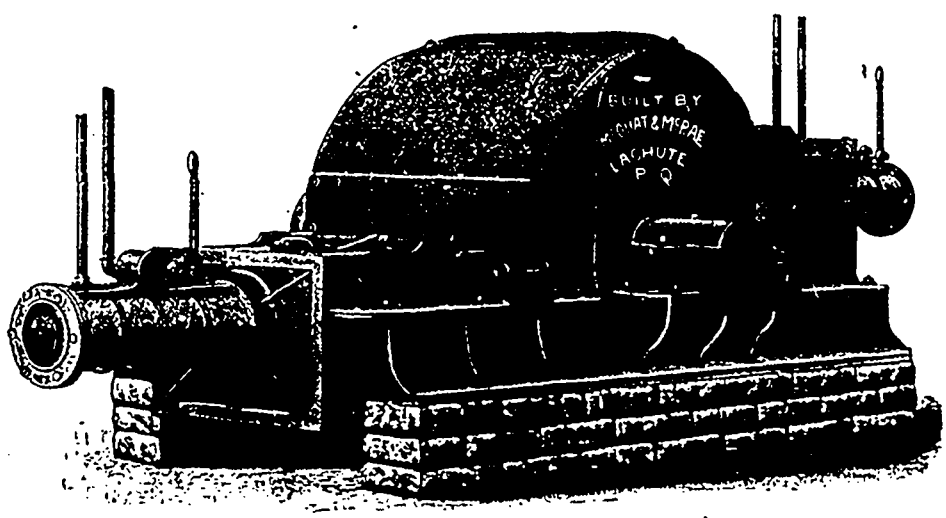
The prepared paper for this process is of a light greenish yellow tint when freshly coated. In the course of time, however, and particularly during the summer months, the paper turns to a darker tint up to a blue-gray, which, however, is no indication that the paper is spoiled and unfit for use. Good prepared paper for this process will keep unimpaired at least three months. The Helios papers have been for many years generally recognized as the best for photographic and other fine work states the Keuffel & Esser Co., in Photo-Printing from Tracings, a pamphlet recently issued. Both their printing and keeping qualities are superior to other blue print papers. Where price is more of an object than quality, the Columbia papers are generally preferred, as being the best value for the money. Cheaper papers can be bought, but they are not economical. The difference in price is small and not enough to compensate for inferior results, to say nothing of the waste of time and paper through the tearing of wet prints. When extra toughness is wanted, the Parchmine papers are used, unless light weight is also a consideration; in that case the E.T. (extra thin) papers are recommended.

Blue process papers cannot be judged by their color; only an actual test will show whether the paper is perfect or not. The exposure of blue process paper takes from four to eight minutes in bright sunlight, varying, of course, with the intensity of the light and the transparency of the material upon which the tracing is made. In the shade, or on dark and foggy days, the exposure may last up to one hour before it is completed, and on such days judgment must be used in determining its duration, and good care taken that the paper is not taken from the frame before it has been sufficiently exposed. When the margin protruding from under the original drawing has attained a greenish-bronze color; open one part of the back of the frame and observe the copy. If the lines stand out sharp and distinct on a gray background, the exposure is completed. Then take the copy from the frame and place it in a bath tray containing sufficient water to fully cover the print. Here the lines will gradually turn into white while the background is changed into brilliant blue. Rinsing

the print by means of a spray will quicken the washing. As soon as the lines stand out in clear white the print may be taken from the bath and hung up to dry, which completes the work. Remember that the fresher the paper is the slower it will print and the quicker it will wash out; the older the paper is the quicker it will print but the slower it will wash. To obtain satisfactory results never take prints from the water bath before the lines are perfectly white, although it may take hours to effect this. As soon as the bath becomes discolored, renew by fresh water, as otherwise the chemicals dissolved in the water will discolor the white lines to a bluish hue. The longer the exposure the darker the blue ground of the paper will be, but the lines of the drawing should always appear in a clear white color, provided the original shows opaque lines. The copies after drying will be darker than when they are taken from the bath. Papers printed in direct bright sunlight will generally not produce such a rich and beautiful blue background as those which are exposed in the shade.

A NEW PULP GRINDER.

McOuat & McRae, engineers and founders, Lachute, Que., have placed on the market a wood pulp grinder, which is here illustrated, and which has been strongly commended by pulp manufacturers who have tested it. This is the New England type of grinder, but of an improved make, and while the price is as low as the New England grinder, the capacity is greater, the machine has a longer life, and will run with less power. In the ordinary New England grinder the boxes were weak where they were fastened to the machine, and often ripped off. By the system of flanges and bolts adopted by McOuat & McRae, the strength is greatest where the strain is most severe. The pockets also can be made fewer and of larger capacity, and are so placed that the pressure and friction are balanced on each side of the stone. By grinding on a large surface with comparatively low pressure, the resulting fibre is longer and better preserved. The result is not only a greater grinding capacity, but easier running with less power. The machine takes a stone of 26-inch face by 50-inches in diameter, held on the shaft by flanges screwed on by right and left thread. Each pocket will admit a piece of wood 24-inches long by about 16-inches in diameter, against a piece 18-inches long in the ordinary grinder. There is therefore less waste in splinters and small pieces at the finish, and there is less stopping to fill the pockets. The Lachute grinder can be built with two or three pockets. Where a third pocket is used the balance of pressure is preserved by using the third pocket while one of the other two is being refilled. The pressure cylinders are lined with brass, and the pistons packed the same as in the hydraulic press, so that while working freely they are also water-tight. Samples of these grinders may be seen in the pulp mills of Hamelin & Ayers, Lachute, and Ford & Co., Portneuf, Que., both of which firms speak in the highest terms of the efficiency of the machine. McOuat & McRae also manufacture other pulp machinery such as stuff pumps, high pressure pumps, fire pumps, calendar roll grinders, etc., which are now gaining a good name in the Canadian mills.



THE LACHUTE PULP GRINDER.

AMERICAN ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.

This association, which was formed a little over a year ago, held its first annual convention in Chicago on the 14th and 15th of March, at which there was an attendance of nearly 150 members. Over one hundred railways, covering an aggregate length of more than 140,000 miles, are represented in this association, and the membership is composed of the principal engineers and general officers of these railways responsible for maintenance of way matters.

President J. F. Wallace, of the Illinois Central Railroad, occupied the chair, and made an excellent presiding officer. Mr. Wallace also has the distinguished honor of being president of the American Society of Civil Engineers, and to him, as well as to Mr. L. C. Fritch, the secretary of the new association, is largely due the success which has characterized all the proceedings of the organization since its inception. The preliminary reports of the several standing committees were read and discussed, and judging from the work of these committees so far, the schemes and objects of this association are most comprehensive, and its high aim, and the zeal of the officers in their efforts to promote these objects were well exemplified in the plan of work. There are fourteen standing committees, and the subject-matters respectively entrusted to their investigations embrace every feature connected with the construction, operation and maintenance of railways.

The Grand Trunk Railway system was represented by General Superintendent McGuigan, who is a member of the board of direction; assistant engineer W. McNab, vice-chairman of standing committee on graduation (who presented the report of that committee), and Superintendent W. Cotter, of the Western Division. The Canadian Pacific representatives were: Chief Engineer P. A. Peterson, first vice-president, and Superintendent James Oborne, of the Western Division.

The standing committees deal with the following subjects: Graduation, ballasting, ties, rail, track, buildings, bridges and trestles, masonry, signs, fences, crossings and cattle guards, signalling and interlocking plants, records, accounts and reports, uniform rules, organization, etc.; water service, yards and terminals. Each of these fourteen standing committees has five or ten subdivisions of work, so that if the programme of the association is carried out it will prove an organization of the highest importance to the railway interests of the continent.

CALCIUM CARBIDE AT CHICOUTIMI, QUE.

One of the most important of the many developments of electricity now going on in Canada is that for the production of calcium carbide on the Saguenay River, near Chicoutimi, Que. On February 5th of this year, Thos. L. Willson, the inventor of the process of producing calcium carbide now so much used, bought from the Quebec Government the Saguenay power at tide water, which is capable of a development of 69 feet head, and would give over 200,000 h.p. At this point the Ship-Shaw River falls into the Saguenay, and has quite a flow of water,

giving at its minimum about 15,000 h.p. under a development of 138 feet over the water wheels, the total fall being over 150 feet.

Here Mr. Willson proposes first, to develop 10,000 electrical h.p. on the Ship-Shaw, and a second development of 100,000 h.p. on the Saguenay, leaving a further possible power development on the Saguenay of over 100,000 h.p. When the Saguenay power is developed, this will be an excellent location for wood pulp manufacture and paper mills, as it is the centre of the finest pulp wood districts in the world. There would be also power to spare for renting to other industries, and being on tide water, and having a railway running to the works, the location would afford a most advantageous situation for manufacturing industries. The development of 10,000 h.p. in the Ship-Shaw is now proceeding.

Industrial Notes.

Edmonton, N.W.T., will build a hospital at once.

The Brockville Peat & Power Co. will install a large drier.

Graham & Johnston have moved their file works from Almonte, Ont., to Toronto.

The Toronto Cold Storage Co. has increased its capital stock from $50,000 to $100,000.

The Winnipeg mill, of the Ogilvie Milling Co., is being enlarged to 3,000 barrels' capacity.

The Manitoba Cream Separator Co., headquarters, Winnipeg; capital, $75,000; is seeking incorporation.

Murney & Baechler, sawmill, Sarnia, Ont., will install a large engine, and are now looking about for one.

The Henderson Bicycle Company, Ltd., has changed its name to The Goderich Engine and Bicycle Company, Ltd.

Sydney, C.B., town council has voted $200,000 for sewerage, water system, fire department, sidewalks, and schools, etc.

R. H. Bogart, formerly with the Rathbun Co., Deseronto, is foreman for the Canadian Wood Specialty Co., Orillia, Ont.

The Northey Co., Ltd., has been incorporated to take over the business of the Northey Mfg. Co., Ltd., of Toronto; the capital to be $350,000.

The N. L. Piper Railway Supply Co., Ltd., has been incorporated to take over the business of Noah L. Piper & Son, Toronto; capital, $40,000.

The Dry Dock & Wrecking Co., Collingwood, Ltd., has changed its name to The Ship Building, Dry Dock and Wrecking Co., of Collingwood, Ltd.

The Haliburton Lumber Co., Ltd., has been incorporated; capital, $50,000; provisional directors are, G. P. Magan, W. D. Thomas, and F. P. Brazill.

Reinhardt & Co., Toronto, have bought about 40,000 square feet of land, at St. Paul St. and Dupre Lane, Montreal, and will build a brewery, costing, it is said, $150,000.

Blakely & Ross, who are interested in brickmaking at Orangedale, C.B., have sold out their business at Halifax, and will confine their attention to brickmaking.

An emery wheel in the Frost & Woods' works, Smith's Falls, Ont., burst March 5th. This is the third accident of this sort in these works in a period of a few months.

H. H. Gervan, W. Northwood, C. J. Smith, N. C. Sparks, J. I. MacCraken, Ottawa, Ont., have been incorporated as the Ottawa Furnace & Foundry Co., Ltd.; capital, $40,000.

A. E. Gazlay, A. E. Rea, Adele Bishopric, and A. Bishopric, Toronto; Lydia Gazlay, Cincinnati, O., have been incorporated as The Victoria Paper Box Co., Limited; capital, $20,000.

Doolittle & Glazier, formerly employees of D. Hibner & Co., furniture manufacturers, have formed a partnership, and are about to build a furniture factory, 60 by 150 feet, four stories high, in Berlin, Ont.

The Sanitation and Utilization of Sewage Company Ltd., Montreal, has been incorporated; capital, $50,000; for the utilization of sewer waters for irrigation purposes. G. Janin, J. A. C. Madore, A. Stuart, J. B. Lapointe, I. L. Lefleur, of Montreal, incorporators.

C. W. Price is working at a steam carriage in his shop on Simcoe street, Toronto, near Adelaide street, and is said to have interested large capitalists in Montreal.

G. G. Roe, P. S. Roe, R. C. Roe, W. Edwards, and J. H. Gervan, Ottawa, Ont., have been incorporated as the Baldwin Iron Works, Ltd.; capital, $40,000; to manufacture engines, machinery, electrical plants, etc., in Ottawa, Ont.

W. A. Farrow, D. W. Moore, H. S. and H. E. White, W. Waldron, W. W. Woods, N. McAlpine, R. H. Riley, and F. Helm, Brantford, Ont., have been incorporated as the Mechanics' Fuel Co., of Brantford, Ltd., to deal in peat, etc.

A. Pequegnat, P. Pequegnat, R. D. Lang, and S. Groh, Berlin, Ont.; L. G. Pequegnat, New Hamburg, Ont.; J. U. Pequegnat, Guelph, Ont.; and James Pequegnat, Stratford, Ont., have been incorporated as the Berlin and Racycle Mfg. Co.; capital, $49,000.

The Dominion Government has recently made soundings in the Ottawa river at Des Joachims rapids, to locate the proposed new bridge to which $15,000 has been voted. The Ontario and Quebec Governments will give $5,000 each, and $10,000 will be subscribed by local capitalists.

The School of Practical Science, Toronto, will get $23,870, instead of $22,470, from the Ontario Government this year, and the professor in engineering will get $200 additional, and the lecturer in surveying $100, also the lecturers in electrical engineering, applied mechanics and mining.

The United States pipe trust is said to be shipping freely to Canada, in order to injure the Canadian makers, who are entering the United States market and finding ready sale for their pipe. Canada will cut very seriously into the United States iron trade in more than pipe when plants now contemplated come into competition.

The new iron and steel company being formed in Collingwood, Ont., by United States capitalists, among whom are several of the shipbuilding family of Philadelphia, the Cramps, has had voted a bonus of $115,000 by the town, and other inducements, such as a fine site, will be granted. The vote in favor of the bonus was very large.

The Dominion Leather Board Co., of Montreal, has put in a new 200 h.p. engine, made by the Jenckes' Machine Co., into their mills at Sault au Recollet. A new beating engine for the leather board works is also being put in, and the capacity of the works will now be one ton per day each for the leather board and paper mills. Both branches are now running night and day.

Hon. J. Dryden, Brooklin, Ont.; C. Mills, Hamilton, Ont.; D. Henderson, Acton, Ont.; W. McGregor, Windsor, Ont.; F. Fenton, M.D., Toronto, Ont.; J. H. Douglas, Warkworth, Ont.; and J. G. Boucher, London, Ont., have been incorporated as the Dominion Fence Co., Ltd., to make and deal in wire fencing, metal roofing, and siding, etc.; capital, $750,000; head office, Toronto.

Wm. R. Perrin & Co., of Chicago, have started manufacturing their goods in Canada, and have leased the plant of the Ontario Engine & Machine Co., on Richmond St. East, Toronto. J. F. Lawson, well-known to the Canadian consumers of their goods, is in charge. Mr. Holmes, of the Chicago plant, has been appointed mechanical superintendent. Their office is at 122 Church St., Toronto.

A great shipbuilding industry is proposed for Halifax, N.S., to use steel made in Sydney, C.B. The promoters speak of a capital of $20,000,000. What reason there might be for locating the ship yard so far from the source of materials is hard to see. Perhaps the people of Halifax may grant a large bonus, but otherwise it would seem natural for a shipbuilding company to avail itself of the great advantages of Sydney for such an industry.

Charles Meyers, Ottawa, who is promoting an iron smelter in Kingston, has made the following offer to that city: The company would put up a smelting works plant worth $225,000, with a capacity to smelt from 100 to 200 tons of iron ore daily; they would employ from 100 to 200 hands; they would transfer their offices, etc., there; they would pay from $100,000 to $150,000 yearly in salaries. In return, they asked from the city a free site, exemption from taxation, and a bonus of $4,000 yearly for fifteen years.

The Midland, Ont., Elevator Co. is taking out its old steam plant and putting in a new engine and boiler.

Hamilton, Ont., is to go on with its $200,000 third water main, which was voted on recently.

McLachlan Bros., Arnprior, Ont., have had their saw mills' assessment fixed at $100,000 for ten years, and $225,000 for another period of ten years.

The McLachlan Electric and Gasoline Motor Co. is busy constructing a gasoline carriage, to be worked with a double-cylinder, non-vibrating motor.

The Winnipeg Commercial states that D. McLean has organized a company to build a 200 bbl. flour mill, and a 50,000 bushel elevator at Moose Jaw, N.W.T.

A Scotch firm writes the Canadian Government offices in London, asking for names of Canadian exporters of broom, hoe, and shovel handles, prices to be quoted for car lots.

McGregor & McIntyre, the Builders' Iron Works, 65 to 71 Pearl street, Toronto, make a specialty of jail cells, iron sidewalk doors and fire escapes. They are well equipped for supplying all classes of builders' iron work.

W. T. Jennings, C.E., has been retained by Toronto to co-operate with the Dominion Government engineer, J. R. Roy, C.E., in preparing plans for the improvement of Toronto harbor.

George J. Dickson, Alex. Robinson, David Sadler and A. G. Dickson are a committee to secure the establishment of a $2,000 butter factory at Napan, N.B., under the auspices of the Farmers' and Dairymens' Association.

The Hamilton Brass Mfg. Co., has sold its cash register business to the American National Register Co., Dayton, O., for about $250,000. It is said the United States monopoly will establish a large factory in Hamilton, Ont., to employ some 200 hands.

The town of Fort William, Ont., has granted a bonus of $50,000 to the Mattawin Iron Mining Company, which is to erect a blast furnace on the banks of the river, and also one of $25,000 for a copper refinery, providing construction is commenced within six months, and finished inside of two years.

Application has been made for letters patent by the Imperial Cotton Company, of Hamilton. Among the directors of the new concern, which is to have a capital of $750,000 are W. D. Long, J. M. Young and Alfred Morgan, Hamilton, Ont., and C. T. Grantham, of Yarmouth, N.S.

J. N. Tallman & Sons, Hamilton, Ont., are enjoying a very much increased business in the manufacture of machinery, ornamental brass, phosphor bronze, zinc, copper, aluminum and aluminum bronze castings, etc. The new building, which has just recently been completed, is one of the largest and best equipped brass foundries in Canada. Among the improvements is a smelting furnace of 3,500 lbs' capacity, for the manufacture of large phosphor bronze castings, etc. Having made extensive improvements for this class of work, orders can be filled on short notice.

The John McDougall Caledonia Iron Works, Ltd., Montreal, has been incorporated; capital, $500,000; to deal in iron and iron ore, to carry on the business of mechanical engineers and manufacturers, and to acquire the business now carried on under the name of John McDougall Caledonia Iron Works. The charter members are: E. M. McDougall, Agnes K. McDougall, Jessie E. McDougall, F. C. Henshaw, L. B. McDougall, wife of J. D. Hayden, Cobourg, Ont., and R. Cowans, Montreal.

Two hundred men employed by the Hamilton Ont., Steel and Iron works, went out on strike March 31st, causing the laying off of 150 other workers and the closing of the works. The strikers were employed as finishers in the nine and ten-inch mills, and claim that under the western scale of the Amalgamated Association of Iron and Steel Workers of America, they were entitled to an advance of 4 per cent. in their wages on March 1st, and as this advance was not received, they struck. The workers in the finishing departments number 150 and were compelled to quit work when the other men went out. The men employed at the Hamilton Bridge Works struck a short time earlier. The works are being overhauled, taking advantage of the men's absence.

The use of steel in large buildings is causing an increased demand for hoisting engines. In the past year M. Beatty & Sons, Welland, Ont., have supplied eight special hoisting engines to the Dominion Bridge Co., and in one month four to the Dominion Iron & Steel Co., Sydney, C.B. The United Coal & Coke Co., Sydney, C.B., has bought one such engine, and the revolving and travelling derricks are now being built in Welland for the Hamilton Steel & Iron Co., for unloading at the docks in Hamilton.

The Still Motor Co., Ltd., 710 to 724 Yonge St., Toronto, has been purchased by English capitalists, who are forming a large company, called "Canadian Motors, Limited." The factory is crowded with orders for twelve months ahead. The automobiles manufactured are motets, Gladstones and delivery wagons, equipped with motors, batteries and controllers, under the Still patents. W. J. Still, the inventor, is now in England with the Oxford carriage, which was manufactured here. To Thomas Bengough is due the chief credit for the successful flotation of the Still business.

The seventy-third meeting of the Mechanics' Society, of Newfoundland, was held in St. John's last month. The reports from the Higher Council and officers showed the institution to be flourishing, that of the former expressing a removal of certain disabilities under which the boiler-makers and tanners labored. The officers installed were: President, T. M. White; vice-president, J. P. Scott; 1st assistant, C. Nurse; 2nd assistant, T. Rourke; treasurer, M. W. Myrick; 2nd treasurer, James Beck; 3rd treasurer, J. Goodland; secretary, J. J. Mullaly; grand marshal, Peter Stapleton.

A trial was made last month of the pumping plant of the Verdun, Que., sewerage system. This plant consists of an eighteen-inch centrifugal pump of the Northey Manufacturing Co.'s make, and a boiler and engine from the Caledonian Iron Works, Montreal. The engine pulley is ten feet in diameter and eighteen inches face, that of the pump shaft being forty inches by eighteen, the whole housed in a neat brick building, fifty by forty feet. (The purpose of the pumping plant, it should be said, is to get rid of the sewage when the river is at flood). The stipulated delivery by the pump was exceeded in the actual working, and the entire plant met with approval.

At the sixth annual meeting of the Nova Scotia Steel Company, the directors' report showed that business done in 1899 was the largest in the company's history. A dividend of four per cent. on preferred stock for the half year ending December 30th, 1899, was declared. On this stock four per cent. had previously been paid in June, 1899, and 24 per cent. in August, 1899. The dividend just declared makes 32 per cent. earned by preferred stock for the year, and pays all accrued dividends up to 1900; 8 per cent. was declared on common stock, payable March 10th. This is the first dividend paid on ordinary shares since the amalgamation of the company in 1895. The profits for the year, after paying floating debt, 28 per cent. dividend on preferred stock, and $75,300 bonds, were $819,945. In these profits, of course, are included $1,000,000, the price of the iron ore mine at Wabana, Nfld., sold by the company to the Dominion Iron & Steel Company.

A meeting of the organizers of the Canadian Steel Company, the incorporation of which, with $18,000,000 capital, $3,000,000 preferred, is now pending, was held in this city this week, says The Journal of Commerce, New York, under date March 28th. At this meeting details of the organization were agreed upon, although the formal organization cannot be effected until the charter has been actually issued, which it is expected will be done about the 20th of next month. The plant of the company will be at Welland, Ont., where a 1,500 acre site has been obtained. This is at the mouth of the Welland Canal, where it is said Lake Superior ores can be laid down as cheap as at Cleveland or Buffalo. The company proposes to enter into practically all departments of the iron and steel business. Among those interested are several capitalists from this and other cities of the United States, while Canadian capital is also concerned. A feature of the company's charter is that it will permit the company to make contracts for electric power with the Hamilton and Lake Erie Power Company, specifically, or with other companies. It is claimed that power can be furnished in this way at about one-fifth the cost of steam power in Pittsburg.

A Wren & Co.'s foundry, Forest, Ont., was burned, March 29th; loss about $5,000.

John Wheeler, needle maker, Paris, Ont., is asking for exemption from municipal taxation.

J. K. Brydon, Rat Portage, Ont., is to build a business block, part of which will be occupied by the Bank of Ottawa.

Simon Peters Co., Ltd., is to be incorporated to do business in Quebec as general contractors, lumber merchants, etc.; capital, $100,000.

The Montreal Rolling Mills were badly damaged by fire, March 24th. The business of the company will not be delayed however. The capital of the company will be increased to $750,000.

M. H. Frost, A. R. Gilbert and J. Brown, Cleveland, U.S.; H. L. Frost, and Clara M. Frost, Welland, Ont., have been incorporated as the Frost Wire Fence Co., Ltd.; capital, $40,000; chief place of business, Welland, Ont.

C. J. Anderson, P. Stenins, G. Everson and W. A. Carlson, Detroit, U.S.A., and A. Lovett, Colchester, North Essex Co., Ont., have been incorporated as the Walkerville Match Co., Ltd.; capital, $100,000; chief place of business, Walkerville, Ont.

A. Bell, judge; A. Park, J. Piggott, M. Wilson, Q.C.; E. R. Smith, W. F. O'Hara, D.L.S., Chatham, Ont.; S. A. King, Kingsville, Ont.; R. Aikin, J. I. Wiley, M.D., Dresden, Ont.; T. L. Pardo, and W. D. Samson, Blenheim, Ont., are incorporated as the Western Peat Fuel Co., Ltd.; capital, $100,000.

J. Hewer, H. H. O. Stull, T. Davidson, W. E. Buckingham, and W. J. Hammill, Guelph, Ont.; A. J. McPherson, Stratford, Ont.; and R. M. Duvall, Springfield, Mass., have been incorporated as the Ontario Seed and Grain Separator Co., Ltd., to make agricultural implements; capital, $40,000; chief place of business, Guelph, Ont.

Redpath-Reid automatic smoke consumers have recently been supplied by the Jubilee Grate Bar Co., Ltd., to the following among others: A. & J. Clark, Bullock's Corners, Ont.; Dunn Spice Mills, Hamilton, Ont.; Hamilton Times, Hamilton, Ont.; T. Upton & Co., Hamilton, Ont.; Penman Mnfg. Co., Paris, Ont.; R. G. McLean Printing Co., Toronto; Verity Plough Co., Brantford, Ont.; Pugsley, Dingman & Co., Toronto Junction, Ont.; Kingdon, Smith Co., and Victor Soap Works, Hamilton, Ont.; P. W. Ellis & Co., Toronto. The company also reports an unprecedented demand for shaking grates.

The Cummer mechanical dryer is approved of by the Fraser River Oil and Guano works, Vancouver, B.C., which writes to the F. D. Cummer & Son company: "The 'F' dryer will easily dry from 50 to 60 tons of fish scrap per day of 24 hours. It is very satisfactory and economical of fuel and labor. It is the best on the market." The Trent Valley Peat Fuel Co. states that a Cummer dryer "evaporated at the rate of 4,565 pounds of water per hour; consumed 414 pounds of combustible per hour: one ordinary workman operates the entire dryer plant. The product obtained is uniformly dried and in excellent condition for pressing."

An explosion occurred at the gas works of the Listowel Gas and Electric Light Company, Listowel, Ont., March 23rd, at 11.30 o'clock p.m. The generator blew up and wrecked the building. The engineer of the works, William Bitton, was in the building at the time, and was carried out before the fire, which at once followed the explosion. He was badly injured, one of his thighs being fractured, and his body being cut and terribly bruised in different places. The force of the explosion shattered all the windows in the neighborhood, and broke plate glass more than a quarter of a mile away. The electric-light plant was in the same building, and was also completely wrecked. The gas company last summer put in a new plant, changing from oil gas to water gas. The insurance was $3,000 on the gas plant, and $800 on the electric light plant.

The Smart-Eby Machine Co., Ltd., is at present working on the following orders: Twelve electro reduction baths, two mixing machines 6-ft. by 12-ft., ten steel tanks 12-ft. diameter by 10-ft., one 30,000 lbs. travelling crane, one 30 h.p. boiler fitted with Rodgers patent shaking and dumping grate bars, 350 feet steel shafting with hangers, etc., for the Hoepfner Refining Co: one 50,000 lb. travelling crane, and 800 rain proof pulley blocks for the Hamilton Electric Light & Cataract Power Co; two alligator shears, each direct connected to its own engine; one 7½ x 4½ x 10 outside packed boiler feed pump, ten steel charging buggies, one ladle heater, for the Hamilton Steel & Iron Company, two travelling radial drills with 20 foot arms for the Hamilton Bridge Works Co., one ten h.p. high-speed vertical engine, one 20 h.p. boiler with Rodgers' patent shaking and dumping grate bars, with shafting, pulleys, etc., for the Hamilton City Hospital laundry; one end bending machine for bending extra heavy bob runners, and one stack bender for bending wagon shafts, for F. W. Hore Sons; one eight can drying machine for the Guelph Carpet Mills Co.; one double disk sander for the Ontario Box Co.; one internally fired boiler for Smith & Baker, Dundas, Ont.

Railway Matters.

R. Sheehy, Peterborough, is building the new Roman Catholic church in Campbellford, Ont.

Reid McManus, C.E., is in charge of the ten-mile contract on the P.E.I. Railway, held by his father, J. W. McManus.

The Grand Trunk Ry. Co. has adopted the new Milne cushion truck brake for use on the passenger rolling stock.

The freight bill of the Dominion Iron & Steel Company, of Sydney, C.B., for the month of January, amounted to something over $82,000, it is said.

The C.P.R. has ordered from the car shops at Perth 100 standard 30-ton flat cars, 200 standard 30-ton box cars, 75 standard 30-ton refrigerator cars for freight service, and 25 refrigerators for the passenger service. The order is to be completed by the 1st of June.

During the present year, the Grand Trunk Ry. Co. intends to expend $800,000 on the Midland Division, to include a new station at Queen street east, Toronto, a new turn table at the round-house, and the double tracking of the line from Niagara Falls to Hamilton, Hamilton to London, and London to Sarnia.

The Great Northern Ry., for which John Ross, Toronto, has the contract, will be finished by August 1st. The bridge at Hawkesbury will be a prominent feature. One span of the steel work has already been put in position. Forty miles of the road have been operated this winter between St. Jerome and Ste. Elizabeth, Que.

The Canada Atlantic Ry. shops at Ottawa, in which work was interfered with a short time ago owing to the scarcity of material, have resumed operations, and are now running on regular time. The company proposes to build about seven hundred freight cars before July 1st, and the heavy undertaking will necessitate the permanent employment of a large staff of men.

The Canadian Pacific Ry. is surveying a new route from Ottawa to Arnprior, Ont. The present road from Arnprior to Ottawa, by way of Carleton Place, is almost double the distance of the proposed short line. The proposed new road is to run parallel with the Ottawa river, and between it and the Ottawa, Arnprior and Parry Sound Ry., traversing the townships of Tarbolton and Fitzroy.

Two branch lines of railways are likely to be built in the Ottawa Valley during the coming season, one to be known as the Bancroft and Pembroke Ry., is to be built from the former to the latter place to connect with the Canada Atlantic Ry. at Pembroke, shortening the distance from Pembroke to Toronto over 80 miles. At Bancroft the line would connect with the Grand Trunk Ry. The other is the North Lanark Ry., which will run from Mud Lake on the Kingston and Pembroke Ry. to Arnprior, and there connect with the C.P.R. and C.A. Rys.

The Grand Trunk Ry. will rebuild the International bridge over the Niagara river at Black Rock, below Buffalo. The bridge was built in 1870. The official announcement states that arrangements have been made for the renewal of the superstructure of the bridge, the property of the International Bridge Co., controlled by the Grand Trunk. There are two independent structures. One is the bridge across the Niagara proper, the other across Black Rock Harbor. The bridge

across the river consists of eight spans and has a length of 1,967 feet. Two openings are bridged by the arms of the draw girder, which has a length of 362 feet. The bridge across Black Rock Harbor is 517 feet. The draw span of this bridge has an opening of 107 feet. This work is being done to meet the requirements of the increasing weight of rolling stock. The contract is let to the Detroit Bridge and Iron Works.

At the annual meeting of the C.P.R., held April 4th, a statement including the following was made: A balance sheet of the affairs of the company at December 31st, 1899, shows the gross earnings for the year were, $29,230,038.26; the working expenses were $16,999,872.77; and the net earnings were $12,230,165.49. The working expenses for the year amounted to 58.16 per cent. of the gross earnings, and the net earnings to 41.84 per cent., as compared with 59.92 and 40.08 per cent. respectively in 1898. The earnings per passenger per mile were 1.79 cents, and per ton of freight per mile 0.74 cents, as against 1.52 and 0.76 cents respectively in 1898. During the year, two hundred and seventy-four miles of the main line were relaid with steel rails weighing seventy-three and eighty pounds per yard. The land sales for the past year were 416,806 acres for $1,327,667, as against 348,608 acres, for $1,121,774, in 1898.

Electric Flashes.

The Record Printing Co., Windsor, Ont., has bought from the Electrical Construction Co., London, Ltd., a 40-light multipolar dynamo.

J. A. Humphrey & Co., Toronto watch case manufacturers, have installed a new plating dynamo of the Jones & Moore Electric Co.'s manufacture.

The new firm of Raney Specialty Mnfg. Co., Kingston, Ont., has bought from the Electrical Construction Co., London, Ltd., three motors for its new works.

The Erie Iron Works, St. Thomas, Ont., has ordered from the Electrical Construction Co., London, Ltd., a 12 h.p. motor, which has already been installed to their satisfaction.

The Electrical Construction Co., London, Ltd., has sold twenty-two of the list of eighty second-hand machines which were recently exchanged for new ones in Winnipeg.

The installation of the electric lighting plant at the dry-dock sub-station, St. John's, Nfld., is under the superintendence of W. A. Mackay. The entire plant is supplied by the Westinghouse Electric Co.

The W. J. Gage Co., Toronto, has bought two new motors from the Electrical Construction Co., London, Ltd., in addition to the two slow speed press motors which had already been bought from this company.

H. McCulloch, sr., has retired from the board of directors of the Galt, Preston & Hespeler Ry., and M. N. Todd has been elected president in his stead, and G. Forbes, of Hespeler, a director. W. H. Lutz was re elected secretary-treasurer.

The Nova Scotia Electric Light Co. has had a second survey made of the source from which it is intended to derive the electrical power for the Annapolis Valley. The engineer's report was satisfactory, and the company is making plans to commence work at once.

The Shawenegan Carbide Company, Ltd., has been incorporated with a total capital stock of $1,000,000, the charter members being: D. D. McTavish and T. L. Wilson, St. Catharines: A. E. Plummer, John Payne and Wm. Gilchrist, Toronto, and Clarkson Freeman, Merritton, Ont.

At the annual meeting of the Hoepfner Refining Co., Hamilton, Ont., the following officers and directors were elected: Hon. J. M. Gibson, president; J. V Teetzel, Q C, vice-president; J. Patterson, secretary; J. Moodie, sec.-treas; Carl Hoepfner, H. R. Leyden and A. T. Wood, M.P.

Work has been started on the construction of the new power transmission line to run along the mountain from the Cataract Power Co's station at DeCew's Falls to Hamilton, Ont. The work was commenced just south of Stoney Creek, and it is expected that the line will be ready for operation July 1st.

J. A. Culverwell, Toronto, has been appointed managing director of the Central Ontario Power Company (proprietors of the Burleigh Falls water power), of which Hon. R. Harcourt and Hon. Peter McLaren are directors. Mr. Culverwell has moved from Toronto to the company's office at Peterborough.

The new Century lamp guard, which is being placed on the market by the Packard Electric Co., Ltd. St. Catharines, Ont., is attracting favorable notice on account of the convenience in packing, as they nest and so occupy much less space than otherwise. The socket fastenings are the same as on the Perfection guards.

Iron trolley pole brackets are now being manufactured in Canada by the Builders' Iron Works, 65-71 Pearl street, Toronto. This concern also carries in stock steel and iron bars, steel angles, channels, tees, etc., and are prepared to tender on any builders' iron work, fire escapes, etc., which the completely equipped plant enables them to produce at short notice.

The Jones & Moore Electric Co. has recently booked orders for complete warehouse private telephone systems for G. R. Renfrew & Co., Watson & Co., Wyld, Grasett & Darling, Monetary Times, all of Toronto; A. A. Matthews & Co., have placed an order with the Jones & Moore Electric Co., for a complete lighting plant, dynamo, engine and marble switch-board for their new steamer "Tilly."

The London Cold Storage and Warehousing Co., London, Ont., has ordered from the Electrical Construction Co., London, Ltd., a 30 k.w. direct connected generator and engine for 250 volt service to supply the lights of the building and two motors of 10 and 15 h.p. respectively, which have also been ordered of the Electrical Construction Co., London, Ltd., of the Perfection type multipolar machines.

The Jones & Moore Electric Co. has recently furnished the following manufacturers with electric motors: Barchard & Co., G. Wellings, C. Wilson & Son, Hemming Bros., Turnbull & Russell, J. S. Bennett, A. R. Williams Co., R. A. Winton, Elliott Mnfg. Co., Chandler & Massey, Minerva Mnfg. Co., Bradshaw & Co., J. E. Dunham, J. E. Ellis & Co., the Featherbone Corset Co., Sexton & Co., J. Cohen.

The cable steamer "Faraday" finished landing at Canso, N.S., the short end of the new cable for the Commercial Company, which is to connect Canso with the Azores. Alexander Siemens, director of the celebrated firm of cable manufacturers, which has a contract for this work, personally superintended the work of landing the cable, which was successfully accomplished. The "Faraday" then proceeded paying out the cable, which will land at Fayal.

The Kneeland Reflector Co., 222 Friend street, Boston, Mass., manufacturer of reflectors, is putting on the market a new shade called Hood, and carries a stock of finished goods in silver bronze, green bronze and green enamel. All the goods manufactured by this company are said to be standard and can be relied upon to give satisfaction. S. R. Kneeland, of the company, is the original manufacturer and patentee of reflectors known for ten years as McCreary Standard Reflector Shades.

Judgment was given in the Court of Appeal last month in the case of Harris v. Toronto Electric Light Co.—Judgment on motion by plaintiff for order directing that upon the new trial directed by the court to take place, the sole question to be determined shall be how the fire which destroyed the plaintiff's premises was caused. Order made directing a new trial generally on all questions raised, except that of damages. Costs of this motion to be considered as part of the costs of the appeal. J. B. Clarke, Q.C., and Swabey for plaintiff. Aylesworth, Q.C., E. F. B. Johnston, Q.C., and Henry O'Brien, Q.C., for defendants.

The Lachine Rapids Hydraulic and Land Co. has within the last two months installed three new generators of 1,000 h.p. each, and a fourth generator of the same power is now on the way, thus increasing the capacity of the works by 4,000 h.p. This machinery was supplied by the Canadian General Electric Co. Some changes have recently been made in the method of driving the exciters at the power house. Instead of being driven from the main shaft they have been put in brick buildings and driven by independent wheels. The company has recently put in lathes, drills and a planer, and have equipped a blacksmith shop, these to be used as a repair shop.

The Chambly Power Co. proposes to build a second dam across the Richelieu River, about two miles above the present dam. This new work will serve the double purpose of preventing the occasional formation of frazil ice at the lower dam, and will furnish 9,000 or 10,000 additional horse power for transmission to Montreal. It is expected that the Montreal Street Railway will take at least a part of this new supply of electricity. At present at certain hours of the day the demand for lighting and manufacturing purposes takes all the current sent to Montreal, but at other hours much goes to waste; but it is proposed to store the waste power in storage batteries, and use it all up in the hours of greatest demand. It is expected that the plans will be settled on the return, from England, of Mr. Ross, who is interested in both companies.

At the twentieth annual meeting of the Bell Telephone Company of Canada the annual report showed that 2,841 subscribers had been added during the year, the total number of sets of instruments now earning rental being 34,923. The company now owns and operates 343 exchanges and 450 agencies. To the long distance system, 1,686 miles of wire were added in 1899 The net revenue for 1899 was $353,307.40, the dividends amounted to $312,920, leaving a balance of $40,387.40, which, added to the balance revenue from 1898 of $149,735.98, leaves $190,123.38 to be carried forward to 1900. The plant and patents to the end of 1899 are valued at $5,244,436.33. The following directors were elected: C. S. Sise, president; Chas. Cassils, R. Archer, Robt. Mackay, vice president; H. Paton, W. R. Driver, John E. Hudson and T. Sherwin.

Personal

W. F. Van Buskirk, C. E., has been appointed city engineer of Rossland, B.C.

Wm. Reid, a well-known contractor and builder, Montreal, died last month at the advanced age of 82 years.

Kenneth Mackenzie has spent some time in Canada recently and will report upon the Ottawa-Georgian Bay Canal plans.

The secretary of the Petrolea Electric Light Co., Walter McDonald, died at his home in Toronto, recently, after a short illness.

George Simpson, assistant engineer of the Northern Pacific Ry., has resigned his position to accept the position of chief engineer of the Manitoba Provincial Government.

H. F. Duck, manager of the Engineering Contract Co., Temple Building, Toronto, was among those injured in the C.P.R. accident at Myrtle, Ont., last month Mr Duck has entirely recovered.

The employees of the Verity Plow Co., Brantford, made a handsome presentation to R. H. Verity, manager of the company, on the occasion of his resignation to accept the position of assistant manager of the Massey-Harris Co., Ltd.

Locomotive Foreman John Donnelly has been transferred from the G.T.R. yards at York, Ont., to Montreal, where he will succeed G. Blackbird, who was formerly locomotive foreman at that point. Traveling engineer W. Newcome will take John Donnelly's place at York.

Wm. Wallace, of Prescott, an old employee on the C.P.R. between Ottawa and Prescott, died suddenly from a stroke of paralysis a short time ago, He was stricken while being presented with a gold watch and chain by a number of his fellow-employees on the C.P.R.

S. Walker, who has been for almost 17 years foreman in the G.T.R. workshops, Point St. Charles, Montreal, was presented with a silver tea service, a marble clock and a bronze lamp by the employees, on his leaving the employ of the G.T.R. to become general foreman of the Dominion Bridge Co.

R. M. Wanzer, founder of the Wanzer Sewing Machine Company, of Hamilton, Ont., died in New York on the 23rd ult. Mr. Wanzer was one of Hamilton's wealthiest and most progressive citizens, and was at one time principal owner of the Hamilton Electric light plant, and also manufactured the Wanzer lamp. Business reverses overtaking him, his fortune was soon used up and latterly he had lived in the United States.

A. P. Polson, son of William Polson, of the Polson Iron Works Co., Toronto, was almost instantly killed at Pittsburg a short time ago. Mr. Polson had charge of one of the departments in Jones & Laughlin Co.'s steel works, and while superintending the construction of a large engine was struck on the head by a flying piece of iron. He was 37 years of age, and served his apprenticeship in his father's works. He left Toronto about a year ago for Pittsburg.

G. B. Reeve, the general traffic manager of the Grand Trunk, will leave the service of the company on the last day of this month, and enter upon a new life which he has been planning for the last twenty years. That life will be spent amid orange groves and grape fruit, in a temperature which will be equable the year round, and in an environment which will realize an ideal Mr. Reeve has long cherished. He will retire to his splendid property near Los Angeles, Cal.

The many friends of Alexander Fraser were much grieved by his death last month in Toronto. He was the son of the late Archibald Fraser of Fraserfield, Glengarry, and 42 years of age. Mr. Fraser has been treasurer of the Boiler Inspection Insurance Company for a number of years. He was one of the oldest and most enthusiastic members of the Argonaut Rowing Club, and was exceedingly popular among his fellow-members, having held the position of treasurer for over ten years. He was a first-class oarsman, and was president of the Northwestern Rowing Association.

Thomas Henry, district passenger and Canadian freight agent of the Northern Pacific Ry., with headquarters in Montreal, has been appointed general traffic manager of the Richelieu & Ontario Navigation Company, in the place of the late Geo. Brown. Thomas Henry, who is 32 years of age, and a native of Montreal, entered the employ of the Ottawa River Navigation Company about twenty-one years ago, and later on that of the Grand Trunk Ry., working for the latter at the ticket office on St. James street. For the past fifteen years he has been with the Northern Pacific Ry., for ten years holding the appointment he is now resigning.

Marine News.

Tug "T. Maitland," built last winter at Owen Sound, Ont., sunk at her moorings last month in 15 feet of water.

J. B. Fairgrieve & Co., Hamilton, have appointed on the steamer "Arabian," Captain O. Patenaude, and Engineer Jas. Smeaton.

The Matthew's Line, Toronto, has appointed to the steamer "Clinton," Capt. W. J. Shaw, Engineer George Wilcox.

The Montreal Harbor Board have been discussing the possibilities of an ice breaker for use between Quebec and Montreal in winter. The Karmak model is suggested.

The issue of $386,000 new stock by the Richelieu & Ontario Navigation Company has all been subscribed privately by the present shareholders, and will not be offered to the public.

Richard Williamson, Niagara Falls, N.Y., who has bought the steamer "Myles," from Thos. Myles' Sons, Hamilton, Ont., has appointed J. O. Moore captain for this season.

North-West Transportation Company, Ltd., Sarnia, Ont., has appointed on the steamer "Monarch," Captain E. Robertson, Engineer Thomas Bard; and on steamer "United Empire," Capt. John McNab, Engineer S. Brisbin.

The St. Lawrence & Chicago Steam Navigation Co. has appointed to the steamers "Algonquin," Capt. James McMaugh, Engineer James H. Ellis; "Rosedale," Captain Jas. Ewart, Engineer Edward O'Dell.

At the annual meeting of the Richelieu & Ontario Navigation Company the report of the president and directors for the year ending December 31st, 1899, was as follows: The gross receipts were $828,322.96; 1898, $728,943.97. Operating expenses, 1899, $674,626.89; 1898, $590,936.53. Fixed charges, 1899, $24,966; 1898, $25,979.89. Net profit, 1899, $128,730.07; 1898, $112,027.55. Two semi-annual dividends of 3 per cent. each, amounting together to $104,400, were paid, leaving the amount of $24,330.07 carried to surplus.

James Playfair & Co., Midland, have made these appointments for this season: Steamer "St. Andrew," Capt. W. H. Featherstonhaugh, Engineer Thos. Crossley; steamer "Magnolia," Capt. R. H. Gilbertson, Engineer A. E. House; steamer "Metamora," Capt. James Tindell, Engineer George N. Smith; steamer "Minataga," Capt. Edward Burke, Engineer James McGregor; steamer "Margherita," Capt. James O'Connor, Engineer Henry Hewitt.

The Northern Navigation Company, of Ontario, Ltd., has made the following appointments for the season of 1900:

Steamer.	Captain.	Engineer.
Majestic	P. M. Campbell	W. J. Asten
City of Collingwood	W. J. Bassett	C. Robertson
City of Midland	F. X. La France	Wm. Whipps
Germanic	R. D. Foote	Jos. Asten
City of Toronto	John O'Donnell	D. McQuade
Atlantic	Jas. Wilson	H. Clelland
City Parry Sound	Ernest Walton	James Smith
Britannic	C. A. Jacques	Samuel Beatty

The Toronto Ferry Co., Ltd., has made these appointments for the season:

Steamer.	Captain.	Engineer.
Mayflower	G. Moulton	E. Abby
Primrose	R. Williams	S. A. Mills
Shamrock	T. Jennings	Isaac Jamieson
Thistle	A. Martin	W. Hopkins
Island Queen	M. Corcoran	T. Good
Luella	C. H. Tufford	J. Smiley

The following appointments have been made in the Montreal Transportation Co.'s fleet for season of 1900:

Steamer.	Captain.	Engineer.
Active	John Gaskin	John Hamilton
Bronson	Joseph Murray	Robert Hepburn
Bannockburn	Alex. Milligan, Jr.	Richard Taylor
D. G. Thompson	Jas. Murray	Geo. Henderson
Glide	Thos. Murphy	M. Rankin
Glengarry	Gordon Kean	Chas. Napper
Jessie Hall	Chas. Martin	Geo. Tuttle
Rosemount	Jas. Mawdesley	John Evans

The Calvin Co., Ltd., Garden Island, Ont., has made the following appointments for 1900:

Steamer.	Captain.	Engineer.
India	A. H. Malone	Thos. C. Smith
Bothnia	Geo. A. Brian	Robt. Veech
D. D. Calvin	Chas. Coon	W. H. Cunningham
Reginald	John Doyle	John Kennedy
Chieftain	John Sullivan	Thos. Gray
Parthia	David Lefave	George Sauvé
W. Johnston	Chas. E. Felix	Thos. Campeau
Blue Bell	John Dix	Chas. Le Riche

The Richelieu & Ontario Navigation Co. has made the following appointments to the various steamers of the fleet for this season:

Steamer.	Captain.	Engineer.
Quebec	L. O. Boucher	F. Gendron
Montreal	L. St. Louis	F. X. Hamelin
Berthier	C. Gouin	E. Arcand
Terrebonne	E. Gouin	A. de Martigny
Chambly	J. A. S. Paulet	C. Gendron
Three Rivers	F. St. Louis	J. Matte
Laprairie	P. McLean	G. Gendron
Hochelaga	H. Maudeville	F. Chapdelaine
Longueuil	F. Jodoin	N. Beaudet
Hosanna	D. Mongeau	E. Gendron
Mouche-a-Feu	F. Crepeau	B. Plantal
Sorel	A. Berthiaume	F. Beaucage
Saguenay	C. Lapierre	E. Hamelin
Canada	Jos. Dugal	E. Denis
Carolina	G. Riverin	M. Latulippe
Toronto	H. Esford	Wm. Black
Hamilton	A. J. Baker	R. Marshall
Spartan	H. P. Grange	N. Beaudin
Corsican	John McGraw	W. Parker
Algerian	D. Mills	— Hazley
Bohemian	A. Dunlop	A. R. Milne

The Georgian Bay Navigation Co. has recently ordered a 300-light dynamo from the Electrical Construction Co., London, Ltd., for one of its boats, to take the place of a 150-light dynamo installed two years ago by the same company, which has given every satisfaction.

It has been announced that in order to meet the requirements of its growing trade, between Cape Breton and Boston, Mass., the Dominion Coal Company has decided to have three large steamers built in Newcastle, Eng. It is understood that each will have a capacity of 6,000 tons, and a speed of 20 knots.

A serious accident occurred March 19th, on the tug "Ymir," at Kootenay Landing, B.C., when R. L. Brown, chief engineer, and Hedley St. Clair, second engineer, were scalded by escaping steam. The engineers were overhauling when a valve broke; the steam rushed out and enveloped them from head to foot. Both were frightfully burned.

The Richelieu & Ontario Navigation Co. has placed under contract a sister ship to the "Toronto," to be called the "Kingston." The new boat will be 14 feet longer than the "Toronto;" the interior fittings, etc., will all be designed by Bond & Smith, architects, Toronto, whose work in the "Toronto" we have referred to at length in former issues.

Mining Matters.

Owing to the amount of space devoted to the report of the Canadian Mining Institute meeting the Editor has been obliged to hold over a large amount of mining news.

The Pembroke Observer says: J. W. Munro has secured, in bond, the Gallagher coal oil well on Allumette Island.

The deep well of the Standard Oil Co., at Inwood, Ont., is said to have proved a failure. A depth of 2,700 feet had been reached.

Sir Wm. Macdonald is about to endow the teaching faculty of mining and chemistry at McGill University, Montreal, with additional sums amounting to almost a quarter of a million dollars.

The Parry Sound district has been recently visited by Dr. N. Lehuen, St. Paul, Minn., on behalf of those interested in the Parry Sound Copper Co. After examining the Wilcox mine on Spider Lake Bay he estimated that the copper ore in this property to the depth to which the shaft has now been sunk might be valued at $9,000,000. This is one of a number of promising properties in this district, and large development is looked for.

—The Hamburg-Amerian Line and Norts' German Lloyd's are each having their new two mail vessels fitted with ice-making and refrigerating machinery. These steamers are now being built by the Vulcan Works, Stettin, for the mail service between Germany, Australia, and China, under contract with the Government. One of the vessels has already left on her first voyage, and a matter of interest is that in addition to the usual cold chambers and ice-making plant, two of the staterooms have been cooled. One of these was recently occupied by Sir Claude Macdonald, on his return to China, and the cool atmosphere added great additional comfort to the voyage. We believe this is the first instance of staterooms being cooled by means of refrigerating machinery, though in several cases such machinery is used for cooling dwelling houses on land. We think that there will be a wide field for this special application, and it will certainly add enormously to the comfort of passengers during a voyage through tropics.