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CONTENTS OF THIS NUMBER:

GOLD QUARTZ MINING IN CANADA AND VICTORIA, AUSTRALIA.*

BY DR. A. R. C. SELWYN, C.M.G., OTTAWA.

We have latterly heard and read so much about gold in Canada and the marvellous richness of Canadian gold mines, that I have thought a few facts and comparisons respecting gold and gold mining in Canada and elsewhere might be welcome, and serve to satisfy some illusory ideas on the subject. It is said that comparisons are odious, but then, in these days of booming, truth to many persons who have axes to grind or schemes to work, is still more odious and unpopular, but that is no reason for telling that most pernicious and meanest of lies—half the truth. You are all so familiar with the history of gold discovery and development in Canada, that it seems needless to do more than refer to a few dates and documents respecting it. In Quebec its existence was first made known by Samuel Baddeley, R.E., in 1835. In the *Geology of Canada*, 1863, all that was known of its distribution and development up to that date is to be found, and in the Geological Survey Report, 1863 66, are to be found the first records of its development. Then, as now, extravagant figures and estimates were indulged in. About the same time, 1860, auriferous quartz veins were discovered in Nova Scotia, and in 1865 there appears to have been 24,867 ounces raised; in 1866, 24,162 ounces; in 1867, 27,583 ounces, equal to 76,612 ounces in three years. From 1869 to 1874 the average production in Nova Scotia was 18,987 ounces. The first record of the discovery of gold in Ontario is in the General Survey Report, 1866-69. This was the well-known Richardson mine, and the first mine worked for gold in Ontario. Nothing was known about gold or its distribution in Western Ontario till about the time of the building of the Dawson road, and the endeavors of the Geological Survey to trace out and define the various belts of Huronian strata, after having recognized the importance as mineral-bearing series of the great so called Laurentian area, as defined on the geological map of 1866, and the further recognition that these belts were not Laurentian, but Huronian, and the same as the lower copper bearing group of Sir W. Logan, consequently that this would probably be found to present the same mineral character. Of the actual yield of gold from these belts in Ontario to date I have no record, but in the Geological Survey Report, 1872-'73, the new Gold field of Shebandowa Lake is described. Prior to 1885, I find the names of six gold mines that were then working in the Lake of the Woods and Ramsay River districts. These were as under: Manitoba Consolidated, Pine Portage, Canada Mining Co., Lake of the Woods, Keewatin mine, Argyle mine. These were all examined and described in the Geological Survey Report, 1884. Not one of these mines now appears in Mr. Bell's "Index to Mining Companies, 1894." And there is no record of their history other than that above referred to. The result of the work done on them would be interesting, especially if accompanied by a debtor and creditor account. It seems unlikely that the history of gold mining in Canada will differ from what it has been in other countries, and under corresponding geological conditions. In British Columbia gold was first discovered in 1858, and, as we all know, has been more or less profitably worked ever since. The total produce from 1858 to 1894 has fluctuated from $70,000 in 1858 to $3,913,563 in 1863, down to $456,066 in 1894, the total in the thirty years being 3,614,989 ozs. Thus the record shows in every country a steady, though gradual and fluctuating, decline in yield. What the effect of the opening of new ground, better mechanical and chemical methods and appliances may be, we have yet to learn, but it is not likely that in the next thirty years an equal amount of gold produce will ever again be recorded, though the advent and vigorous production of vein mining in British Columbia will have a potent influence in that direction. In the last copy of the *Mining Review* I see a statement that "it is out of place to attempt a comparison between the gold fields of Ontario and those of any other province or county." Why, does not appear, and I certainly cannot endorse the statement. It is only by knowing and comparing with results elsewhere that we can gain a true and accurate knowledge of our own results and possibilities. In any case comparisons are always educationally useful if truthfully and carefully considered, and intelligently applied. All circumstances duly considered, I hold that Australasia is the richest mineral country in the world, and especially as regards gold. I find the following record of produce for quinquennial periods from 1851 to 1893:

* Abstracted from a paper read before the Federated Canadian Mining Institute, Montreal.

Australasia	92,648,000 ozs.
United States	89,353,000 "

This probably includes Canada and amply proves that, population and age considered, Australasia is really the richest mining country in the world, unless development in Africa place it in the first place. The idea seems prevalent that Canada is an exceptionally rich mining country. This I hold to be a fallacy. Canada's resources in minerals are large and are capable and worthy of better development. It is, however, in the last degree unlikely it can ever vie with the smallest province of Australia. Canada is essentially an agricultural and pastoral country, and on the vigorous development of these will her future prosperity mainly depend. The produce from these is always an increasing one, while that from mining is always diminishing and must eventually terminate. Of the three kingdoms of nature only one is incapable of reproduction and therefore mortal. The chief and greatest value of gold and gold mines, especially in a new and unexplored country requiring people to work and develop its reproductive resources, lies in its power to attract such people rapidly and in such numbers as no other inducement will succeed in accomplishing, and therefore every Canadian must wish the utmost success to the effort now being made to develop the gold mining industry in the Dominion, but not by the plan of the modern miner who, unlike the ancient miner, begins by opening a broker's office in a leading thoroughfare, instead of a tunnel in a mineralized hill side. Canada in eight years has not produced as much gold as Victoria often in a single year. In 1894 Victoria yielded 673,680 ounces, while Canada, from 1886 to 1893, yielded only 496,896 ounces.

GOLD PRODUCED IN VICTORIA IN QUINQUENNIAL PERIODS SINCE 1851.

	Ounces.
1851-1855	11,218,772
1856-1860	12,712,946
1861-1866	8,341,464
1866-1870	7,105,820
1871-1875	6,130,962
1876-1880	4,136,753
1881-1885	4,081,269
1886-1890	3,111,373
1887	617,751
1888	625,026
1889	614,839
1890	588,561
1891	576,400
1892	654,456
1893	671,126
Total	61,187,518

The deepest mines in Canada have not yet exceeded 700 feet in Nova Scotia, and I believe not 500 feet in Ontario. Now in view of the relative dates of quartz mining in Victoria, and in Canada, and the recorded yield of the quartz, the quantities crushed and the depths obtained are not complimentary to the enterprise and energy of the Canadian mines. As regards Nova Scotia, at least, the conditions are precisely like those in Victoria, and there seems no reason why the veins in Nova Scotia should not be worked to depths as great as those of Victoria. To depths already reached, the average richness of the quartz crushed has been greater than that of Victoria, and the returns should certainly be much greater than they have been. In British Columbia, unlike Nova Scotia, Quebec and Ontario, nature has given you easy access to depths of thousands of feet beneath the surface, and the facilities for mining and mineral development are far greater than they ever can be in the other provinces.

STATUS BY EXAMINATION.*

No profession requires more education, theoretical and practical, and more training of the mind, than the profession of a civil engineer, and to be an associate member or member of the Institution should be a credential of both. Are we quite certain that the present system of gaining these credentials is satisfactory?

You know what the by-laws require. The council carries out their requirements as carefully as possible; but in my opinion, the present system leaves much to be desired, and the scientific education of a candidate must be taken more or less on trust. It seems to me that, if our engineers are to hold their own in the future, we must keep abreast of the training of foreign engineers. In France, Germany, Russia, Belgium and Holland, the state sees that all candidates for employment as engineers are, so far as technical education is concerned, thoroughly equipped for their work. The same results can only be obtained in this country through this Institution, and we should see that any credentials conferred by us are based on undoubted qualifications. Ours is undoubtedly a learned profession, and the study necessary for a young engineer should be, at least, as complete as that for holding a junior brief. We have as instructive a mass of technical literature as physicians and surgeons, and practical training is as necessary for an engineer as for a doctor or surgeon: but every medical student has to pass a whole series of examinations, both theoretical and practical, before he can be admitted to practise his profession. The same remarks apply to the other learned professions.

Why should we be content to accept any lower position for our calling, to take matters of education and training on trust, and to be content with lower standards? It is sometimes said that our great predecessors could not have passed a scientific examination, and that they, as may be the case with future heaven-born geniuses, would thus be kept out of the Institution. Our distinguished predecessors would, I feel sure, have passed such an examination as would have represented the knowledge of their day with the greatest ease; and for the future, with the present possibilities of education, the coming genius will pass with honors any examination adapted to an average man. No doubt technical schools do much for us, but young men leave them, as a rule, too soon; and before a man becomes an associate member he should be able to show that he has not only had a distinctly scientific education, but has known how to make a practical use of his education, and to apply common sense to his work. Nor should we be content with a low standard of general education, the recently adopted examinations as to which are a distinctly forward step.

The remarks I have made point unmistakably to our having qualifying (not competitive) examinations for our status of associate member. I think that the admission to the class of full member can be more easily dealt with by the council. It may or may not be desirable to examine for the higher position, but I feel strongly that there ought to be an examination for the lower classification, by which course we shall not only guarantee the public that every member of this body has had a good general, scientific and practical training, but also confer on our brethren very great advantages in all respects. I have conceived it my duty to bring these matters before the Institution from the great interest and affection which I have for my profession, and from my earnest wish that it should advance and prosper in the future as it has done in the past.

* Abstract from Inaugural address by John Wolfe Barry, C.B., F.R.I. President of the Institution of Civil Engineers, England.

EFFICIENCY OF COAL CONSUMPTION IN RAILWAY PRACTICE.*

BY HERBERT WALLIS, PRESIDENT CAN. SOC. C.E., 1896.

Concluded from last Issue.

Patent fuel, a combination of coal dust and tar manufactured under pressure into "briquettes," while giving good evaporative results, has not, owing to the cost of production, been equal to successful competition with coal.

Petroleum by-products have been tried, and are successfully used in Russia. In Canada the uncertainty as to cost, owing to limited area and extent of production, and the unavoidable risk that would attend operations on a scale of sufficient magnitude, constitute objections which are not likely to be overcome, so long as coal can be obtained at or about present prices.

On the Great Eastern Railway of England satisfactory results are reported from the residual product of the illuminating gas used in passenger coaches. On that railway the oil and coal are used together, and the ultimate cost of operating is about the same as for coal alone; but a use is thus found for a refuse commodity which otherwise would be difficult to dispose of. To accomplish a given amount of work, petroleum occupies about one-half the space of coal, and this fact is no doubt a point towards a favorable consideration of its merit. I will now call your attention to some of the influences which affect the consumption of fuel in locomotives. Apart from the loss sustained through interruptions and obstructions by snow, there is a well defined condition of inverse ratio due to heat radiation from the boiler and cylinders on the one hand, and to the temperature of the feed water on the other, existing as between atmospheric temperature and fuel consumption.

Some interesting information as to the relative summer and winter operations extending over a number of years will be found in the following figures:

YEAR.	January. Coal used per car per mile, lbs.	January. Temperature of atmosphere, Montreal.	January. Snow-fall, Montreal, inches.	January. Snow plough miles run per mile of railway.	February. Coal used per car per mile, lbs.	February. Temperature of atmosphere, Montreal.	February. Snow fall, Montreal, inches.	February. Snow plough miles per mile of railway.	July. Coal used per car per mile, lbs.	July. Temperature of atmosphere, Montreal.	August. Coal used per car per mile, lbs.	August. Temperature of atmosphere, Montreal.
1882..	4.02	13	28	.69	3.74	19	23	.99	2.83	68	2.86	68
1883..	4.46	6	20	4.71	5.80	12	17	10.78	3.00	67	3.08	66
1884..	5.23	6	44	6.68	4.56	18	29	1.97	2.95	68	2.95	70
1885..	4.15	13	22	1.03	4.95	4	44	5.87	2.96	71	2.91	64
1886..	4.02	11	17	.82	4.06	11	10	2.38	2.92	70	2.96	68
1887..	4.63	5	50	10.17	4.50	12	34	6.98	2.99	75	3.12	66
1888..	4.76	2	34	5.63	4.41	13	30	2.15	3.15	70	3.32	65
1889..	4.14	9	41	.60	4.87	9	32	7.48	3.21	69	3.26	65

*Extracts from the President's address at the annual meeting of the Canadian Society of Civil Engineers.

These figures are based upon the total car mileage of the Grand Trunk Railway. It is quite true that a possible variation in the rate of train speed, or in the weight of the cars or their contents, would interfere with a too close comparison as between one year and another. They are, nevertheless, quite reliable as illustrating my remarks. The figures show that over a series of eight consecutive years, the average weight of coal required to carry the freight traffic of the Grand Trunk Railway was 50 per cent. more per car per mile during the months of January and February, than during July and August. They also show that while January has been the colder month during the time referred to, the rate of coal consumption has been relatively higher in February, owing no doubt to greater interference by snow during that month. If exception should be taken to the use of Montreal thermometric records, I will say that the traffic of the Grand Trunk Railway is chiefly derived from the West, and that the prevailing winds from that quarter seem to regulate the atmospheric temperature in something like an equal ratio throughout the section of country to which the statistics apply. This will be seen from the records in degrees Far., also given, for the months of January and February, 1888 and 1889, at the five terminal points:

YEAR.	Detroit.		Buffalo.		Toronto.		Montreal.		Portland.	
	Jan.	Feb.	Jan.	Feb.	Jan.	Feb.	Jan.	Feb.	Jan.	Feb.
1888	15	21	17	21	15	22	2	13	11	19
1889	27	16	29	18	28	18	19	9	27	17

The following figures give the coal consumption per car mile for each month during 1895:—

1895.	Temperature of air, Far.	Cars per train.		Speed of trains in miles per hour.		Coal consumed in lbs. per car per mile.	
		Pass'r.	Freight.	Pass'r.	Freight.	Pass'r.	Freight.
Jan. ..	14.9	4.7	17.5	21.1	11.9	13.19	4.95
Feb. ..	14.2	4.5	17.4	19.3	10.5	13.85	5.08
March .	22.1	4.6	18.6	21 5	12.2	12.25	4.41
April ..	41.2	4.8	19.1	22.0	12.8	11.18	3.84
May ..	58.3	4 8	19.3	22.2	12.9	10.51	3.53
June ..	69.5	4.9	18.7	21.9	12.9	10.31	3.40
July ..	67.2	5.2	18.2	21 7	12.8	10.20	3.47
August.	65.8	5 3	18.0	21.6	12.7	10.14	3.53
Sept. ..	60.3	5.4	18.8	21.8	12.8	10.16	3.57
October	41.2	4.9	19.0	22.7	12.5	11.07	3.91
Nov. ..	34.3	4.8	19.5	22.9	12.2	11.62	4.13
Dec. ..	22.5	4.9	19.0	22.5	11.8	12.22	4.37

I have included the results of the passenger as well as of the freight train service, though the latter furnish a better guide, owing to the fact that freight trains are, as a rule, worked more closely to the capacity of the engines. The average rate of speed is also recorded, and the number of cars of which the trains were made up, so that these influences upon the rate of fuel consumption may be duly appreciated. Unfortunately the weight of the trains is not obtainable, though it is likely the variation as between one month and another for a year would not be important. The advantages accruing to railway companies, whose lines are removed from the rigor of our northern latitudes, is made by these figures sufficiently apparent. The influence of gradients and curvature may here be illustrated by reference to trials made some years ago on the main line of the Grand Trunk Railway between Sarnia, a town situated on the River St. Clair, and Portland, Maine, the distance being 798 miles. This mileage was divided into nine locomotive divisions, of which the shortest was 58 and the longest 125 miles in length.

A locomotive having cylinder 17 inches diameter and 24 inches long, with four coupled driving wheels of 62 inches diameter over the tires, made the run over the entire distance, completing the work of one division each day, with a freight train of a weight corresponding to its capacity. The fuel was of the same quality, and was accurately weighed, and the trials took place at a time of year and time of day when the variation of atmospheric conditions was inconsiderable. The intention was to compare the cost of working upon the various divisions, and no effort was spared to ensure accuracy in the result.

The following table gives the particulars:—

Division West to East	Miles apart.	Differences in altitude of terminals, feet.	Lift between terminals, feet.		Cars per train.		Tons per train.		Coal in lbs. per mile.					
									Per Train.		Per Ton.		Average.
			West.	East.	West.	East.	West.	East.	West.	East.	West.	East.	
Sarnia & Stratford	80	57	615	....	35	21	346	494	34·39	57·75	.1169	.0993	.1081
Stratford & Toronto	88	937	....	994	32	21	346	494	59·16	36·20	.0733	.1708	.1221
Toronto & Belleville	113	39	305	275	35	19	315	448	42·57	48·07	.1076	.1352	.1214
Belleville & Brockville	95	5	100	110	35	21	345	489	43·52	44·20	.0904	.1262	.1083
Brockville & Montreal	125	230	....	300	45	27	345	617	46·76	45·24	.0751	.1050	.0900
Montreal & Richmond	76½	345	565	225	35	23	344	541	36·86	56·62	.1106	.1160	.1133
Richmond & Island Pond	71	796	989	....	35	19	344	446	28·23	63·77	.1431	.0822	.1126
Island Pond & Gorham	58	389	....	389	35	24	344	563	50·22	41·56	.0738	.1461	.1099
Gorham & Portland	91¾	787	....	787	35	24	344	563	49·45	34·70	.0616	.1526	.1071

The cars were loaded going eastward and empty westward, in consonance with the general direction of traffic. It will be noticed that the consumption of fuel per ton per mile is fairly proportional to the lift in feet. In cases where this rule does not obtain, excessive curvature, the assistance of a pilot engine, or a longer run between stations, reducing the percentage of coal used in firing up, may be said to account for the difference.

The variation in the rate of consumption is from 1 to 2.3 in connection with eastbound, and 1 to 1.85 with westbound trains. In August, 1882, arrangements were made under which the Grand Trunk and Great Western Railways were cemented into one system under Grand Trunk management. Each company owned a line from the west to the Niagara frontier, and also to Toronto. Owing to representations made by myself, it was decided to make use of the Great Western line, which with its lower gradients runs nearer to the level of the lakes, for eastbound "through" freight traffic, and to convey the westbound business, consisting largely of empty or return cars, by way of the main line of the Grand Trunk, which rises in the neighborhood of Stratford to an elevation of 1,000 feet. Thus the partial effect of a double line of railway was secured, and the easiest gradients were made use of for the heaviest trains.

The new, or what has been since called, "circular" system went into operation September, 1883, and the first three months gave the following results:—

	October 1st to December 31st.			
	Western Division.		Central Division.	
	1883.	1882.	1883.	1882.
Coal tons	18,365	20,669	33,878	32,484
Train miles	505,821	550,170	794,608	827,037
Car "	10,432,390	10,315,884	19,466,668	19,747,683
Cars per train	20 6	18.7	24·5	23·9
Coal, lbs., per train mile	72 61	75.14	85.27	78 56
Coal, lbs., per car mile	3·52	4·01	3 48	3·29

The two divisions, viz., the Western and Central, met at Toronto and the figures show how the former, working under the "circular" system, compared with itself when under the old system, and with the Central division, upon which the system remained the same. It will be seen that while the coal requirements per car per mile increased on the Central division, due to various causes applicable to both, by six per cent., they decreased on the Western division by twelve per cent., thus effecting a saving of over 2,500 tons, and a very much larger saving, if it is, as it reasonably may be, assumed that the then prevailing conditions would have warranted the rate of increase which obtained upon the Central division. It is an interesting fact that while the empty engine mileage westward advanced by 37 per cent. on the Central, the advance was 18 per cent. on the Western division, showing the advantage of a better balancing of traffic under the "circular" system. The desirability of low grade railways is of course understood, but a greater regard for the cost of operation, especially in the matter of fuel, would often prevent the construction of lines of railway which are destined from their inception to be unprofitable ventures. It may be safely asserted that the great increase which has taken place within comparatively recent years in the haulage power of locomotives has reduced the rate of coal consumption per unit of work (one ton to one mile). The train mile, that most unreliable standard of work measurement, has in the past unquestionably been the means of encouraging the use of small engines, and thus of interfering with economical operation.

It may, however, be doubted whether improved service in the form of more roomy coaches, frequent trains, and more rapid transport induced by keener competition, has not more than absorbed the savings which might otherwise have been effected. The old 40-feet coach has expanded into the 55-feet car of to-day, with its wash and smoking rooms and other conveniences not thought of twenty-five years ago, so that its weight has been added to, without material or proportionate increase of carrying capacity. The calls upon the locomotive boiler for steam to warm the cars, to apply the brakes, to ring the bell, and to signal the train, could only be effectually responded to by a more frequent resort to the coal bin, and these calls must of necessity be intensified with an increase in the rate of train speed. To reduce the drain upon the boiler, the

compound engine has without doubt been effective, and the use of steam pressure as high as 200 lbs. per square inch, a natural outcome of the compound principle for single expansion engines, has been productive of economy. Additional attempts have been made, with more or less success, to utilize exhaust steam to raise the temperature of the feed water, more attention has been paid to the boiler clothing and to the graduation of the valve "cut off," and slower and more perfect combustion has resulted from the abandonment of double exhaust nozzles and from the use of the extended smoke-box and improved arrangement of the netting and diaphragm plates forming that necessary evil, the spark arrester. Material benefit has been derived from the duplication of main lines in crowded thoroughfares from the correction of grades and from the greater stability and more perfect alignment of the permanent way. More care has also been exercised in design, and specially in regard to the better relative proportions as between tractive force and adhesion, the engines of years ago being very deficient in weight for the capacity of their cylinders.

An interesting comparison may be made as between the years 1875 and 1895, if applied to the central division of the Grand Trunk Railway for the last six months of each year. During both periods the fuel consisted of soft coal, but during 1875 the locomotives were practically all of one type, having cylinders 17 x 24 inches and working with from 135 to 140 lbs. boiler pressure. In 1895 the passenger engines had 18 x 24-inch cylinders, the steam pressure was from 160 to 180 lbs. per square inch, and the freight engines working at the same steam pressure had 18 x 26-inch cylinders. The central division covered 333 miles of railway between Montreal and Toronto, and the train mileage over it exceeded two millions during the six months.

The figures are here given :—

SIX MONTHS ENDED	Passenger trains.			Freight and mixed trains.				
	cars per train.	Lbs of coal per car mile.	Lbs of coal per train mile.	cars per train.	Lbs. of coal per ton mile.	Lbs. of coal per car mile.	Lbs. of coal per train mile.	Tonnage per train excluding engine and tender.
Dec. 31. '75	7.4	6.39	47.57	21.9	.18	2 83	61.87	340
do. '95	4 9	10 57	62.13	25.1	.16	3.37	84.62	517

Turning to the working time tables for this division, I find the schedule rate of speed in the earlier period to have averaged 24 miles per hour for passenger trains, while the average during the latter period was 30 miles per hour, being an advance of 25 per cent. The passenger trains, though composed of fewer cars, did not, though this cannot be actually demonstrated, show a material decrease of weight. As a matter of fact, the larger engines were needed to meet the requirements of faster service, and to secure the comforts and safeguards which during the intervening period railway companies were called upon to provide. As regards freight trains, the average weight has been estimated on the basis of ten tons in 1875 and 12 tons in 1895 per empty car, which together with the actual weight of the contents, and exclusive of the engine and tender, make up the train tonnage, which, it will be noted, has increased in the later period by 50 per cent., a circumstance to which must be attributed the improvement recorded in the rate of fuel consumption per ton per mile. Freight trains were not scheduled in the time tables during the years under consideration, and the average rate of speed cannot therefore be drawn from that source; but dating from the year 1886, very accurate records of averages were kept, and these show that the rate of speed in 1895 exceeded that of 1886 by eleven per cent. It is a fact, however, that the calls upon freight engines for what may be called extra work have not been so numerous or exacting as upon those engaged in working passenger trains, and it is also true that the former have benefited to a great extent by the reduction in delays or train detentions, consequent upon this central division of a practically double track railway. "The greater the tonnage per train the greater the gain," ought to be a good maxim to adopt in dealing with freight traffic, especially with the traffic of those railways which are called in the United States and Canada the "trunk lines," and of which the Grand Trunk is an example. Such a maxim suggests easy gradients and curves, allied with a roadbed and structures of sufficient stability for rolling stock of the maximum carrying capacity, and the observance of such a maxim would yield a profitable return out of all proportion to the necessary increase in dead weight of train, while a reduction would follow in the rate of those operating expenses of which the cost of rolling stock maintenance partially, and wages almost wholly, may be considered as proportional to the number of trains rather than to the tonnage per train. The consideration of my subject from this standpoint suggests a reference to the compound principle as applied to locomotive engines.

In the autumn of 1895 the Grand Trunk Company completed in their workshops at Montreal the construction of two locomotives, of which the first, being No. 567, had a pair of cylinders 18 inches diameter, with a piston stroke of 26 inches, its weight in working order being 100,212 lbs., and which was worked single expansion at a boiler pressure of 190 lbs. per square inch; and the other, No. 326, being of the compound type, having a high pressure cylinder of 19 inches and a low pressure of 29 inches diameter, with a piston stroke also of 26 inches, and carrying a steam pressure of 190 lbs. per square inch. This engine weighed 118,412 lbs. Both engines had three pairs of coupled driving wheels of 62 inches diameter outside the tires, and virtually were of the same design. These engines were placed on that section of the Central division which extends from Montreal to Brockville, 126 miles in length, and for a number of trips the results were accurately kept in order to determine the relative fuel consumption.

A distinction has been made in the table of figures which is submitted, as between the west and the east-bound trips, because the trains composing the former consisted of mixed empty and loaded cars, whereas the east-bound cars were all loaded, also because the gradients are in favor of east-bound trains. The coal used on the trips from Brockville was from the Punxsutawny mines, Pennsylvania, and at Montreal it was supplied by the Dominion Coal Company from their Gowrie mine, Cape Breton. Great care was taken to prevent loss of water or steam at the safety valves, from the injectors, or by priming, so as to ensure as far as was possible accurate comparative results. The trials were made during the months of September and October:—

	Single Expansion.			Compound.	
	394	567		326	
	East.	East.	West.	East.	West.
Train miles	2,000	630	504	756	630
Car "	54,000	33,516	21,042	38,556	26,149
Ton "	1,186,289	875,649	418,792	1,007,914	556,787
Cars per train....	27	52.2	41.75	51	41 5
Tons " " ex engine and tender	593	1374.7	830.9	1333.2	883.8
Weight of loaded car, tons	22	25.8	19.9	26.1	21 5
Coal used, lbs. ..	107,555	71,035	57,280	53,220	48,085
Coal used per train mile, lbs..	53.78	112.8	113.6	70.4	76 3
Coal used per car mile, lbs	2.00	2.12	2.72	1.38	1.84
Coal used per ton mile, lbs.....	.091	.081	.137	.052	.086
Coal used per sq. foot of grate per train mile	3.36	6.18	6.22	3.88	4.19
Water evaporated, lbs.	792,253	394,842	301,292	353,976	309,556
Water evaporated per train mile, lbs.	396	627	598	468	491
Water evaporated per ton mile, lbs.	.668	.451	.719	.351	.556
Water evaporated per lb. of coal, lbs.	7.37	5.56	5 26	6.65	6 44
Water evaporated per lb. of coal from and at 212°	8.81	6.78	6.31	7.98	7.73
Temperature of air, Far.	69.2	53.6	53.4	66.5	72 6
Temperature of feed water	62.73	48 6	48.8	69.1	68 6
Boiler pressure, lbs. per sq. inch	122.6	174	171	175	177
Rate of speed, miles per hour.	19.6	19.2	19.4	21.0	21.8
Engine in steam per 100 miles, hours, minutes.	10.5	8.0	7.4	7.3	7.3
Stoppages per 100 miles	12.9	7 9	8.5	7.6	7.8
Ashes and clinker	12,580	3,600	3,275	3,520	3,235
Per cent. of coal..	11.7	5.07	5.72	6.61	6.72
Fire grate surface, sq. feet.....	16	18.25	18.25	18.25	18.25
Heating surface, square feet	1099.6	1122	1122	1122	1122
Weight of engine in working order, lbs.	70,000	100,212	100,212	118,412	118,412

For additional comparison, I have added another column containing particulars of a trial made in the autumn of 1882 with No. 394, one of the old type of freight engines having cylinders 17 inches by 24 inches, and two pairs of coupled drawing wheels also 62 inches diameter over the tires. The initial boiler pressure in this engine was 140 lbs. per square inch, and the train mileage was wholly in the easterly direction, viz., from Brockville to Montreal.

Comparing the result of the single expansion types, it will be seen that the larger engine consumed less fuel per ton of train per mile by 11 per cent., notwithstanding the inferior evaporative efficiency of its boiler, due to the disproportionate area of fire grate (unavoidable in this type of engine), and in spite of the loss of power due to the extreme length of train. Extending the comparison to the compound engine in the same direction of travel, it will be seen that with a somewhat similar train length and tonnage the gain, expressed as in the previous case, per unit of work over the larger of the two single expansion engines, was 35¾ per cent., and over the smaller of 42¾ per cent., and in respect of westbound trains, the comparison as between the single and compound engines of the same capacity closely approximates to these figures, the difference in favor of the latter being 37½ per cent. A very interesting and instructive feature in these figures is that which shows that a locomotive boiler is not, as ordinarily arranged, capable of economically supplying sufficient steam, under the extreme conditions which obtain on this continent, or perhaps I should say in this country and in the United States.

Train tonnage has increased without, as a rule, a corresponding increase of boiler capacity, and fire grate area and heating surface are generally altogether inadequate to economically fulfil the conditions now imposed upon them. Especially is this the case with the fire grate area, as will be seen by reference to the figures of coal consumption per square foot, per train mile, and those of water evaporated from and at 212° per lb. of coal consumed. It will be seen that the firing of engine 567 was forced to an extent that reduced the evaporative efficiency of its boiler, and although, owing to its heavier train, the engine was able to show a lower rate of fuel consumption than No. 394, the rate was greatly in excess of No. 326, which, on account of the second expansion in the larger cylinder, required less fuel, and was thus able with the same grate area to show a higher comparative efficiency. In running engines 567 and 326 without trains over the same division, it was found that the boiler of the former evaporated from and at 212 deg., 10.09, and of the latter 9.24 lbs. of water per ton of coal. The following figures show the effect of train tonnage upon the consumption of coal per ton per mile, and the effect of the quantity of coal burned per square foot of fire grate per hour and per mile upon the evaporate efficiency of the boiler. In these figures, the engines and tenders are included in the total train tonnage:

Engine No.	Direction of train.	Size of cylinders.	Tonnage of train.	Coal (lbs.) consumed per			lbs. water evaporated per lb coal from and at 212°.	Remarks.
				Ton mile.	Sq. foot of grate area per hour.	Sq. foot of grate area per train mile.		
567	East.	18 x 26	90	.231	27.7	1.14	10.09	engine only.
326	"	19/29 x 26	100	.2??	36.8	1.31	9.24	do.
394	"	17 x 24	666	.081	65.8	3.36	8.81	
326	"	19/29 x 26	1433	.049	81.5	3.98	7.98	
326	West.	19/29 x 26	984	.077	89 3	4.19	7.73	
567	East.	18 x 26	1465	.076	118.6	6.18	6.78	
567	West.	18 x 26	920	.125	120.7	6.22	6.31	

In boilers of more recent construction for burning soft coal, the much desired increase of grate area has been obtained by raising the level above that of the frames, thus securing greater width and allowing of an extension over the rear drawing axle. Such an arrangement adds materially to the weight of the engine, but the grate area can be doubled. It is fairly well established that a well designed locomotive on the compound principle will effect a saving in steam, under equal conditions of 20 per cent., and thus it would seem that further economy in coal consumption lies for the present in that, rather than in the direction of abnormal increase in the weight of engines which now sufficiently tax the endurance of existing roadbed and structures.

And in closing, gentlemen, it remains for me to thank you, and I take this opportunity to thank you again for the honor conferred upon me in my election to the presidential chair, and for your confidence during my year of office. That the year 1896 has not been without its peculiar anxieties and responsibilities, you

will all probably understand, but the ready and cordial co-operation of the council has made these comparatively light. To these gentlemen and to the office-bearers I tender my best thanks. I need scarcely say that though my responsibilities will be lighter, my interest in the society's welfare will not abate, and I venture to hope and to believe that this new year upon which we have entered will be a happy and prosperous one for the Society as a body, as I wish it may be for each of you individually.

For THE CANADIAN ENGINEER.

SANITARY APPLIANCES.

BY W. M. WATSON, TORONTO.

A lecturer once stated that when he got fully informed touching the climatic influences, he was able to describe in a general way the temper and habits of the people who lived under them. Having a long experience on both sides of the Atlantic, I can bear out the statement when applied to matters adopted for the preservation of the public health.

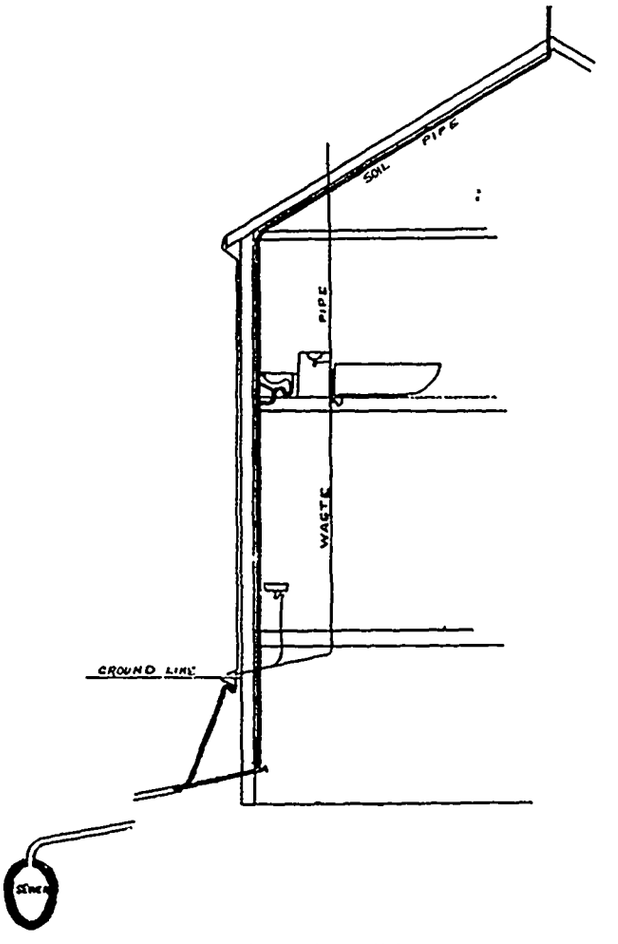
An old British citizen or statesman will move slowly, think hard and try to foresee what will occur in coming years should he give his vote and influence to any proffered scheme. In this climate, which goes to greater extremes of heat and cold, and which is almost void of the soft balmy influence of the salt sea air, the legislator's mind is open to sudden conviction and his vote can often be secured for the support of an influential or wealthy faddist, and in many cases legislation overreaches itself and increases the evils which it aims to stamp out.

Some eight years since an alderman—a trained plumber—got a code of by-laws adopted for Toronto regulating the private drains and plumbing, containing four bad points. I believe they are similar to the rules in force in Chicago, where legislative excesses in this line is a common thing. The result of the enforcement of these four rules has not been to the benefit of the public health, but quite the reverse.

At that time the public officials (parrot-like) erroneously declared that the cause of every contagious sickness was bad plumbing or drains, and so prepared the taxpayer to submit willingly to bear the cost of an unreasonable number of inspectors and increased cost of their sanitary arrangements. We observe that the well regulated municipalities of Great Britain do not unnecessarily put every confidence in their officials, but use their own judgment and keep their positions as employers, and usually legislate to give the greatest good to the largest number at the least possible expense; the result being that the waste of money and human life through the unsanitary surroundings is far less than here, though they have a dense population to deal with.

They properly object to drains being placed near or under any building. They insist that all subsoil is sealed air-tight under dwellings, that the floors of cellars, pantries, kitchens, stables, cattle byres, piggeries, etc., are either flagged or concreted, and that the sidewalks, back lanes, streets and yards are paved, flagged or macadamized, so that they cannot absorb moisture and can be easily cleaned.

They have ventilation grates for the sewers similar to Toronto in the centre of the streets, but their use is very different. They let the atmospheric air into the sewers, whilst ours bring up the foul gases and contaminate the streets. Their sanitary rules are such that it is impossible for even the most inexperienced mechanic to make a serious mistake. They use the shortest length of drain and water-pipes possible to serve the houses, knowing that every foot in length deteriorates its efficiency. They are particular to have every foot of street mains for the public water supply laid and graded in a way that they can be easily and well washed out with a small quantity of water. All their mechanics and workmen are trained to pay proper attention to the smallest details, and a strict rule and method runs through all departments. It is by adopting these principles that the British people enjoy generally good health, almost free from illness caused by inhaling foul gases.



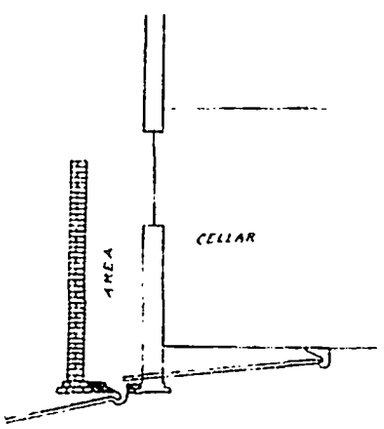
In sanitary as well as in political customs, it is wise to preserve the good points and reject the evil. There are mansions in England, built before the reign of Elizabeth, with small mullioned windows and low ceilings, which had baths, closets, basins, etc., introduced into the houses over a century ago, that are healthier than modern houses. The reason can be found in the substantial and durable way every part and detail was constructed in a plain and simple form; the waste water pipes pass through the walls to the outside at the nearest convenient point, and the elaborate use of stone, concrete and tiles for walls and floors; soft wood, plaster and papering, being avoided. The whole building was constructed of materials that would not absorb moisture or retain foul gases.

What a contrast to our sanitary customs and municipal governments of towns in Canada, where we are allowed to inhale the foul air rising from the unsealed subsoil under our living rooms; the stagnant pools of putrid water under our cellar floors, covered out of sight by decaying planks; from the foul gases discharged from the drains through the street grates; the odors

thrown off the wood pavement and sidewalks. We always appear to favor plans, regulations and ideas that will take the most labor to erect and cause the circulation of the most money.

My first objection to the latest sanitary rules in force in Toronto is the compelling of each house to have a separate drain and a running trap placed near the street line, and a fresh air inlet to the house drain near the front door or window, because it usually takes about fifty feet of sewer pipes from the street line to the first house branch or vertical soil pipe, and the small quantity of sewage delivered from one ordinary dwelling house is not sufficient to keep so long a stretch of poorly graded drain clean, because there is so much friction to overcome that the discharge moves forward sluggishly, and a total stoppage or choke is daily liable to occur.

The separate drain rule is a disadvantage to both the public health and the public sewers. A six-inch sewer pipe will easily serve a block of six houses better than it will serve one; indeed, should the unexpected ever happen, and each of the six houses were discharging its full complement of sewage at one and the same time, the pipe would pass it all easily. The more a sewer is used the cleaner and healthier it keeps, and less sewer gas is created. The best place for sewer pipes to run is along the rear lanes or through the yards, at least six feet from the houses or kitchen walls, handy to receive the soil pipes, leaving the front streets as much as possible for the storm water drains, which should in all cases be kept separate, because when one sewer serves both purposes, it is by far too large to convey the sewage water only.



The simplest and straightest designs of public and private sewers are the best. They should have slowly turned bends and full junctions, giving the pipes, when possible, a good equal grade, and they should be conveyed by the shortest route to the point needed. By so doing the waste water will continue on the run from the time it enters the sewer until reaching the outfall, making it impossible for it to generate any dangerous sewer gas or leave any deposit in the pipes behind it to choke the drain. The drain will never need flushing in this case.

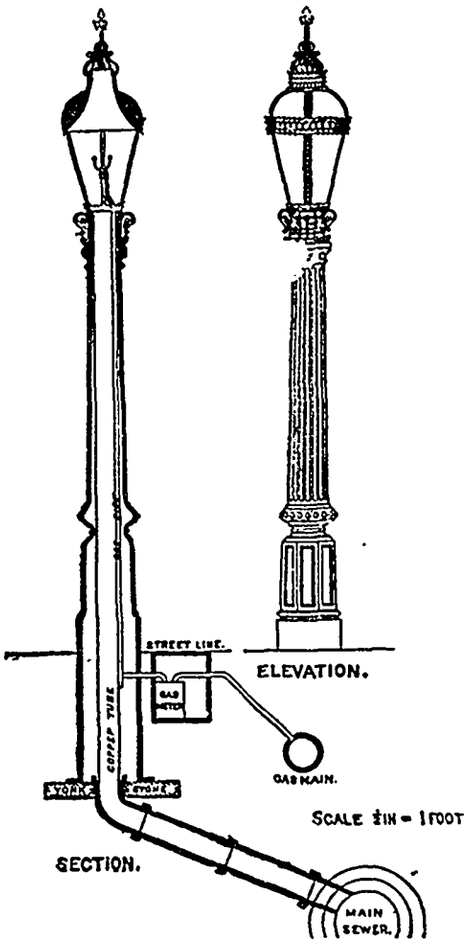
A running trap on the main house drain often acts as a catch-bag, preventing chips, straws, paper and hard material from passing forward to the street drain. A slight impediment causes the trap to choke, preventing the excreta from floating round the dip. The stoppage often remains unnoticed for about a year until the solids fill the underground drain to the first house junction; the liquids during this time are either leaking through a defective joint, contaminating the sub-soil, or worming their way through the solids to the street sewer. It also stops the needed passage of air between the street sewer and the house-top, thus preventing the main sewers from being ventilated. The fresh air inlet near the front door discharges a volume of foul air each time the water closet is flushed, and whenever there is a turbulent atmosphere or a very low temperature. On these grounds this method ought not to be adopted. Nor should a sewer pipe go under any dwelling. The metal soil pipe should always pass through the wall and be connected to the sewer at least five feet from the building.

The next dangerous rule is compelling small traps to be ventilated by a pipe one size less than the trap. The head of the ventilation pipes being open to the atmosphere, makes good evaporators in very dry or frosty weather, and it, soon dries the water out of the small traps if not frequently replenished. The evaporation of two tablespooofuls will break the seal, and allow the sewer gas to be conveyed from the soil pipe through the empty trap into the rooms inside the house. On this ground small traps should not be entirely relied upon, especially for baths which are seldom used. The safest way to handle waste water from small fittings is to place the bottom of the waste pipe over a trapped gully outside the building (see sketch, Fig. 1 and Fig. 4), or if the weather is considered to be too severe in winter then the gully might be fixed in the basement or cellar, the surface being sufficiently below the level of the cellar floor that both the weeping tiles and the cellar drains deliver the water over and on the top of gully-trap, together with all the small waste-water pipes, the rain-water pipe, and the pipe from the ice-box. This method can be made healthy by fixing a hood over the gully with a local ventilation pipe carried to and inserted into the chimney, and be made safe by using a metal pipe and gully-trap (see Fig. 4), the pipe going five feet through the wall before connecting to a tile drain To collect the waste water from all the small traps in the house take 1½ or 2-inch pipe from immediately over the gully-trap placed in the cellar or outside the building, up inside the house and through the roof, and branch a P-trap squarely in, to serve the wash tubs, sink, bath and basins (see Fig. 1); by adopting this method good ventilation is secured and the traps cannot syphon. The usual vent pipes are unnecessary, nor can any sewer gas enter the house even should the trap be syphoned or dried out.

On account of the excreta, the waste pipe from the water closet must be connected direct with the sewer; but there is little danger of the seal of the w. c. traps being broken because they are often used. These traps hold about three quarts of water, and one-third would have to evaporate before the seal is broken, and they cannot evaporate so rapidly as small traps, because the ventilation pipe is only one-fourth the size of the waste pipe. I have already described how to drain a cellar when a gully is fixed in to receive waste pipes, etc. But where there is no such arrangement, the floor of the area around the cellar window should be sunk low enough, be dished and concreted; the gully set in the centre, and both cellar, drain and weeping tiles should pass through the wall and deliver their water over the trap. (See Fig. 2.) On account of the great depth of the area it will not freeze.

By arranging the sewer and waste pipe thus the building is absolutely secured from the risk of collecting sewer gas, because the small waste pipes are not

attached to the street sewers. All public sewers should be designed and constructed so that fresh air can freely circulate through every part, by taking every branch serving a stack of soil pipes out of the crown of the sewer, and continuing each line on an upward grade to above the highest point of the house (see Fig. 1), and similar ventilating pipe from the terminating end of every branch sewer, if there be a building near to fasten it to, and if not erect a hollow pillar to answer the same purpose, or use a gas pillar similar to Fig. 3. Grates must be fixed in the crown of the streets at short periods, especially over and at the lowest point of any dip in the drain and at the lowest end of short streets connected to the drains, for the purpose of providing an intake of atmospheric air to pass down into and through the sewer and up each soil pipe to the house top, out of harm's way. This gives an efficient ventilation at short periods, each house having a w. c. taking its fair share.



It is better policy to use sufficient forethought in laying, constructing and ventilating public sewers in a way that poisonous gases cannot possibly generate or in any way come in contact with our breathing organs, than it is to employ an army of men to fight the mischief so unwisely created. Intricate fittings and self-acting machinery cannot be made reliable for sanitary purposes. All public sanitary arrangements should be constructed on the plainest workable plan, in such a way that the parties using them can easily understand their workings.

Walls, ceilings and floors of lavatories and bath rooms should be either cemented, tiled or painted, making them moisture proof. All the fittings should be open, and easily inspected and cleaned.

The bathroom should have a proper system of ventilation besides the window and the local vent near the w. c. seat. Wherever the property is so poor that it cannot afford to go to the expense of safely erecting sanitary appliances in living apartments with proper materials, then for the good of the public health the water closets should be outside the building.

As this climate is too severe for outside water closets to work smoothly, the pail system of privies might be adopted in their place, which is as odorless and efficient when properly erected, and afterwards managed and kept clean, also less repulsive in appearance than many water closets. Under many of the

closed seats of common cheap water closets there is at present an accumulation of filth and putrid water sufficient to cause a fever, and the soft wood work around the water closet and bath is loaded with poisonous moisture, which emits such a strong odor that the bath-room window is kept open, thereby increasing the evil, because the incoming air drives the poisonous atmosphere of the bath-room into the adjoining bedrooms when the door is open.

Water pipes and traps should not be packed or surrounded with sawdust, because the sawdust and all other vegetable fibres will attract damp, and whatever attracts damp will also attract frost, and also create foul odors. To prevent traps freezing, they should have a casting of plaster of Paris or Portland cement around the dip or water seal, and water pipes could be prevented from freezing by being encased with a thick rubber pipe stocking, carefully sealed at each end to prevent the inlet of cold air.

When it is necessary to flush public sewers, water should be dropped into the drain in bulk; one hundred gallons of water suddenly dropped into a fifteen-inch pipe sewer will run through it in bulk for a long distance like a ball, driving every particle of dirt and foul air before it, and does more useful good than thousands of gallons of water passed into the same sewer by a three-inch hose, which will pass over and by any hard accumulation adhering to the bottom of the sewer pipe.

TO THE NORTH POLE FROM CANADA.

The fact that Nansen has gone 170 miles nearer the Pole than any previous explorer, and that the polar region is a more or less open sea, has stimulated interest in this fascinating theme. There is a growing conviction among many devoted to this subject that the most certain route to the north pole will be out of Canada, and that some hardy Canadians will be "the first that" shall "ever burst into that silent sea." It was no doubt this faith that inspired W. Chipman, L. Stewart, and others in the Association of Ontario Land Surveyors, to form a Committee on Polar Research, and we are glad to learn from the report presented at the associa-

tion's meeting in February that, though they had not been able to make much advance, the committee was not inactive during the past year.

J. W. Tyrrell, chairman of the committee, interviewed the Minister of Marine and Fisheries, on learning of the projected Government expedition to Hudson Bay this year, in the hope that arrangements could be made to have a small party accompany the expedition, but he was informed that he would have to apply to the Minister of the Interior. This he did, suggesting that a small exploring party be sent with the expedition, to be landed on the east shore of Fox Channel and to work along the coast to the north while the expedition proceeded on its own work; a second season, if possible, to be devoted to the west shore of Grinnell Land. Hon. Mr. Sifton replied that he was unable to expend anything on the project this year, but might "be able to do something in the direction suggested in the future." It appears to us that the Government have here lost a golden opportunity of acquiring valuable information about a practically unknown region of Canadian territory, as well as aiding the cause of science, at the merest trifle of expense, but it is to be hoped the Government will appreciate the value of this opportunity next year.

The committee considers that the results of Dr. Nansen's expedition show that the model of the "Fram" settles the problem of dangerous ice navigation, and Nansen "has proved most conclusively by his three years' experience, which was entirely free from disaster, that it is possible to spend a healthy and cheerful, if not a pleasant existence, even amidst the solitary darkness of a polar night. Nansen's expedition sailed from the coast of Norway in the summer of 1893, and on the 22nd September of that year, when north of the Siberian Islands, entered the polar pack, with which for nearly three years it was to drift in a westerly direction. On the 14th March, 1895, after spending a year and a half in the pack, Nansen and Johansen stepped over the side of the "Fram," and accompanied by a number of dogs and 100 days' provisions for themselves, set out over the frozen sea for the pole. They did not reach it, but they reached lat. 86° 14′ N. on April 7th, and after five months' travel over the ice, and experiencing many hardships and escaping many dangers, they returned to the shores of Franz Josef Land, where they arrived August 8th, 1895, and where for the ten succeeding months they lived in a hut 10 x 6 feet, built of stones and covered with walrus hide. During this time they subsisted entirely on polar bears and such other animals as they could kill. In June, 1896, while attempting to reach Spitzbergen over the drifting pack, they happily fell in with the Jackson-Harmsworth expedition near Cape Flora, and thence were taken to the coast of Norway.

Besides sentimental reasons there are many practical reasons why judicious polar exploration should be prosecuted. It is well known that for many years the northern portions of the Hudson Bay have been favorite whaling grounds. Several New England vessels have made Marble Island, in the north-west part of the bay, their regular winter quarters for the purpose of getting at the whales when the ice breaks up in the spring. For years an American vessel wintered at Spicer's Harbor, on the north shore, for the same object, and accumulated much wealth. When it is considered that a single Right whale is valued at $10,000 to $20,000 in oil and bone, it will be seen that the business has great possibilities. Regarding other forms of marine life, Mr. Tyrrell says, "I have observed the surface of the water, as far as the eye could reach from the deck of a vessel, appear an undulating sheet of white, caused by great schools of white whales. This species of whale, in the adult state, is about 14 feet in length and is valuable for both hide and oil. Great numbers of them are captured by the traders of the Hudson Bay Co., and their products are shipped to England. Walruses are also found in great numbers in various parts of our north seas. I have met with many large herds of them, usually in shallow water and in the vicinity of sandy shores, where they feed on clams which they dig up from the sand. A walrus hide, the weight of which averages 300 pounds, is valued at 10 cents a pound, which, together with the ivory tusks, places the value of one animal at $30 to $40. Hence a few hundred walruses alone would form a cargo of no mean value. Besides these there are nar-whales, porpoises, several varieties of seals and many species of magnificent fish, all of which are of much commercial value."

As to furs, the fact is recalled that the Hudson Bay Co. has for the past 200 years been making untold wealth out of the fur products of these districts. "At one station alone," says Mr. Tyrrell, "it is not an uncommon event for the Eskimos, in one season, to bring down from the north 300 or 400 skins of musk oxen, besides many others of polar bears, Arctic wolves, wolverines, foxes, etc. I have myself seen the richest of furs stacked by the Eskimos like haystacks upon the shore, to await transportation to the Hudson Bay trading posts. At one locality I visited in 1885 the Eskimos had trapped over 1,000 white foxes, besides many wolves, wolverines and colored foxes."

As to minerals there is no reason why the limitless rocky plains of the north should not be found to contain as many and as rich mineral tracts as have ever been discovered in the temperate or torrid zones. In fact they have been discovered, and beyond doubt many more rich ones await the arrival of the explorer and the prospector.

From a scientific view there is much to be gained by judicious exploration in the arctics, and the following among other branches of science may be pursued with fruitful results in this broad realm of mystery: Geology, geography, ethnology, zoology, botany, meteorology, oceanology and terrestrial magnetism. In conclusion the committee quote the opinion of Admiral A. H. Markham that "no more important or interesting work associated with polar research can be conceived than the exploration of that vast unknown region situated between Wrangle Land and Prince Patrick Island, and the connection of the latter with Aldriches in Grant Land." Now this unknown and most interesting region lies within the Dominion of Canada, but what are we as Canadians doing to establish our claim or to lift from it the enveloping cloud of mystery?

"Up! up! Let us a voyage take,
Why sit we here at ease?
Find us a vessel tight and snug
Bound for the Northern Seas!"

UNITED STATES MINERAL AND METAL PRODUCTION IN 1896.

Products.	Customary Measures	1895. Quantity. Customary Measures.	1895. Quantity. Metric Tons.	1895. Value at Place of Production. Totals.	1895. Value at Place of Production. Per M. Ton.	1896. Quantity. Customary Measures.	1896. Quantity. Metric Tons.	1896. Value at Place of Production. Totals.
NON-METALLIC.								
Abrasives:								
Corundum and emery	Sh. T.	385	349	$56,400	$161 60	372	361	$55,189
Garnet	Sh. T.	2,065	1,873	93,350	50 00	2,365	2,135	97,350
Grindstones	Sh. T	36,38)	33,004	290,378	8 49	31,865	30,972	282,538
Millstones	Sh. T.			8,525				13,452
Tripoli and inf. earth	Sh. T.	1,788	1,622	26,049	16 00	2,012	1,955	26,207
Whetstones	Sh. T.	1,609	1,459	78,303	53 67	610	553	29,309
Alum	Sh. T.	75,000	68,025	2,225,000	32 70	75,000	72,900	2,225,000
Antimony ore	Sh. T.	1,083	982	37,905	38 60	150	145	4,750
Asbestos and talc:								
Asbestos	Sh. T.	1,010	916	11,400	11 35	716	696	12,670
Fibrous talc	Sh. T.	66,500	60,316	665,000	11 03	50,000	45,260	500,000
Talc and soapstone	Sh T.	18,885	17,129	361,353	21 00	7,219	6,990	64,595
Asphalt	Sh. T.	14,300	12,970	300,000	23 13	4,500	4,374	90,000
Asphaltic limestone	Sh. T.					700	680	3,500
Bituminous rock	Sh. T	43,778	39,707	143,456	3 61			
Bit. sandstone	Sh. T.					17,000	15,422	68 000
Barytes	Sh. T.	20,255	18,371	99,020	5 39	18,000	16,329	86,543
Bauxite	L. T.	14,145	14,371	56,580	4 00	15,000	15,240	
Borax	Lbs.	13,506,356	6,126	742,850	121 09	15,181,890		759,094
Bromine	Lbs.	394,854	179	102,662	573 53	550,285		143,074
Cement, nat. hydraul.	Bbls. *a*	7,694,053.	1,047,006	4,597,285	4 30	6,728,103		3 629,666
Cement, Portland	Bbls. *b*	749,059	135,879	1,430,089	10 53	1,684,261		1,790,772
Clay, refractory	Sh. T.	3,750,000	3,401,250	4,500,000	1 35	3,750,000	3,401,250	4,500,000
Clay, kaolin	Sh. T.	30,910	28 035	258,431	9 22	29,056	28,242	219,732
Coal, anthracite	Sh. T.	58,362,985	52,965,538	89,948,699	1 69	51,580,928	46,794,218	79,434,629
Coal, bituminous	Sh T	*h*137,398,347	126,627,141	125,344,248	4 00	141,720,099	128,568,474	127,548,089
Coke	Sh. T.	9,927,348	9,006,090	15,258,935	1 69	10,372,624	9,410,044	15,973,840
Cobalt oxide	Lbs.	6,400	3	8,640	2,880 00	12,825	6	16,672
Copperas	Sh. T.	14,118	12,805	69,846	5 46	11,108	10,796	53,112
Copper sulphate	Lbs.	45,000,000	20,412	1,350,000	66 13	45,000,000	20,412	1,350,000
Chrome ore	L. T.	1,450	1,473	16,795	11 39	323	293	3,670
Feldspar	L. T.	22,195	22,550	104,082	4 67	19,923	20,241	103,599
Fluorspar	Sh. T.	4,000	3,628	36,440	10 04			
Graphite	Lbs.	392,008	178	17 640	9 95	450,000		20,250
Graphite, amorphous	Sh. T.	1,100	998	4,700	8 00	574	557	3,850
Gypsum	Sh. T.	298 572	270,804	974 219	3 60	248,869	241,900	867,071
Iron ore	L T.	16 950,000	17,221,200	29,662,500	1 72	17,000,000	70,272,000	32,300,000
Lime	Bbls. *c*	160,000,000	5,443,164	30,000,000	5 50		5,443,164	30,000,000
Magnesite	Sh. T.	2,200	1,995	14,700	7 39	2,067	2,592	13,435
Manganese ore	L T.	14,883	15 121	92 044	6 12	7,303	7,419	69,585
Mica, ground	Lbs.	750,000	340	31,956	94 00	772,000		33,332
Mica, sheet	Lbs.	6,200	3	6,400	2,133 00	3,000		3,150
Mineral wool	Sh. T.	6,742	6,115	69,481	11 36	7,659	7,444	82,814
Monazite	Lbs.	1,900,000	862	114,000	132 40			
Natural gas				12,000,000				10,000,000
Paints, mineral	Sh. T.	47,084	42,705	1,086,767	25 40	75,219	73,112	1,070,556
Paints, vermilion	Sh. T.	118	107	118,190	1,105 00	96	93	94,677
Paints, white lead	Sh. T.	95,389	86,537	9,061,965	104 00	89,313	87,688	7,378,332
Paints, zinc oxide	Sh. T.	22,690	20,498	1,588,300	77 43	16,799	15,239	1,595,905
Petroleum (crude)	Bbls. *d*	50,652,025	6,420,742	42 547,701	6 60	46,795,760	5,731,920	42,116,184
Phosphate rock	L. T.	831,498	844,802	2,577,643	3 00	312,718	317,721	1,059,655
Marls	L. T.	217,700	221,183	587,790	2 67	155,000	157,480	418,500
Precious stones				250,000				200,000
Pyrites	L. T.	81,000	82,296	353,160	4 29	73,822	75,003	186,698
Salt, evaporated	Bbls. *e*	12,521,498	1,539,178	5,844,348	3 78	10,958,751	1,391,349	5,432,105
Salt, rock	Bbls. *e*	1,367,638	173,662	518,740	2 99	1,157,000	146,998	138,840
Silica, sand and quartz	L. T.	523,640	532,018	553,128	1 04	634,355	644,504	992,676
Slate, roofing	Squares	645,361	190,277	2,062,239	10 83	537,063	179,021	1,726,790
Slate manufactures	Sq. ft.	3,786,599	11,170	369,062	33 00	2,267,424	7,558	285,803
Soda, natural	Sh. T.	1,900	1,724	47,500	27 56			
Soda, manufactured	M. T.		167,000	3,841,000	23 00			3,500,000
Stone, limestone (flux)	Sh. T.	3,390,000	3,444,240	2,542,509	0 74			2,500,000
Stone, marble	Cu. ft.	6,942,533	568,593	4,086,261	7 18	6,116,847		2,729,727
Stone, onyx	Cu. ft.	800	66	10,750	163 00	500		5,000
Other building stones				33,000,000				30,000,000
Sulphur	L. T.	1,650	1,676	126,950	15 75	1,500		100,000
Est. prod. unspecified				5,000,000				5,000,000
Total non-metals				437,383,364				410,999,987
METALS.								
Aluminum	Lbs.	900,000	408	495,000	1,213 23	1,300,000		520,000
Antimony	Sh. T.	433	393	68,847	175 28	596	579	83,440
Copper	Lbs.	386,453,850	175,294	36,944,988	210 76	453,824,000		48,786,080
Gold	Ozs. *f*	2 265,612	*j*70,470	46,830,200	*j*664 60	2,757,620	85,773	57,000,000
Iron, pig	L. T.	9,446,308	9,597,449	108,632,542	10 77	8,768,869	8,909,000	87,688,690
Lead, value at N.Y.	Sh. T.	156,854	142,298	10,132,768	71 20	175,717	159,410	10,472,733
Platinum	Ozs. *f*	150		2,250		150		2,250
Quicksilver	Flks. *g*	33,978	1,179	1,313,589	1,114 00	33,012		1,222,444
Silver, commercial value	Ozs. *f*	46,331,235	*j*1,441,087	30,254,296	20 99	45,465,173	1,414,148	30,461,665
Zinc (spelter)	Sh. T.	81,858	74,245	5,942,890	80 04	77,084	74,925	6,074,219
Total metals				240,617,370				242,311,481
Grand totals				678,000,734				653,311,468

(*a*) Barrels of 300 lbs., (*b*) 400 lbs., (*c*) 200 lbs., (*d*) 42 gals., (*e*) 280 lbs. (*f*) Troy ounces. (*g*) Flasks of 76½ lbs. (*h*) Bituminous coal includes brown coal and lignite. The anthracite production is the total for Pennsylvania, Arkansas, and Colorado. (*j*) Estimated. (*k*) Kilograms.
Abbreviations—Sh. T., short tons (2,000 lbs.); L. T., long tons (2,240 lbs.); M. T., metric tons (2,204.6 lbs.); Sq'es, squares (100 sq. ft., lapped and laid).

THE PULP QUESTION.

THE CANADIAN ENGINEER has taken the position that Canada should manufacture its own wood-pulp. The growth of the wood-pulp industry is one of the marvels of recent times, and, in addition to the manufacture of paper, there are now over 100 distinct lines of manufacturing in which wood-pulp is the raw material, and year by year the uses of this material are increasing in variety and importance. It is only in 1881 that the wood-pulp industry figures in the Canadian census returns. The mills in Canada then had an invested capital of $92,000, and the annual product was valued at $63,300. By 1891 they had developed into an invested capital of $2,900,907, with an annual product of $1,057,810. Since then several new mills have been established devoted exclusively to the export trade, the Canadian pulp having attained a high reputation in England and elsewhere, while vast quantities of pulp logs are shipped to the United States, where it is used by the American paper mills in preference to pulp wood of American growth. English and American paper manufacturers have found that Canadian pulp makes a stronger paper, and is capable of a higher finish than the pulp of Norway and Sweden, which heretofore was almost exclusively used. So marked is the difference in quality between Canadian and Scandinavian pulp that the former brand now brings from $4 to $5 more per ton and has the preference even at that.

It is to be feared that our governments have not realized the enormous value and the almost unlimited prospects of the pulp business, but the fact is that Canada has the pulp and paper business of the world in her control, and the only question remaining is whether she shall give this away, or keep it for herself. The facts are very simple, if not generally familiar. The spruce tree, which is the best suited of all trees for the production of wood-pulp, grows in Canada to a perfection not attained in any other country in the world. We speak of course with reference to the adaptability of Canadian spruce for the particular industry of paper-making, and other products from pulp.

In conversation with a Canadian paper manufacturer of wide experience, we learn that the qualities of Canadian spruce are derived from this particular feature of the climate in the great spruce belts of Canada—that at the close of a comparatively hot summer the advent of winter puts a more sudden stop to vegetation and growth of fibre than in any other climate. Other climates grow spruce, but the advent of winter is slower, and this gradual and partial cessation of vegetation leaves a fibre that is too hard, while the tree grows too knotty for the best quality of pulp. In the spruce belts of Canada vegetation is completely dead in the winter, and its sudden restoration in the spring is equally favorable to the maintenance of that precise quality required for first-class paper. Now the forest area of Canada is 1,248,798 square miles, and exclusive of the spruce belts of New Brunswick, Nova Scotia and Quebec, there is a tract of land extending from the shores of Labrador on the east to the North-West Territories on the west, and from the northern settlements of Ontario and Quebec up to the shores of Hudson Bay, and this vast area is more or less timbered with spruce of capital quality for pulp making. The spruce tree will grow to maturity in from twenty to twenty-five years, and thus it requires only careful management and a wise policy to make Canada the future headquarters not only of the pulp-making industry, but of paper manufacturing and other industries having pulp as their raw material.

We do not advocate the imposition of a heavy export duty on pulp logs as a mere act of retaliation against the United States. We urge it simply as an act in our own interest, designed to promote home manufactures, and to put our own trade in the position which nature has designed for us. Nature has marked out Canada as the great pulp and paper manufactory of the world, not only because she has given us enormous quantities of the best raw material that there is in the world, but because she has given us the colossal water powers, the hardy labor population and cheap water transportation required to develop it.

We only require a firm and judicious policy on the part of the Dominion Government to put the pulp and pulp-wood industry in such a position that within ten years millions of dollars of new capital will be invested in it, and Canadian pulp, paper, and other pulp-wood products exported to every leading country in the world.

THE CANADIAN ELECTRICAL ASSOCIATION.

A meeting on June 2nd, 3rd and 4th of the Canadian Electrical Association at Niagara Falls, Ont., promises to be one of unusual interest and benefit to the members who can arrange to be present. At a meeting of the executive committee, which was held at Niagara Falls on Saturday, the 27th ult., a general programme was outlined by Wilfrid Phillips, manager of the Niagara Falls Park and River Railway, which presents most attractive features to those interested in the important electrical developments of which Niagara Falls is at present the centre. The meeting of the association proper will be held in the large banquet hall of the Dufferin Cafe in the Park, which is most conveniently situated to the convention headquarters at the new Hotel Lafayette. Papers on various timely and interesting subjects have been asked from engineers and central station managers, and the programme in this respect should be especially interesting. It is the desire of the president, John Yule, to give the papers read before the association such a practical turn as will make them of real benefit to the central station manager in connection with the various problems which he has to meet from day to day in the successful and profitable operation of his plant. As a large part of the incentive to attend this year's meeting of the association lies in the fact that it is being held at Niagara Falls, arrangements are being perfected by which an opportunity will be afforded for the complete inspection of the various electrical enterprises now in operation or under construction in the neighborhood. Amongst these will be a trip over the Niagara Falls Park and River and Gorge Railway routes, an inspection of the Cataract Construction and the Hydraulic Co.'s plant, and also of the group of electro-chemical manufacturing establishments, which are now becoming the most important industrial application of the Niagara Falls water-power. In view of the widespread interest displayed in the operation of the transmission plant to Buffalo from the Falls, arrangements are being made for a trip over the line of the Buffalo and Niagara Falls Power and Railway Co., to where the rotary converters now in use are transforming 1,000-h.p generated by the electric current machines in the Cataract Construction Co.'s power house, to 550-volt direct currents for use on

the Buffalo Street Railway system. Invitations have been issued to prominent engineers and other gentlemen connected with electrical interests to be present at the banquet, which is to be held in the Dufferin Cafe, and arrangements for some pleasing and unique decorative effects have been made. The free use of the Niagara Falls Power and River Railway is offered to members of the association, and the same courtesy has been extended by the roads on the American side.

In view of the fact that the convention of the National Electric Light Association of the United States is to be held at Niagara Falls, in June, to be followed later on by that of the Street Railway Association, the meeting of our Canadian Association at the same place this year is most timely, and should be taken advantage of by those interested in electrical developments in the Dominion, as a most favorable opportunity of inspecting the progress made in developing and utilizing by electrical means the energy of the world's greatest water-power.

THE FEDERATED CANADIAN MINING INSTITUTE.*

During the session of the Federated Mining Institute, Montreal, the chair was occupied by the President, Major R. G. Leckie, Torbrook, N.S., whose executive ability and kindly manner did much to facilitate the transaction of business. In his address at the opening of the convention, he said:

"The effort to bring together, in one federal body, the several mining societies of our different provinces, is fully justified by the results which we now see. Around us here are met men from every province in the Dominion. Engineers of high technical training and extended experience; explorers who have shown pluck and endurance in their tireless search for croppings; miners who have developed the discoveries, and metallurgists who have extracted the refined metals from the ore.

"Mining and metallurgy are among the most important industrial arts, and, therefore, the importance of the Federal Institute is readily seen, and the necessity of its organization could not be called in question."

Every profession has its individual, and, perhaps, exclusive society. Every branch of industry and commerce has its organization, and craftsmen and laborers vigorously maintain their own unions. Our institute, as you know, is a federation of provincial mining societies, which in their own limited spheres have been of great service to their members, both from a technical and commercial point of view, besides promoting a spirit of social good fellowship. This Federated Institute will carry their work to a wider sphere, extending from ocean to ocean, and discuss matters from a broader point of view. The provincial societies will still have their own immediate affairs to look after, which in many respects are practically of greater importance. The titles to lands, conditions and terms of mining leases, laws regulating the workings of mines and employment of labor, all come within the sphere of the Provincial Legislature, likewise local taxation, the encouragement and regulation of technical education and other such matters. The Canadian Mining Institute will, we take it, devote itself more to technical and scientific matters, as the syllabus now before us shows. It contains a list of papers of the highest interest and practical value, which would do much credit to any similar association in the world.

* Abstract from the President's address.

THE paper which appears in this issue on the sanitation of Toronto is one of serious import to the people of the Queen City, and other authorities besides Mr. Watson regard the present plumbing and drainage system as wrong in principle in more than one respect. In some cases, at least, the so-called fresh air "inlets" connected with the house drains may be more correctly described as sewer gas outlets, and while the present system and the abomination of cedar-block paving are continued, the health of Toronto is certain to go from bad to worse. Twice this spring have the schools been closed, owing to infectious diseases. Contrast the record of Hamilton, where the English system of sanitation is followed, and that of Toronto, which has looked to Chicago as its model. The report of the Registrar-General for 1896 is not yet to hand, but the figures for 1895 show that the deaths from typhoid fever and diphtheria in Toronto were at the rate of one in each 955 of the population, while the deaths in Hamilton from the same diseases were at the rate of only one for each 2,200. These are the cold facts, and the sooner the city authorities squarely face them the better it will be for the future reputation of Toronto.

THE present number closes the fourth volume of THE CANADIAN ENGINEER. The editors and publishers thank the friends of the paper for their hearty support in enabling it to attain its present position. During the coming year a number of papers and articles of special interest are being arranged for, among which may be mentioned a series of articles on railroad engineering by Prof. Cecil B. Smith, of McGill University. An index for volume four is now ready, and will be mailed free to any subscriber who wishes to bind the paper.

A NUMBER of topics to which we promised to refer in this number have been left over for our next issue, owing to the pressure on our columns, due to the fact that this is the final number of the fourth volume. Among them are papers on "The Mines of Ontario," "Irrigation in the North-West Territories," etc. We have also held over articles on "The Ottawa Valley Canal," "Steam Heating," etc.

THE CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

A joint meeting of the Ontario Association of Stationary Engineers and the Canadian Association of Stationary Engineers was held in Toronto on St. Patrick's Day, to consider the question of federal legislation in the interests of stationary engineers. A committee was nominated for the purpose of framing a draft bill. The representatives of the O.A.S.E. on this committee were: A. Ames, president, Brantford, Fred. Mitchell, vice-president, London; A. M. Wickens, acting registrar, Toronto, and Robert Mackie, treasurer, Hamilton. The representatives of the C.A.S.E. were: Jas. Devlin, executive president, Kingston; Wm. Norris, Hamilton; C. Moseley, John Fox, G. C. Mooring, James Milne and Wm. Cross, Toronto. The committee are now making the draft of a bill which is to be presented to the Dominion Parliament at the present session.

HAMILTON NO. 2, C.A.S.E.

Hamilton, No. 2, held an open meeting March 19th. Mr. Ballard, Inspector of Public Schools was present, and gave an interesting lecture on "Decimals and Fractions," which was thoroughly enjoyed by all present. Mr Edwards, architect, also made a few remarks, stating that in the near future he would give a paper on "Mechanical Drawing." W G. Blackgrove, past president executive council, was present and gave a short address. The membership certificates were handed to the members by W. Norris, who presided at the meeting. The annual dinner of the Hamilton Branch will be held April 15th.

ADVANTAGES OF COMPRESSED AIR.

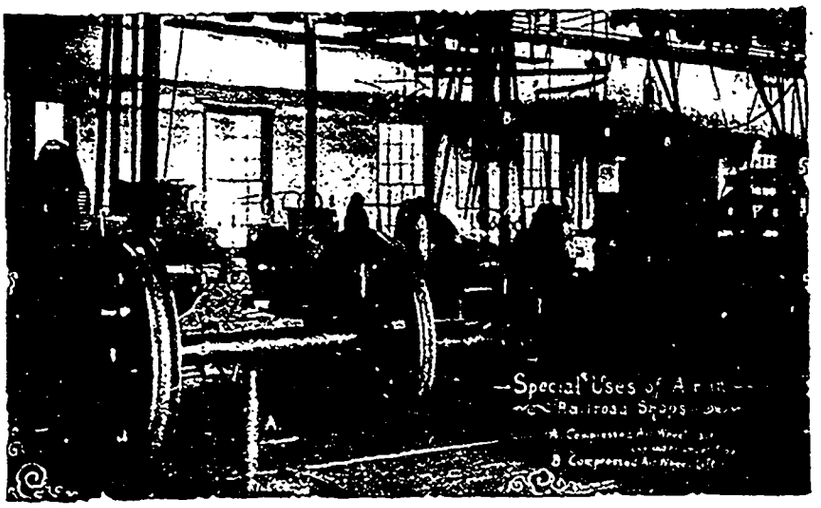
BY JAMES F. LEWIS, CHICAGO

Concluded from last issue

J. H. McConnell, superintendent of motive power of the Union Pacific Railway, furnishes the following interesting and reliable figures showing what can be done by the use of compressed air in shops. He says "The many savings through the use of air in shops of the Union Pacific system aggregate $10,000 per year in labor alone. Savings per day:

Putting wheels in wheel lathe, three lathes in the shop, an average of one change a day, saves one man in handling this work $1 60

Hoisting steel tired wheels and axles in lathe, an average of six changes a day, saves one hour in time, twenty cents, and one man less to handle the work, $1.60..... 1 80



Hoisting axles into cut-off lathe, an average of ten changes a day, saves one hour per day in time..... $0 25

One large boring mill averages two changes a day, $1.60, saving of time of thirty minutes and the use of one helper, fifteen cents..... 1 85

Handling cylinders in large boring mill and planer, saves the labor of one man and one-half hour each change 1 60

Three men working on pistons, etc., in raising them from the floor to the bench, serving three machinists, saves one helper a day..... 85

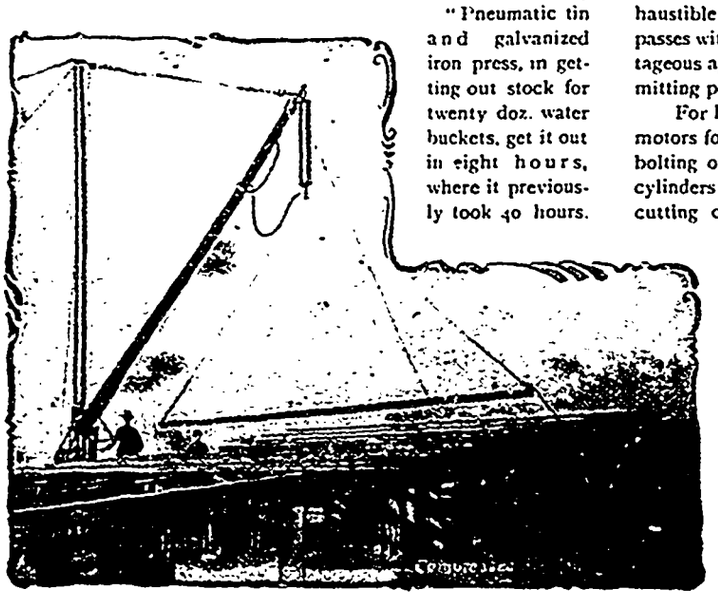
Raising chucks, face plates, and other heavy work, air hoists in the machine shop, saves one helper a day 1 50

Lifting driving wheels and other heavy work on the large slotting machine saves the time of one man and twenty minutes..... 1 50

In applying cylinders on boilers, saves one machinist and helper's time of ten hours..... 2 40

Facing valves, saves helper's time of four hours..... 60

Pressing on driving wheels and axles, etc., three less helpers one hour each..... 45



"Pneumatic tin and galvanized iron press, in getting out stock for twenty doz. water buckets, get it out in eight hours, where it previously took 40 hours. In making brake shoes, stamping a loop to have casting run on, previously one man would do 200 in a day, where he now does 600. All work on this machine saves in the neighborhood of from fifty to sixty per cent. Running foundry elevator with the air hoist saves twenty-five per cent. of one man's time. Saves seventy-five per cent. time putting in stay bolts in a fire box by using air motor for tapping out holes and screwing in bolts. Save in the neighborhood of fifty per cent. by using pneumatic hammers for caulking both flues and boilers. Take engines in and out of round house when necessary to change them, save the work of six men pinching, possibly forty-five minutes, not counting the delay of men waiting to go back to work on the engine. Blowing out engines with air, saves a cord of wood, besides the inconvenience and delay, as the men cannot work around a hot engine to advantage. Handle all engines on the transfer tables, now run by air, previously run by crank. One man does now what six did before. Where six men move a foot in a minute, air motor under like conditions will move twelve feet. As this is moved several times a day; this is in itself a great saving. Pneumatic hoist for unloading scrap at the foundry. The old method took six men ten hours; under the same conditions with the hoist, two men will do it in four hours. Unloading a car of wheels it takes six men half an hour, now three will do it in fifteen minutes. Sandpapering off a fifty 100t baggage car by hand took in the neighborhood of sixty hours, now it takes fourteen hours with the sandpapering machine. Air jacks for raising and lowering freight cars now take one man three minutes, where previously it took two men ten minutes. Truck jacks to remove three pairs of wheels takes 1½ hours, the old method takes six hours. Cleaning a car by air saves ten per cent. in time. Air white-washing machine, where it took ten men five days, it now takes four men one day, and a seventy-five per cent. better job. New applications of compressed air are made daily, two of the most recent being an air motor attached to a differential hoist, and a portable stay-bolt cutter, that can be operated in the hands of one man, thus doing away with the cumbersome affair hung on a post."

Geo. D. Brooke, master mechanic of the St. Paul and Duluth Railroad, says: We are rapidly increasing the use of the air in the shape of hoists, air boring machines, air bull dozer for blacksmith shop, air flue welder, and a four inch cylinder air hammer for light forgings, and drawing out the ends of driving and truck springs. It is giving perfect satisfaction and will soon pay for itself in the item of saving in laboring help, independent of shortening the time of doing work.

F. L. Wanklyn, master mechanic of the Grand Trunk Railway system, has been greatly interested in the use of compressed air for a long time, and has made it quite a study so far as he could with the machine that the company was willing to give him, which consists of an old engine taken out of the scrap heap, to which he fitted an air cylinder. He is using air for the following work and says

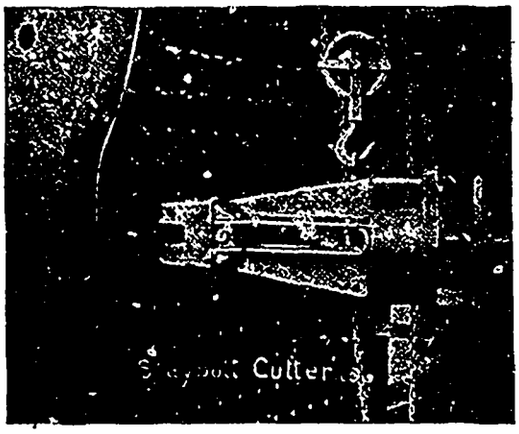
The uses to be found for compressed air seem to be inexhaustible as far as a machine shop is concerned, as hardly a day passes without some suggestion being made for a new and advantageous application of this handy and expeditious system for transmitting power.

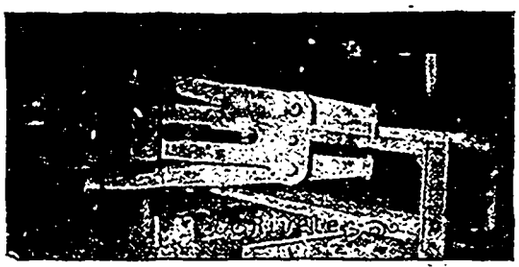
For hoisting; running small reciprocating engines and rotary motors for drilling and tapping, especially in connection with staybolting of fire boxes, also for facing valve seats and re-boring cylinders; breaking stay bolts when removing old inside fire boxes; cutting off projecting ends of new staybolts prior to riveting; chipping and caulking, and driving and snapping tank rivets; whitewashing; operating moulding machines; testing air brake apparatus, and blowing through air and steam pipes, supplying necessary blast in connection with oil gas furnaces for setting and removing tires; supplying blast to riveting fires in portable forges; operating cinder hoist in connection with round house ash pit; operating small pneumatic jacks to take the place of the holder-up in riveting over firebox stay bolts.

In a discussion on the advantages of compressed air at a meeting of the Western Railway Club, E. M. Herr, then master mechanic of the Chicago and Northwestern Railway, now superintendent of motive power of the Northern Pacific Railway, says:

Compressed air is advantageous about a railway shop

for another reason; in this it differs from electricity and has an advantage over it, that is, that when the storage is not being drawn upon the plant can be shut down absolutely and still the reservoir with the power is at hand at all times for use. This is of great advantage in a place where but a small amount of compressed air is used and used occasionally For instance, at night it might be very advantageous to have compressed air at hand for use at intervals, when a compressor that would probably work an hour or an hour and a half at night, would compress all the air that was necessary.





This being stored in the reservoirs can be drawn upon, and the compressor would automatically shut down when the desired pressure was attained. There has been but very little data accumulated from actual practice regarding the cost of making compressed air. We have the following from the A.T. & S.F. railway shops at Topeka:—

Steam pressure	80 lbs.
Air pressure	100 "
Tons of coal of 2,000 lbs per month	155
Cost of coal per month	$139.50
Cost of coal per ton	.90
Amount of free air per minute	1,712 cubic feet.
Amount of free air per day of 10 hours	1,027,584 "
Amount of free air per month of 31 days	31,855,104 "
Revolutions per minute	50
Pounds of coal per 1,000 feet of free air	9.7 lbs.
Cost per 1,000 feet of free air	.00437 c.

The above compressor is fitted with Meyer adjustable steam valve, compound air cylinders with mechanical air valves on low pressure cylinders. Air taken from outside the engine room. The above cost is for the air delivered from the compressor for fuel only, that is, the cost of oil, labor and interest on cost of plant not considered. Steam cylinders 20 by 48 inches, air cylinders 28 and 16 by 48 inches, h.p. 310.

Wm. Forsyth, of the C.B. & Q.R.R., says regarding the cost of compressed air:

We have indicated the engine with the air compressor free, and also when it was compressing air to 80 lbs., and found that it required 40 h.p. We get a horse power with the Corliss engine with 4¼ lbs. of coal per hour, and the air compressor consumes 204 lbs. of coal per hour, and at $3 a ton the cost of a thousand cubic feet of free air compressed to 80 lbs. is 10 cents. With coal at $1 50 per ton, it is of course only 5 cents per thousand cubic feet

Wm. Renshaw, Superintendent of motive power and machinery of the Illinois Central R R. Co., says "We installed at our Burnside shops, about a year ago, a Rand Duplex Corliss Air Compressor with compound air cylinders, and at present are using compressed air for the following purposes: Elevating sand at engine sand house, elevating oil at oil house, hoisting heavy castings and parts, at machine tools, etc., forcing couplings on air hose, operating cylinder boring bar, operating valve facing machine, filling cylinders of hydraulic presses, removing and applying driving tires, testing water pumps after repairs, drilling with motor, tapping with motor, reaming with motor, cleaning boilers, cleaning machinery, punching jacket rivet holes, taking old paint off tin roofs, rolling and beading flues, chipping, cutting, caulking, small bull dozer, elevating water from deep wells, testing air and driver brakes, elevators in store house, operating letter presses, cutting out staybolt stubs, jacking up cars and trucks, cleaning interior of coaches, cleaning upholstered work, burning paint off coaches, painting cars, sand blast ends of cars, gasoline heater, cutting off staybolts, screwing in staybolts, rivet forges, one blacksmith forge, pressing in driving box brasses, operating flange clamp, swedging flues. This is the list to date, but we are finding further use for the compressed air every day, and we could not afford to be without it. I consider it the best means of transmitting power in and about shops: First, on account of the many uses to which it is adapted, and the simple appliances needed in connection with its use. Second, with but few exceptions in the above list steam and electricity could not perform the work without more complicated apparatus, and in a great many instances, air alone is applicable. Third, most of the appliances used are of our own manufacture, and in connection with the pipe line are easily kept in repair by our own shop men. Fourth, there is no element of danger, and the apparatus requires no skilled mechanic to handle same, and it is safe to use in places where steam or electricity might be objectionable. Fifth, it can be carried greater distances without loss than steam, and taking into consideration cost of plant, cost of maintenance skilled help required, etc., it can be produced for less money than electricity. As regards saving made over old methods, would say, taking into consideration all things, that an average all round saving of from twenty-five to thirty per cent. would easily be realized. Take, for instance, the saving effected by use of air hoists alone, which, though hard to figure, will assume large proportions when the amount of labor they take the place of is taken into consideration. We figure a saving of sixty per cent in burning paint off passenger cars, and fifty per cent. in painting freight cars and passenger trucks. This compressor is a duplex, with steam cylinders 20 inches diameter by 30 inch stroke, fitted with improved Corliss valve gear. The air cylinders are compound, 16 by 30 inches low pressure air cylinder, 15 by 30 inches high pressure air cylinder, having an intercooler which carries the air from the low pressure cylinder to the high pressure, through pipes that are surrounded with water, thus cooling the air after the first compression, before it goes into the second compression cylinder. The intake cylinder has a hooded head, arranged so as to take the air from the outside of the building. Whenever required, it gives them the air compressed to 150 lbs., with steam pressure at 80 lbs.

The same type of compressor is used by the St. Paul and Duluth Railway Co., also Atchison, Topeka and Santa Fe Railway Co, also the Michigan Central R. R. at St. Thomas.

In a paper read before the Western Foundrymen's Association by Geo. A. True:—

"Taking a basis of 2,000 ton-feet per day, assuming the operators labor at $2 per day, we have an operating or attending labor of about twenty-five cents per 1,000 ton-feet. The total cost, therefore, of hoisting one ton 1,000 feet will be about thirty-two cents, or in a foundry of thirty tons daily capacity, about sixty-five cents per day, using direct-acting vertical hoists, or roughly, in a thirty ton per day foundry, $5 per day represents the labor of hoisting by hand power, against sixty-five cents per day by air hoists, a saving well worth considering. Making a comparison with hand power, as already stated, the cost of hoisting by manual labor in the foundry under consideration would be not far from $5 per day, equivalent in good times to $1,500 per year. By air it would cost $200 per year, or, if we include interest on the investment, which is only fair, we will have a hoisting cost, when operated by hand-power, of about $1,600, against $380 using air The saving would go far towards purchasing a first-class air plant."

The Massey-Harris Co., of Toronto, Ont., say.—

"We are using this air compressor in connection with burning oil fuel in our smith shop. We have for some years been using oil for fuel instead of coal. Last week the writer spent some hours in the factory of Wm. Deering & Co., Chicago, where they are using compressed air for hoisting cranes, which seems to work very nicely indeed. The heavy flasks in the molding shop and the molten iron are lifted by these pneumatic hoists, as well as the heavier castings in the machine shop. They are also to a limited extent using it for ramming the sand into the molds, etc. I have no doubt it will be used to a very much greater extent in the near future than it has been in the past. So far as using it in connection with

oil fires is concerned, we may say that after some six years experience with oil we would not go back to coal under any consideration. Air is being used very extensively for pumping deep wells, taking the place of the old style deep well steam pump, and in every case it increases the output of the wells from twenty five to seventy-five per cent."

In a recent twenty-four hour test, pumping four St. Peter wells, the following data were gathered :—

"Wells about 400 feet deep. Water standing within about six feet of the top when not being pumped. When being pumped, the water fell to about eighty-four feet. Wells were cased with 6¼ inch I.D. casing. Air pipe 1½ inches. During the twenty-four hours there were 2,016,678 gallons of water delivered, lifting it about ninety-six feet. There was an average delivery of 11.15 gallons of water per horse-power. Cards were taken from the steam and air end of the compressor each hour. Average horse-power of steam cylinders, 125.6 Average horse-power of air cylinders, 116 14, showing a mechanical efficiency of about ninety-two per cent., or about eight per cent. of friction."

We also have the following data taken from one month's report in pumping water from three deep wells

Steam pressure	80 lbs.
Air pressure	68 "
Tons of coal of 2,000 lbs. per month.	106¾
Cost of coal per month.....	$167.60
Cost of coal per ton.....	$1.57
Amount of free air per minute	352.8 cubic feet.
Amount of free air per day of 24 hours	508,032 "
Amount of free air per month....	15,748,992 "
Revolutions per minute	45
Pounds of coal per 1,000 feet of free air.....	13.5
Cost per 1,000 feet of free air	.0106 cents.
Amount of water pumped.....	76,255,000 gallons.
Cost per 1,000 gallons.....	$.002

The above compressor is fitted with Meyer adjustable steam valves, fourteen inches in diameter by twenty-two inches stroke, air cylinders simple, fourteen by twenty-two inches, fitted with mechanical air valves, air taken from outside of engine room. The above cost is for the air delivered from the compressor for fuel only, that is, the cost of oil, labor and interest on plant not considered, h.p. fifty-one

The United States Government made very exhaustive tests before adopting compressed air for the navy. They have recently purchased air compressors for use on board ship, compressing the air to 600 pounds, with eighty pounds of steam pressure. Air is now used on shipboard to operate main engine auxiliaries, auxiliary, fire, bilge and water service pumps, steering engine, anchor engine boat cranes, winches, turret-turning engines, hydraulic cylinders for working guns, ammunition hoists, ash hydro-pneumatic hoists, feed pumps, smoke hose for guns, whistle and siren, to send messages about the ship, to clear a compartment of water when flooded to ventilate, to heat and cool the ship. The ordinary working launch is also run by compressed air. The air is carried in tanks that extend around the boat They have also purchased several compressors for their dynamite guns, using the air at 1 700 pounds pressure, with fifty pounds steam.

The efficiency of compressed air is greatly increased by re-heating before it enters the working cylinder. This has been demonstrated by experiments in our shops, also practically demontsrated in Paris, where air is carried about the city for power purposes by what is known as the Popp system. They claim an efficiency of ninety-two per cent. by re-heating the air, as against seventy per cent. not heated. During an experiment by the writer, in running street cars by compressed air, it was found that the cars could be run eight to ten miles, when the air was re-heated before entering the cylinder, and only four to five miles with cold air. The air was carried in storage tanks at from 600 to 800 pounds pressure being passed through water heated to 360 degrees, to a reducing valve, and used in the cylinders at from fifty to one hundred and fifty pounds pressure, according to the grades or condition of the track This was known as the Mekarski system, which has been used successfully in Nantes for the last eight or nine years, and three years ago three street car lines were established in Paris under the same system. They carry the air at a pressure of between 1,100 and 1,200 pounds, reducing it to the proper pressure when used. During the experiment in this country, the cars were run about 40,000 miles, fully demonstrating that compressed air is practical, economical and most delightful for street car propulsion.

Compressed air as a power has certainly proved itself worthy of consideration, and to be produced economically it should be treated on the same basis that a mechanical engineer would treat the question of economy in a steam plant. I am happy to say that there have been rapid strides in this direction during the last two years. There is no question but what compressed air can be produced and utilized with as much economy and as great efficiency as any other power by simply putting in economical machinery for producing it.

NOTES ON THE MINING OF LOW GRADE GOLD ORE IN NOVA SCOTIA.*

BY C. F. ANDREWS.

Concluded from last month.

In the mine every attention has been paid to working the rock to the greatest advantage. On account of the dip to the seams in the belt, it has been found that two drills working towards the west accomplish as much as three drills working towards the east. The works below are now supplied with a regular system of tracks over which the ore is conveyed in trolleys to the electric-lighted loading stages at the shafts. The south shaft, being the main shaft, is supplied with two skip tracks, one for the east and one for the west ore The pump way is between the skip tracks and a little below them, or nearer the foot wall, thus being out of the way when ore is being loaded into the skips, or timber being unloaded from underground. The ladder-way is a compartment by itself cribbed up under the foot-wall cribbing, where it passes through the surface material, thus being out of the way of anything which could fall or injure a man. The slope of the shaft is so flat that no ladder is required to get at the pump. The north shaft has a skip-way in the east end and a ladder-way in the west end. The stopes were started from the east side of the south shaft and carried round to the north shaft, this rock being hoisted from the south shaft. The stopes are then continued west beyond the north shaft and the ore hoisted from the north shaft. Thus while ore has been hoisted from both shafts, the sinking and expenses connected therewith have been confined to one shaft. The number of hand-drills employed here to produce 2,000 tons of crushing ore per month has never exceeded nine—two men to a drill. The surface plant at the mine consists of a 60 h.p. tubular boiler set in brick, and a 50 h.p. compound engine set on concrete foundation. Floors of engine and boiler rooms are of concrete. The hoisting machine is a double drum one, built by the Jenckes Machine Co., and laid on a concrete foundation. The drums are side by side and of the usual cone-friction type, but instead of being driven by two small cylinders attached to it, its driving shaft is driven by belt and pulley from the compound engine, the same engine serving to drive the pumping gear and the rock breaker. The experience here has been that it is far more economical to drive everything from one compound engine than from a number of smaller ones, particularly where all machines are working continually day and night. The engineer fires his own boiler, and no extra attendance is required for the hoisting machine, the levers at the machine being connected by wire ropes with counter levers at the deck head, so that all hoisting and lowering is controlled by the deckman. Thus the deckman, when not engaged in bringing up or lowering skips, can wash and assort ores. The water from the mine pump is discharged into a tank under a hatch in the peak of the roof. A hose from this serves for washing quartz or for fire purposes. The building is heated by exhaust steam from the engine, and like the mill, forge, workshop, stables, office, manager's house, etc, is lighted by electricity. At the mill the plant consists of forty 850 lb. stamps, two return tubular boilers, one 16 x 42 Corliss engine, one Worthington duplex steam pump, 3½-inch suction and 3-inch discharge, one Northey pump of the same description, dynamo for lighting purposes and the hauling gear for bringing the ore from the mine. The forty stamps are arranged in a row, and the ore bin extends the full length of the batteries. The ore cars enter the building at right angles to the ore bin, are turned on a table and run along the top of the bin to be dumped wherever the ore may be most required One mortar is reserved for the test purposes, the bin in front of it having a partition to keep the test ore separate from the regular ore The stamps drop 90 times per minute, and the mortars are arranged for very fine crushing. At times the gold is so fine as to be invisible to the naked eye. An instance of this was noticed when 4,000 tons of ore were milled, in which not a color of gold was seen, but which, when cleaned up, gave a fair profit

With this plant, up to the time when my connection with the mine ceased, the total cost for mining and milling, including all charges, was $1.65 per ton At the mill but one engineer was em-

* A paper read before the Federated Canadian Mining Institute.

ployed on each twelve hour shift, it being also his duty to attend to the dynamo and lights. It may be interesting to know that the electric light plant installed here paid for itself in one year in the saving of kerosene oil alone. Where there is power to spare, as was the case here, and a large number of lights required, it cannot be too highly recommended, particularly around the plates of a mill.

The Richardson belt is very heavily mineralized, and there is great cause for regret that only the free gold is saved. The results of a careful and elaborate series of tests of the tailings from this mine, made by F. H Mason, are somewhat surprising to many who do not consider the auriferous ores of Nova Scotia worth concentration But facts speak loudly for themselves, and much as we would like to have all our ores free milling, this desire does not alter the refractory nature of some of it According to these tests, made when the ore being crushed was of an unusually low grade, the average loss was 1 dwt. 18 grs. per ton. A sample of tailings from which all the concentrates were not extracted gave 1.3 per cent. of concentrates, which had an assay value of 1 oz. 10 dwt. 1 gr. per ton, and still left a value of 1 dwt per ton in the tailings. Another sample of tailings gave 6 3 per cent of sandy concentrates, having an assay value of 1 oz 1 dwt 13 grs. per ton of concentrates. In neither sample was free gold or amalgam detected. The majority of the arsenical iron pyrites is contained in the slate; some samples of this slate assay very high. A chance sample gave the surprising result of 28 ozs. 8 dwts. of gold to the ton of concentrates, and yielded 30 per cent. of its total weight in concentrates. Two more assays of this slate gave concentrates valued respectively at 4 ozs. 2 dwts. 8 grs., and 5 ozs. 6 dwts. 12 grs. per standard ton of concentrates. As this slate contains so little free gold, but a small portion of it is crushed.* An analysis of clean concentrates taken from the sluices of the mill gave the following composition:—Silica, 2.65, iron, 35.63, sulphur, 16.80; arsenic, 42.25; copper, trace; bismuth, trace; zinc, trace; mercury, nil. An assay of these concentrates gave gold 2 ozs. 14 dwts. 21 grs. per ton. A chlorination test of these concentrates obtained an extraction of 97.1 per cent. of gold contained.

Being myself present when Mr. Mason made a great many of his tests and assays, and knowing the care that was taken with them, I cannot help feeling that it would be of general interest to those interested in gold mining in Nova Scotia, to quote from Mr. Mason's report as follows: "It will be seen that you are losing a considerable amount of refractory gold in your tailings, you are dumping a considerable quantity of auriferous slate and leaving a further and larger quantity in the mine, and finally you have a large tailing dump, parts of which would pay handsomely for working over. I am satisfied that the gold you are losing in your tailings is practically all in the form of concentrates. In churning up an ore (often heavily charged with mispickel) in the battery, you must of necessity at times flour a certain quantity of mercury; added to this, owing to the quantity of slate you are finally crushing, you have very slimy tailings, consequently the floured mercury has little chance of re-settling, and small quantities are at times bound to be carried away with your tailings." With a view to saving the refractory gold, "I would strongly advise you to put in Frue vanners, use a coarse mesh screen and cut down your discharge to one-half what it is at present. I would also increase the stamping capacity by increasing the number of drops from ninety, at which you are now running your mill, to one hundred drops per minute. In advising you to do this I wish to bring the following advantages you will gain to your notice:

"1. You will be able to crush the whole belt, for your slate certainly contains refractory gold, and at times free milling gold. Your mine superintendent told me that he estimated that not more than one-third of the rock broken underground was milled, so at the present time you are paying for breaking rock, 66 per cent. of which you have not in the past milled, nor would I advise you to mill it unless you put in concentrators, and crush it only coarsely, for it is highly refractory, and if crushed finely it will flour mercury, and in that way probably carry away more gold than it would contribute to the amalgam in the battery or on the plates.

2. You will decrease your mining expenses by more than one-half, the only extra expense will be in hauling part of the slate, and in winding and hauling the remainder, while your output will be nearly three times what it is at present.

3. I am of opinion that the slate will provide enough free gold to pay for the milling, in which case the concentrates will be all clear profit.

"4. You will dispense with the cost of picking the ore. I estimate that the cost of Frue vanners erected in Nova Scotia will be about $150 per stamp. To get satisfactory concentration it will also be necessary for you to put in mechanical sizers (the cost of which is small), and feed the coarse tailings on to one set of vanners and the fine on to another set.

"Having obtained your concentrates chlorination is undoubtedly the method by which they should be treated. The cost of such treatment in Nova Scotia will, I estimate, be about $4 per ton of concentrates. It will also be a matter for consideration whether the arsenic will not be worth saving for two reasons—firstly, for its value, which is doubtful, and, secondly, to prevent its contaminating pasture lands, and consequently prevent claims against you for poisoning cattle. The cost of an eight to ten-ton chlorination plant erected in Nova Scotia will be about $3,000, exclusive of building."

Up to the present time this property has produced 43,000 tons of ore, which goes to show that the mining of low grade ores in Nova Scotia at a reasonable cost per ton has got beyond the experimental stages and is a reality. The handling of the refractory ores has yet to be experimented with, and from the appearance of nearly all the ore I have seen along the Gold Brook anti-clinal, I am of opinion that material for the experiment is not lacking.

* Near the surface, the slate is soft and partly decomposed. In this condition it yields considerable free gold when milled. As the depth increases, the slate becomes harder, increasing perceptibly in bulk, and in the quantity and quality of its concentrates. Below a depth of 100 feet, it contains so little free gold that it is unprofitable as a free milling ore.

THE ROYAL ELECTRIC COMPANY.

Concluded from last issue.

In 1892, the first electric motor circuit was established, and the extensive field available in Montreal for the application of electric current directed the attention of the company to the utilization of water power. After an exhaustive examination of all those contiguous to Montreal, and after a most thorough comparison of the merits and demerits of each as applicable for electric light and power purposes, all were rejected except that of the Richelieu Rapids at Chambly, the rights of which were secured by the company.

In 1894 the desirability of an improved line of electrical apparatus and the opening of the new fields for such apparatus, resulted in a contract arrangement with the Stanley Electric Mfg. Co., of Pittsfield, Mass., for the right of manufacture and sale in the Dominion of Canada of the apparatus which they had a short time previously introduced in the United States, and which almost immediately assumed first rank in electrical machinery, and was recognized by all, competent by experience to judge, as being vastly superior to any hitherto produced, and possessing features entirely unknown to the old style of apparatus—features and character of construction which placed it as far beyond all that had previously been made as the marine engines of the ocean liners of to-day are in advance of the ordinary stationary engines of fifty years ago.

This apparatus, known and designated as "S. K. C.," the initials of the names of its joint inventors and designers, Messrs. Stanley, Kelly and Chesney, being capable of supplying from the same machines and from the same wires incandescent lights, arc lights and motors, occupied a new field and made profitably possible the extension of electrical business in directions not hitherto commercially available. In the manner of details of construction it also occupied a new field, for instead of the cheap and temporary method of construction, characteristic of earlier electrical machinery, it is built in the very best manner, equal in every particular in finish and character of manufacture to the best machinery in every other line of commercial practice.

The S.K.C. generators completely revolutionized the method of construction and operation heretofore employed. The particular feature, which in all other generators is the source of constant repairs and loss of service, namely, the revolving wire wound mass known as the armature, with its complicated commutator and constantly wearing and fire emitting brushes, requiring the closest attention of employees and numerous devices for operating and regulating, was entirely abandoned, and instead is employed simply a solid steel wheel, having contact with no other part and having no wearing or contact surfaces except the journal bearings. To the electrical operator this feature alone was a long coveted boon and is a source of constant delight. To the owners it is a source of great economy and increased net revenue. The record to date of these generators is that the maintenance and repair account has been reduced to nothing.

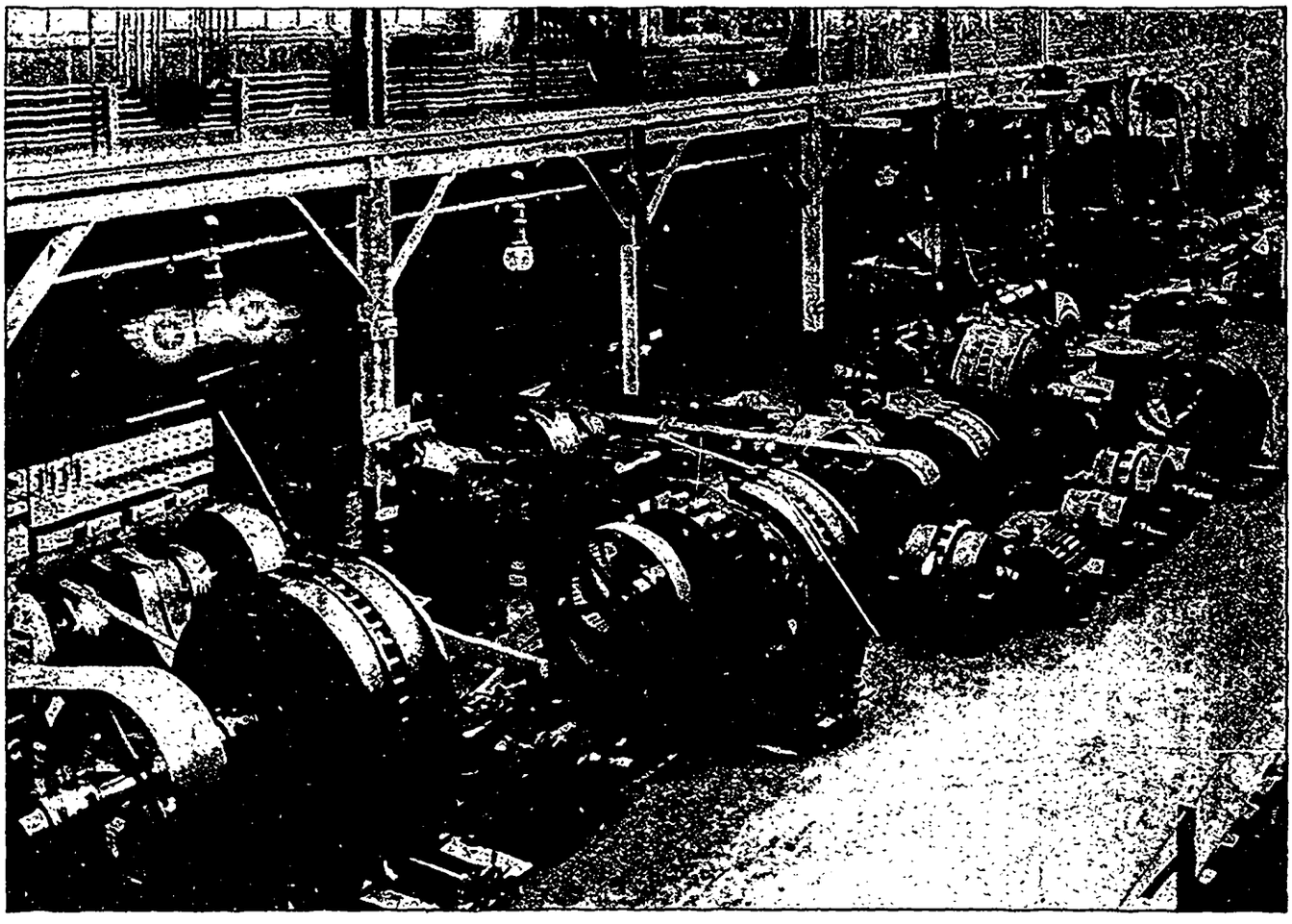
The S.K.C. system employs the simplest method of what is known as the polyphase system, the development of which has made possible the transmission of power commercially to great distances,

thereby opening an avenue to the manufacturer of electrical apparatus before impracticable, and enabling the development of otherwise unprofitable water power.

In Canada this field promises to be of prodigious proportions. This class of business usually calls for apparatus of large capacity, and the equipment of the new factory has been planned and carried out to meet this new demand. To the former extensive equipment was added larger tools, among them being two boring mills, one adapted to finish parts of apparatus having a diameter of seven feet, the other capable of finishing parts having a diameter of twenty feet (the latter tool, by the way, being built in the factory itself), a planer probably the largest of its kind in Canada, also an electrical crane capable of hoisting and moving to any part of the building masses of thirty tons in weight, together with several drilling machines, bolt and screw making machines, punches and other accessory tools. Thus equipped the factory is capable of, and is actually at work now on, the manufacture of dynamos, namely, those for the Chambly Water Power, each of which will aggregate in weight upwards of one hundred tons and each capable of developing 3,000 h p., being the largest dynamos, except those at Niagara Falls, that have ever been made. Besides these, there are being manufactured at the present moment for the Montmorency

The S.K C. system is alone in this feature, and this characteristic opens the way for the Royal Electric Company to be the advanced leader in the electrical field for light and power purposes, and particularly where the transmission of power to considerable distances and in large quantities is required. These conditions practically constitute the Royal Electric Company as the engineers for such systems. Since the introduction in the early part of 1894 of the S K C system in the United States, when it was practically first introduced, to the present time, there has been put in use or are in process of construction, under order in the United States and Canada, generators of this system of a total aggregate capacity of about 900,000 horse-power Another appliance of the S.K.C. system, namely, the transformer, also revolutionized that necessary adjunct of every alternating current lighting plant, which, as made before the introduction of the Stanley transformer, was a source of the greatest expense of such stations.

Since the introduction by the Royal Electric Company of these transformers into Canada, their value in the prevention of waste has been frequently demonstrated, and is now so firmly established that every electric lighting station, in the endeavor to improve its earning capacity, is displacing the old type transformers which they have in use, and substituting therefor "S.K C" transformers.



Company, of Quebec, two dynamos each of 1,000 h.p. capacity and two each of 350 h p capacity, and there have been just completed for a water power, 16-mile transmission plant from St. Narcisse to the city of Three Rivers, two each of 400 h.p. capacity, and the dynamos aggregating 2,500 h.p. capacity, which you have just seen in operation in the station in which you are now, a total for the four places of upwards of 25,000 h.p.

The S.K C system is the only one in which dynamos are made to deliver current at very high voltages directly from the generators. Those now in operation at, as well as being constructed for the Montmorency Company of Quebec, are being operated and will operate at a voltage of nearly 6,000 volts. The Chambly generators will deliver directly from the machines to the lines 12,000 volts. In all other systems the high voltage necessary to convey electric current long distances must be obtained by other devices, known as transformers or converters, the generators usually only delivering a pressure of 1,000 volts and the transformers increasing such pressure to the voltage desired This transformation involves a loss of energy and is a source of interruption and expense, besides its increased cost, which is unnecessary with the S.K.C. system.

Although first offered to the electrical public but a few years ago, there are in use to day "S.K.C." transformers, having an aggregate capacity of upwards of 1,000,000 lights, and the demand for them is constantly increasing. The peculiar success of the "S.K.C." system is due to the new features and principles it embodies, but it is also equally due to the extraordinary high character of the methods and materials employed in manufacture. These methods require the utmost accuracy, the greatest care, the best materials and the finest finish. The manufacture by the Royal Electric Company of the "S.K.C." apparatus is carried on in direct accordance with the plans, specifications, drawings and methods in use by the Stanley Electric Mfg. Co., in their own works, and in every detail and particular are exact duplicates of those made by them All the advantages of contact with the widely extended field covered by the Stanley Company in the United States are available to and at the disposal of the Royal Electric Company, and are utilized for the benefit and are at the service of its customers.

The factory is planned, equipped and manned for the manufacture of high class apparatus only, and is devoted solely and entirely to work of that character. When the introduction of this

class of electrical apparatus was begun by us, we were told by some of our good friends that there was no market in Canada for this class of goods. Our experience during the last two years fully and completely refutes their contention, for we have found that when we made known in actual practice the fact that electrical apparatus of this character was available, the best and only the best was wanted, and the result is the condition of our factory to-day, engaged to its utmost capacity in the fulfilment of orders, being in many cases repetitions of previous orders.

Judging by the past of the Royal Electric Company and by its present conditions, and the demand for its manufactures, with the large new opportunities opened by its "S. K. C." system, the future bids fair to tax the capacity of this complete factory to its utmost working power. At the present day the business already in hand will keep it constantly occupied at least during the present year, working day and night. The "S. K, C." system, however, does not constitute the entire business of the factory, the manufacture of direct current dynamos and motors, arc lamps and machines and railway generators and motors adding materially to the demands on the capacity of the works; a recently completed order being the entire new equipment of generators and motors for the Montreal Park and Island Company. The manufacture of insulated wire and of many kinds of instruments and other appliances is extensively carried on.

Since the beginning of the business of the company, it has installed in Canada 70 arc light plants, using an aggregate of 8,000 arc lamps and 145 incandescent plants, with a total capacity of more than 250,000 lights, distributed from Victoria in the west to Prince Edward Island in the east.

With such improved apparatus available, it became incumbent upon the Royal Electric Company to utilize in its own illuminating business the advantages obtainable from the "S.K.C." system To that end, about a year ago, the Board of Directors authorized the improvements which have been recently completed in its lighting system, these improvements being the placing of Stanley transformers upon its lines, of the "S.K.C." generators which you have just seen in this station, and the erection of the new distributing switchboard. One of the advantages resulting from these improvements, which will appeal directly to our shareholders, is that, with more than 10,000 lights connected to the station at the present time than there were a year ago, and although the improvements have practically been only just completed, an economy has been accomplished in the item of fuel to the extent of 6,000 tons, that is, there was consumed during the year 1896, with the increased business, 6,000 tons of coal less than during the year 1895 When the improvements within the station were begun a year ago, four engines, two of 500 h. p. capacity and two of 1,000 h p capacity each, were connected to some thirty separate dynamos by means of lines of shafting on two floors of the station As you have just seen three of these engines are connected by belting directly to what are practically three dynamos, the fourth engine being at present not required

Any of you who saw this station a year ago will remember that the entire space of the first and second floors was completely filled with shafting, pulleys, belting and dynamos, and both floors presented an exceedingly crowded condition. As you have perceived to-day, the first floor alone fulfils all the purposes of the station, and its condition is open, roomy, bright, cleanly and cheerful The switchboard which bears the same relation to our lighting and power systems as the pilot house does to a steamship, and controls the distribution of the electrical current from the generators to the premises of our customers, has been especially designed to secure an entirely incombustible condition and to obtain a flexibility and facility of operation enabling the transfer of any circuit to or from any generator so quickly as to be practically imperceptible when all the lights are burning. The first condition, incombustibility, is a necessity to insure permanent service and has been completely accomplished. The second condition secures uniformity of service, a condition we realize has been accomplished. The switchboard is so arranged that any circuit, with every light thereon burning, may be instantaneously transferred from one generator to another without perceptible change in the light, and this is done so frequently without being noticed that it is the best possible evidence of the complete adaptability of the switchboard to its purpose.

A fact in connection with these improvements, and the change from the old system to the new, is that all these changes were made without the interruption for a single instant of the service to the upwards of 60,000 lights served from this station, which is in operation continuously during every hour of every day in the year. To those familiar with the handling of electric currents, this will be considered a feat almost without parallel, and even to those who are not familiar, a consideration of the labor, risk, care and rapidity of action involved in transferring nearly 100 wires, all of them charged with electrical current, from nearly 30 dynamos and from the old switchboard to the three dynamos, and to the new switchboard without the least interruption, will represent a work of great magnitude. This entire change from the old system to the new, from the old to the new switchboard, was made within the period of ten hours, our customers obtaining their service undisturbed. The dynamo room and the switchboard are models in arrangement, with abundance of room, ready opportunity for attention, and complete capability of control and manipulation.

As the generators are of the two-phase system, we are able to furnish from the same machines and on the same wires incandescent light, arc lights and motive power, and we are now prepared to furnish current for motive power purposes in any part of the city, and can furnish such power measured by meter the same as incandescent lights are used.

All this work and apparatus in the station has been placed specially with a view to being utilized in connection with the electric current to be transmitted from the water-power generator plant at Chambly.

The switchboard has been constructed so as to be capable of handling and distributing current for upwards of 200,000 incandescent lights and equivalent capacity in electric motive power. The generators at present operated by the steam engines are designed to be operated by the electric current from the Chambly water power as motors, wherewith will be operated the necessary complement of arc-light dynamos to serve current for all the arc lights in the city streets and public places, as well as to operate the direct-current generators now supplying current for motive power. The circuits for such direct current motive power will be maintained so that customers having motors available for use on such current can be supplied with such power. Within this station will be placed transformers to reduce the high voltage on the lines from Chambly to that used for distribution throughout the city. This current will be conveyed to the present switchboard, and thence to the lines already extending throughout the city and to the generators, which will then become motors. The entire system of lighting and power now carried on in this station and at the East End station will be served entirely from here, as will also any additional current required for increased business, the entire distributing system being concentrated in this station with practically no alterations in the present equipment.

The east end station will be maintained in its present condition as a steam generating arc station to be used as a relay or emergency station only. The steam engines in this west end station will also be retained in their present position, and in the extremely remote contingency of an interruption from any cause in the delivery of the current from Chambly, the motors will immediately again become generators and perform the functions they are now fulfilling. With this arrangement there will exist a water power plant and a steam plant, entirely independent of each other, thus insuring absolute continuity of service. The maintenance of the east end station in its present condition, and the arrangement of this west end station so as to be promptly transformed again into a steam generating station, is a precaution taken against what is assuredly a very remote contingency, but it has been so arranged in order to remove all opportunity for interruption of service to our customers. That there is extremely little chance of interruption in the delivery of current from the Chambly Water Power into this city, may be determined by a consideration of the conditions entering into its development, and at this juncture it is appropriate to speak of the Chambly water power generation and distribution of electric current therefrom.

The dam being built is to be one homogeneous mass of concrete, forming practically a monolith or a structure made of but one stone. This dam has been designed and is being built under contract by the foremost hydraulic engineering company on this continent, according to the plans and under the direct supervision of its chief engineer, who is recognized as the most competent authority in this character of construction. The wheels are also to be provided by and are under contract with the same engineering company. The entire hydraulic work has been contracted with the above mentioned company under guaranteed results, among which are the maintenance at all times of a working head of 28 feet and the delivery to the shaft of the electrical generators of not less than 20,000 horse-power. There will be eight units or sets of wheels, each of a capacity of 2,650 horse-power. Each of these units or sets of wheels will be connected directly, without the intervention of any gearing or appliances to cause loss of energy to the shaft of one

electrical generator; in fact, the shaft of each set of water-wheels and of each generator will be practically one continuous shaft, thereby reducing to a minimum the loss of energy and the occasion for the expense of repair. Besides these eight sets of wheels and generators (the generators we have already described as being under construction in our factory, and each of which will weigh 100 tons), there will be two sets of water-wheels, each operating an exciting generator of capacity sufficient to supply the excitation current required by all of the generators. The dam, as stated before, will produce a head of water 28 feet in height, and will utilize the entire water of the Richelieu River, the outlet of Lake Champlain. The reservoir or head-race thereby created will extend up the river from the dam to a point where the level of the water at the head race of the dam will merge with the natural level of the river, such point being a mile and a-half or more above the dam, thereby securing a very long deep mill pond, which, with the high working head of 28 feet, will effectually remove all possibility of that bugbear of water powers in cold climates—frazil. The location of the dam has been selected at a point where the highest known rise of the water in the Chambly Basin below the dam will not affect the level of the tail race. Therefore, all possibility of interruption due either to frazil or back water is completely removed. The character of the construction of dam, power house, wheels, dynamos, switchboard, is all of the highest order. There are no gears to wear or break, there are no wire-wound armatures liable to destruction, there are no commutators, brushes, or wearing parts in the dynamos, the only wearing parts in the water wheels and electrical machinery being the shaft and its bearings, consequently every source of danger has been apprehended and guarded against.

The current will be conveyed from the power house at Chambly to Montreal by two separate lines of poles and wires. Should any accident happen to any part of either lines of poles or wires necessitating repairs, the current from such lines will be cut off, and all the current required will be transmitted by the other line during the time such repairs are being made. This will permit such repairs to be made without interruption to service or danger to employees, because there will be no current passing over the line being repaired, as the other line will carry all that is required.

Arrangements have been made with the Grand Trunk Railway whereby the wires for the crossing of the St. Lawrence River will be carried on the Victoria Bridge, and there also the wires will be so placed that a duplicate system corresponding to the duplicate pole line will be provided. The same duplicate system will be employed within the city from the bridge terminus to the distributing station No danger of interruption from injuries to pole lines can therefore be apprehended.

All the work and material for the Chambly Water Power Electrical Transmission Plant is under contract to be completed by September 1st, 1897. The progress already made in all the various parts of the work assure completion in accordance with the contracts, so that in September of this year this West End station, which is now a generating station of large size, will become merely a distributing or sub-station of the one at Chambly, the second largest electrical generating station in the world.

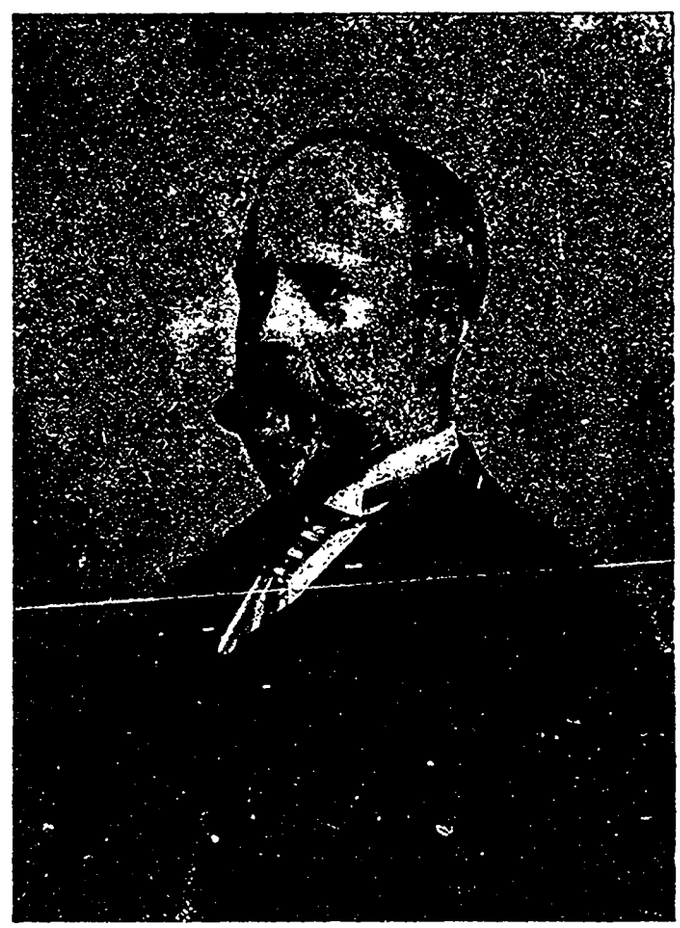
The advent of the electric current from Chambly will create new conditions in the city of Montreal. The low price at which electric current can be ' en supplied will permit its use in many directions not now considered. Its use for illumination will naturally become greatly increased, but the greatest advantages from it will accrue to commercial interests. Motive power will be available at rates which will not only render it profitable for present users of steam power to abandon it, but numerous new industries will be attracted to and established in the commercial metropolis of Canada, where, in addition to the many other advantages, it possesses power that will be as inexpensive to the manufacturers as if they were located directly upon some water fall, with its usual disadvantages and expense of inaccessibility and inconvenience. It must have direct, immediate, and permanent beneficial influence upon the value of real estate in the city and vicinity because of the largely increased demand for land required for additional manufactories. The appearance of the city, as well as its hygienic condition, and, therefore, also its value, will be greatly improved, for, as it will be unprofitable to operate steam plants, they will be discontinued and soon will disappear their necessary accompaniment of black smoke. Besides accomplishing these material benefits in the commercial interests of the city, the electric current from Chambly will lighten the labors of the household, affording the means of cooking and heating without the labor of handling coal and ashes, or the disagreeable adjuncts of flame or odors; making easy and agreeable the service in the kitchen, the laundry and the sewing room. And, most important of all, with these results will come increased safety from fire; your insurance statistics will indicate most graphically the numerous sources of danger in this respect which will be removed by the extended use of the electric current above outlined. The diminished cost of electric current for illumination will very extensively increase the use of light; exteriors as well as interiors of buildings and windows will be illuminated for decorative effect; public or street lighting will not alone be extended into every street, by-way and lane, but will be increased in number in every street, which will be possible within reasonable expenditure, and the city will become bright, cheerful, healthful and clean, and its streets at night be as safe as under the glare of the noonday sun. This is no idle anticipation, but a very probable reality.

The successful progress of the Royal Electric Company is a component of he increased commercial prosperity of the City of Montreal, and through the use of its manufactures the Dominion will obtain similar advantages. We can, therefore, anticipate with pleasure as the result of your visit here to-day, a more intimate knowledge of the Royal Electric Company, and in consequence, not only your good wishes but your valuable friendly aid and assistance in promoting its enterprises to broader dimensions and still greater successes.

On taking his seat, Mr. Browne was loudly applauded by the assembly.

WM. H. BROWNE.

Wm. H. Browne, general manager of the Royal Electric Co., was born in Troy, N.Y., in 1849. When only seventeen years old he went to New York city, where he was employed in the foundry, machine shop, and general hardware manufacturing business. In 1888 he became interested in, and was one of the organizers of, the Richmond, Va., Electric Railroad. This was the first electric road



WM. H. BROWNE, GENERAL MANAGER ROYAL ELECTRIC CO.

in the United States. Mr. Browne managed this road and its electric lighting plant until 1891, but, in 1888, in addition, he became general manager of one of the largest electrical companies in New York, the United Electric Light and Power Co., which later absorbed the United States Illuminating Co. and the Brush Illuminating Co. In January, 1895, he came to Canada and accepted the position of general manager of the Royal Electric Company.

MINERAL PRODUCTION OF CANADA.

The following summary of the mineral production of Canada in 1896 has been issued by the Geological Survey Department, and is subject to revision in a later bulletin.

Product.	Quantity (a)	Value (a)
METALLIC.		
Copper (fine, in ore, etc.,) (b) ....lbs.	9,385,556	$1,021,148
Gold	.....	2,810,206
Iron ore .....tons	88,206	184,313
Lead (fine, in ore, etc.,) (c).....lbs.	24,199,977	721,384
Nickel (fine, in ore, etc.,) (d)..... "	3,500,000	1,155,000
Silver (fine, in ore, etc.,) (e) .....ozs.	3,205,343	2,147,579
Total metallic.....	.....	$8,039,640
NON-METALLIC.		
Asbestus..... ....tons.	12,250	$ 429,856
Chromite ..... "	2,362	25,982
Coal ..... "	3,743,234	8,006,305
Coke (f) .. .. "	49,817	111,560
Felspar ..... "	480	1,368
Fire clay ..... "	667	1,427
Graphite ..... "	.....	9,455
Grindstones .. .. "	3,663	32,810
Gypsum..... ..... "	205,203	174,403
Manganese ore..... "	12	900
Mica.....	.....	60,000
Mineral Pigments—		
Baryta ..... tons.	145	715
Ochres ..... "	2,250	10,925
Mineral water .....gals.	706,372	111,736
Natural gas (g)	... .	276,301
Petroleum (h) ....bbls.	726,822	1,155,646
Phosphate (apatite) .....tons.	570	3,990
Pyrites..... ..... "	33,715	101,155
Salt ..... "	43,956	169,677
Soapstone .. .. "	410	1,230
Tripolite..... "	664	9 960
STRUCTURAL MATERIALS AND CLAY PRODUCTS.		
*Bricks.....	.....	1,600,000
*Building stone	.....	1,000,000
Cement, natural ....bbls.	69,705	60,500
" Portland ..... "	78,085	141,005
Flagstones	.....	6,710
Granite .....tons	18,717	106,709
*Lime	.....	650,000
Marble ....tons.	74	905
Pottery	.....	163,905
*Sands and gravels .....tons.	.....	120,000
Sewer pipe	.....	153,875
Slate	.....	53,370
Terra-cotta	.....	110,855
*Tiles.....	.....	225,000
Total non-metallic	.....	$15,087,665
Total metallic	.....	8,039 640
Estimated value of mineral products not returned	.....	500,000
1896, Total	.....	$23,627,305
1895 "	.....	22,000,000
1894 "	.....	20,900,000
1893 "	.....	19,250,000
1892 "	.....	19,500,000
1891 "	.....	20,500,000
1890 "	.....	18,000,000
1889 "	.....	14,500,000
1888 "	.....	13,500,000
1887 "	.....	12,500,000
1886 "	.....	12,000,000

(a) Quantity or value of product marketed. The ton used is that of 2,000 lbs.

(b) Copper contents of ore, matte, etc., at 10.88 cents per lb.

(c) Lead contents of ores, etc., at 2.98 cents per lb.

(d) Nickel contents of ore, matte, etc., at 33 cents per lb.

(e) Silver contents of ore at 67 cents per oz.

(f) Oven coke, nearly all the production of Nova Scotia.

*Partly estimated.

(g) Gross return from sale of gas.

(h) Calculated from inspection returns at 100 galls. crude to 42 refined oil, and computed at $1.59 per bbl. of 35 imp. gals. The barrel of refined oil is assumed to contain 42 imp. galls.

It is remarked that since the calendar year 1886, the total value of the mineral product of Canada has nearly doubled. The following table shows the principal changes in production and values during the calendar year 1896, as compared with the figures given in the revised summary for 1895:—

Product.	Quantity. Increase.	Quantity. Decrease.	Value. Increase.	Value. Decrease.
Coal..... .. tons	229,738	....	$278,859	$ ..
Copper .....lbs.	596,394	....	71,919	....
Gold	....	....	899,306	....
Iron ore .....tons	....	14,591	....	53,757
Lead..... lbs.	1,124,085	....	....	28,582
Natural gas.....	....	....	....	146,761
Nickel..... lbs.	....	388,525	....	205,904
Silver..... ozs.	1,429,660	....	988,956	....

A WORD IN SEASON.

The time for letting contracts and ordering supplies is now upon us, and every firm who wishes to maintain old business and create new, requires to keep in touch with the trade.

There is no better way to accomplish both these ends than to be represented in THE CANADIAN ENGINEER. It has been enlarged four times since it started—being now double its original size—and its circulation record is unparalleled in the history of trade journalism in Canada. The best of it is that the increase shown below is in *bona fide* paid subscriptions, and not free copies. THE CANADIAN ENGINEER has now more than double the paid circulation of any paper touching the engineering and kindred trades. Our mail sheets are open for proof of this. But even if we had one-half, instead of double, the issue of any contemporary, THE CANADIAN ENGINEER would still be a better medium, because it is more closely associated with, and is of more practical interest to, the trades which the advertiser wishes to reach.

Now is the time to begin. Cuts can be made from photos or drawings to suit advertisers. One or two specially favored positions are still open. For rates, etc., address our Montreal or Toronto office.

THE RECORD.

To whom it may concern:

Toronto, Feb. 15th, 1897.

This is to certify that the statement given below is a true account of the copies of THE CANADIAN ENGINEER we have printed and mailed for Biggar, Samuel & Co., beginning with May, 1895, issue, and ending with Feb., 1897, issue.

THE MONETARY TIMES PRINTING CO. OF CANADA, LTD.,
Per A. W. LAW, Sec.-Treas.

Date of Issue.	Copies Printed and Mailed.
Volume III., No. 1, May, 1895.....	2,000
" " 2, June, "	2,000
" " 3, July, "	2,100
" " 4, Aug., "	2,200
" " 5, Sept., "	2,400
" " 6, Oct., "	2,400
" " 7, Nov., "	2,500
" " 8, Dec., "	2,600
" " 9, Jan., 1896	3,500
" " 10, Feb., "	3,900
" " 11, March, "	3,100
" " 12, April, "	3,150
Volume IV., " 1, May, "	3,250
" " 2, June, "	3,450
" " 3, July, "	3,600
" " 4, Aug., "	3,450
" " 5, Sept., "	3,975
" " 6, Oct., "	3 725
" " 7, Nov., "	3,800
" " 8, Dec., "	4,050
" " 9, Jan., 1897...	4,100
" " 10, Feb., "	4 350
" " 11, March, "	4,350

THOUGHTS.

Editor CANADIAN ENGINEER:

Please find enclosed $1.10 for the part containing the description of the Taylor system of hydraulic air comp., vol. ii., pp. 343-346, and for one year's subscription to THE CANADIAN ENGINEER, beginning with the new vol. v. We have seen a few copies of it and consider it a very able engineering publication.

Yours truly,

ERNEST A. SJOSTEDT,
The Pictou Charcoal Iron Co., Ltd.

Bridgeville, N.S., March 18th, 1897.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

G. A. Keefer was born in 1836, of a representative Canadian engineering family, and at the early age of 16 began his engineering career on the surveys and location of the Grand Trunk Railway, between Montreal and Cornwall, under William Kingsford. At the

G. A. KEEFER, MEM. CAN. SOC. C.E.

present date he has been over 40 years in the active practice of his profession. Up to the year 1867, Mr. Keefer filled successively the positions of assistant, resident and chief engineer on various railway works in the Dominion. During the temporary suspension of railway construction in Canada—or for a period of eight years, from 1867 to 1875—he spent in the United States, acting as United States civil engineer under General Wilson and Colonel Worrall on the hydrographical survey of the Illinois River, and on the construction of the Keokuk Canal for the improvement of the Des Moines Rapids of the Mississippi River, and later in charge of the lock and dam at Henry, Ill., for the improvement of the Illinois River for that State. Returning to Canada, in 1875, he was engaged by the Dominion Government on the surveys and construction of the Canadian Pacific Railway until the completion of the Government work in 1884. After the opening of this railway, Mr Keefer acted as Dominion Government inspector, for the years 1887 and 1888, of the line in British Columbia. Since that date he has been in private practice in that province, during which he designed and built the Vancouver waterworks system, now in successful operation, and is at present engaged as engineer for the Alberta and British Columbia Exploration Company, of London, England, on an extensive scheme of reclamation on the lower Kootenay. Mr. Keefer is a member of the English Institute, as also of the Canadian and American Societies of Civil Engineers, and is now filling for the third time the position as member of council in the latter.

At the meeting of this society at its rooms, Mansfield St., Montreal, on the 11th ult., Prof. Durley delivered a lecture on "Thermal Storage and the Distribution of Power by Steam." The question of holding a summer meeting in Quebec, postponed from a previous meeting, came up and was again postponed. At the meeting held on the 25th ult., Prof. Nicholson lectured on "The Transmission of Power by Gas." A vote of thanks to Profs. Nicholson and Durley was moved by W. J. Sproule, seconded by Henry Irwin, and carried. W. J. Sproule further expressed his appreciation of the course of lectures now closing and hoped they would be printed as transactions of the society. As a result of this Duncan McPherson proposed, and Henry Irwin seconded, that the lectures be so recorded. The question of the summer meeting in Quebec again came up and was definitely abandoned.

CARTER'S PATENT ACETYLENE GAS MACHINE.

The first principle upon which Carter's Acetylene Gas Machine is constructed is that a given quantity of water poured on any quantity of calcium carbide will evolve a known quantity of acetylene gas. Therefore, it is absolutely necessary to know the quantity of water passing to the generator, if we desire to know the amount of gas that will be made.

The automatic measuring device between the water supply and the generator as used in this machine, measures the quantity of water that is from time to time automatically brought in contact with the carbide, as the consumption requires, so that gas cannot be generated beyond the capacity of the holder. Not depending upon the gas pressure to regulate the supply of water, the pressure on all parts of the machine is at all times equal, and does not exceed the amount necessary to supply the burners, viz., one ounce per square inch. We have, therefore, a steady, unvariable gas pressure, requiring no regulating devices.

A simple trap containing a column of three inches of water, [illegible]ed to the outside atmosphere, is used as a safety device, so that if by any means the pressure should rise beyond two ounces per square inch, it would relieve itself through the trap outdoors. The ashes or residue are at all times in a dry state and not sodden with water, and can easily be handled. The generator containing a large quantity of carbide, requires but little attention.

The acquiring of local rights by companies in small towns and places beyond the gas companies' mains, and where there are no electric light companies, would seem to be a basis for a sound and profitable commercial business, by putting in an acetylene machine plant, which requires no steam or water power, and but little attention or expense after the gas houses is built and the generating machine installed. These machines may be had of the makers, the Niagara Falls Acetylene Gas Machine Co., Ltd., Niagara Falls, Ont. The company has an exhibit in its Toronto office, 42 York street.

TIDAL MOTORS.

Editor CANADIAN ENGINEER:

Concerning tidal motors the writer of this has thought for a long time, and pointed out in the *St. John Globe* of December 26th, 1896, that the rise and fall of the tide in the Bay of Fundy might be used to supply power. Now any practical mechanic or engineer could put up the machinery so as to utilize the power of the tide, but the difficulty would be at the lull of the tide, at extreme high or low tide. There is plenty of power to generate electricity, but a large battery would need to be used, and the question is, could it be made to pay? Trusting that some of your many readers will take this matter up and give it their consideration.

ALEX WILSON,
St. John, N.B., March 8th, 1897. Mechanical Engineer.

ONTARIO ASSOCIATION OF LAND SURVEYORS.

The officers elected at the annual meeting of the Ontario Association of Land Surveyors, which was reported in our last issue, are all well known to our readers, and of most of them we have published portraits and biographical sketches at different times. The 1st vice president, Peter S. Gibson, has not, however, appeared in our pages before.

Peter S. Gibson was born near Toronto in 1837, his father, the late D. Gibson, C.E. and P.L.S., being a member of Parliament for West York at the time. He passed the examination for P.L.S. in 1858, and graduated at the University of Michigan in 1861 as a civil engineer and bachelor of science, and in 1864 took degree of M.S. Mr. Gibson was appointed by the Government a member of the Board of Examiners of Provincial Land Surveyors in 1873, and on the incorporation of the Society of Ontario Land Surveyors, was again appointed by the council on the Board of Examiners. He became a member of the Canadian Society of Civil Engineers in 1887, and was for many years engaged in Government surveys,

PETER S. GIBSON, MEM. CAN. SOC. C.E.

laying out new townships and Government colonization roads, and, as civil engineer, constructing the roads. Of late years he has practised as a surveyor and civil engineer in the County of York and adjoining counties, and now, with his son, H. H. Gibson, C.E. and O.L.S., is engineer for the Township of York and other municipal corporations, and carries on a general business of surveying and engineering.

WATER WHEELS.

Editor CANADIAN ENGINEER.

SIR,—I have a question in hydraulic engineering which you may be able to answer, or get an answer from some of your professional acquaintances. The query is, "Given a wheel 60 feet in diameter, supplied with floats having a square foot surface of 60 (20 x 3), what amount of horse power would they generate in a stream running ten miles an hour?" If you succeed in getting an answer to this, I would also be obliged if you can furnish me with the formula, in as simple a form as possible, by which proportionate results could be got. Yours very truly,

C. T. REID,
Times Printing Co., Hamilton, Ont.

[One of the best books of reference for questions regarding water wheels, etc., is "Mechanics of Engineering," by Weisbach-DuBois, published by John Wiley & Sons, New York. The theory of the wheel you describe is in a crude state, very few experiments having been made in connection with it. Prof. J. Galbraith, Toronto, to whom we submitted this question, says: "On the supposition that not less than two floats are continually immersed in the water, and that the maximum immersion is two-thirds the depth of the float-board, the following formula is considered to give the maximum horse power of the wheel:

$$\text{Horse power} = .384\ \frac{Avw.}{550} - \frac{v^2}{2g} \quad \text{where}$$

A = Max. immersed area of float.
v = Velocity of stream in feet per second.
w = 62.3 weight of cubic foot of water in lbs.
g = 32.16.

Such is the uncertainty of the theory, however, that it is possible that the horse power might not be more than 50 per cent. of the above."—ED.]

TORONTO ISLAND TUNNEL.

Editor CANADIAN ENGINEER.

In your number for March 1 notice you state that my proposition to run a tunnel under the western gap, "completely ignores, or at least overlooks, the necessity of deepening the present western gap, an oversight fatal to the plan." In order to explain that I made no oversight, I enclose a blue print showing the plan and profile of the proposed tunnel, by which you will perceive that eight feet is allowed for deepening the channel, and the tunnel would be lined with hard bricks set in Portland cement, to prevent any percolation of water. The depth of water on the south side of the channel is twelve feet, instead of nine as stated in your article, and I may mention here, Capt. Eads' channel only contemplated eighteen feet of water. The shallow water where a vessel drawing nine feet touched the bottom, not rock, but sand, is outside the channel, which will soon be dredged to fourteen feet, according to a contract with McNamee & Simpson recently entered into by the commissioners. The commissioners will never consent to permit the construction of a bridge, with a centre pier, across the channel, and before a tunnel could be constructed a survey and levels should be prepared, and close estimates made of the cost and land damages, as provided in the City Bill as amended by the Private Bills Committee of the Legislature. Yours truly,

Toronto, April 2nd, 1897. KIVAS TULLY.
Engineer, Toronto Harbor Commissioners.

[Unfortunately the blue print, referred to by Mr. Tully, was received too late for reproduction.—ED.]

FIRES OF THE MONTH.

March 7th.—L. E. Parsons' saw mill and several piles of lumber at Goldcn Lake, Ont. Loss, $4,000; insured for $600.——March 10th.—The fire alarm system of Toronto was burned out by a live wire crossing the alarm wires. The damage was about $1,000.——March 13th.—S. L. Elkin's cheese factory, Mansonville, Que. Fire supposed to be of incendiary origin.——March 14th.—B. B. Barnhill's portable saw mill, Two Rivers, N.S. Loss, $3,000; not insured.—March 18th.—Wm. McLachlan's saw mill, Magnetawan, Ont. Loss, $2,000; will be rebuilt at once.——March 19th.—Alex. MacKay & Co, plumbers, 62 Victoria Square, Montreal, damages amounting to $3,000.——March 25th.—The J. B. Armstrong Manufacturing Co., Guelph, Ont., damaged to the extent of $300.——March 28th.—The Waterloo, Ont., Manufacturing Co.; agricultural implements, damaged to the extent of $3,000; fully insured.

METAL IMPORTS FROM GREAT BRITAIN.

The following are the values in sterling money of the imports of interest to the metal trades from Great Britain to Canada during Feb., 1896, and two months to Feb., 1896-1897:

	Month of February,		Two months to Feb'y,	
	1896.	1897.	1896.	1897.
Hardware and cutlery	£4,322	£2,298	£10,094	£7,063
Pig iron.....	1,260	55	3,033	435
Bar, etc.....	791	965	2,422	2,201
Railroad	852	552	852	552
Hoops, sheets, etc.....	631	1,771	2,372	3,611
Galvanized sheets	2,942	2,572	4,021	3,226
Tin plates	11 860	15,893	22,969	38,401
Cast, wrought, etc., iron ..	2,601	3,068	5,924	4,752
Old (for re-manufacture) ..	....	285	....	476
Steel	5,777	2,347	12,085	4,933
Lead	1,122	760	2,168	1,279
Tin, unwrought	936	1,451	2,087	4,497

LITERARY NOTES.

Lucien Serraillier has compiled, and Whittaker & Co., London, Eng., will shortly publish, a "Technical Railway Vocabulary," giving over 5,000 French, English and American technical terms used in railway management, construction and working. The book is destined for the use of engineers, railway men, contractors, company directors, financiers, lawyers, patent agents and inventors.

The report for 1896-7 on the Archæology of Ontario has been issued as an appendix to the report of the Minister of Education, and makes a pamphlet of 117 pages. It is prepared by David Boyle, the able curator of the archæological collection now stored at the Canadian Institute, Toronto. The report records the collection of a large number of pre-historic relics within the province, and the patient industry with which Mr. Boyle is gathering and arranging the monuments of the hitherto unknown past of Ontario is meeting its reward. Already his enthusiastic labors have placed the province in possession of the most valuable collection of Indian remains in Canada.

Messrs. Murray & Williams, of Montreal, have just issued their catalogue and price list for the coming yachting season. It is nicely got up and contains illustrations of pleasure yachts, engines, boilers and fittings, with sufficient description. Added to this is a price list for complete sailing and steam yachts of various capacities, and for tugs, second-hand engines, etc. In the Feb. No. of the ENGINEER we gave some account of the Tregurtha water-tube boiler, and the catalogue under notice supplements that with some pertinent information. This catalogue should be consulted by all who need improvements in last season's yachts or are contemplating the purchase of new ones.

"Gas, Gasoline and Oil Vapor Engines," by Gardner D. Hiscox, M.E., is a book designed for the general information of every one interested in this new and popular motive power, and its adaptation to the increasing demand for a cheap and easily managed motor requiring no licensed engineer. The book treats of the theory and practice of gas, gasoline and oil engines, as designed and manufactured in the United States. It also contains chapters on horseless vehicles, electric lighting, marine propulsion, etc. Illustrated with 220 handsome engravings. Octavo, 350 pages. Price, $2.50. Norman W. Henley & Co., are the publishers, and orders may be placed through THE CANADIAN ENGINEER.

What will beyond doubt be a most valuable publication to every one interested in the British Columbia mines has just made its appearance We refer to the "B. C. Directory of Mines," whose first number reached us this month. It is a quarterly, but already it is proposed to issue it monthly. It contains a synopsis of the B.C. mining laws (a) as applicable to placer mining, (b) as applicable to lode mining. The facts and figures are given under each of the following heads: Provincial Government, Mining Recorders, Gold Commissioners, Provincial Government Agencies, Banks and Bankers, Money Order Offices, Express Companies, Assayers in B.C., Mining Associations, Mining Centres, Railways and Steamers, Stage Distances, Hotels, Fruit, Game, Fish in B.C., Telegraph Offices, Post Offices, Incorporated Mining Companies, B.C. Mining Stock Quotations, Directory of Mines. "The B. C. Directory of Mines," edited by Alex. Beg, Victoria, B.C. $2 per annum.

We have received a very neat and attractive catalogue from Sadler & Haworth, long known under the style of Robin & Sadler, and Robin, Sadler & Haworth, belting manufacturers, of Montreal and Toronto. The personnel of the firm is precisely the same as heretofore, Mr. Sadler residing in Montreal and Mr. Haworth in Toronto. A glance at their catalogue informs us that they have begun manufacturing a high grade of belting for a class of customers who want something more than the ordinary good stock and

are willing to pay a little more for it. Belting of this kind will be stamped "Crown," with the firm's name, while their well-known "Standard" brand will retain all its good points. We see that they make a special belt for dynamos, and have furnished very many lighting stations and power-houses in Canada. Sadler & Haworth are also heavy dealers in cotton and rubber belting, and mill supplies of various descriptions. These catalogues, with any other information, will be furnished on application to the firm at either Montreal or Toronto.

"Sketches in Crude Oil" is the title of a very graphic history of the origin and development of the mineral oil industry of the United States, by John J. McLaurin, author of a "Brief History of Petroleum," etc. The work is dedicated to the Hon. Chas. Miller, president of the Galena Oil Works of Franklin, Pa., who have recently opened a branch works at Toronto. The dedicatory note refers to the Hon. Mr Miller as "a man of large heart and earnest purpose, whose sterling qualities have achieved the highest success in life, and won the confidence and esteem of his fellows" Judging by the complimentary references to Mr. Miller in the text of the work, the dedication is well deserved, for he seems to be a man whom money has not spoiled, though he made plenty of it The author gives many an amusing and telling picture of the vicissitudes and humors that mark the history of the American oil wells, and these sketches appear to have the color of real life, though "done in oil"

J. H. Chewett, B.A Sc., C E., has issued a Pocket Mining Manual, containing condensed and accurate information on all branches of mining. It is neatly gotten up in flexible covers, and is written in language which any one of average intelligence can understand. Many illustrations add to its value The sections on mineralogy and geology deal with minerals and rocks of common occurrence, and are at the same time in a form to be valuable to mining engineers. Gold and silver ores, how found, how mined, and how treated, are dealt with thoroughly as their importance demands. For the prospector no better reference book could be desired. The chapters on mining and ore treatment will fill a long felt want of brokers, lawyers and business men interested in the development of our mines. The contents are arranged in the following order: Geology, Mineralogy, Prospecting, Mining, Ores and Ore Treatment, useful information and tables, glossary of mining terms and a complete index; the whole is comprised in about 150 pages. This book may be obtained through THE CANADIAN ENGINEER See announcement elsewhere.

Personal

J. Shields, M.E has begun the practice of his profession in Rat Portage, Ont.

T W. Ness, formerly head of the electrical firm of T. W. Ness & Co., Montreal, is now with the Holtzer-Cabot Electric Co., Boston, Mass.

H. J. Franklyn, formerly superintendent of the Toronto Street Railway, has been appointed secretary of the Rossland, B.C., Board of Trade.

Robert Murray, foreman in the plumbing establishment of Rogers & Hamilton, Hamilton, Ont., died suddenly from blood-poisoning recently.

A. W Browne, civil engineer and surveyor, Toronto, is leaving for Wabigoon, Ont., Rainy River District, to engage in the practice of his profession.

Bell & Wilkie, civil engineers, surveyors, etc., Almonte, Ont., have dissolved partnership. Mr. Wilkie moves to Carleton Place, Ont., and will practise there

J. H. James, C.E., who was a brother of the manager of the Bank of Montreal at Vancouver, B.C., died at Rossland, B.C. March 18th, from typhoid fever.

D. C Dewar, Ottawa, manager of the Bell Telephone Company, has been appointed manager of the Montreal office of the company, and will move to Montreal.

E. Lafontaine, civil engineer, Montreal, has been given a position in the Public Works Department, Ottawa. His work will be chiefly in the District of Montreal.

Samuel Wark, Toronto Junction, a Canadian Pacific locomotive engineer, recently received severe scalds and cuts on the left arm, caused by the explosion of the water-gauge of his locomotive

Lieutenant Paul Weatherbe, Halifax, N.S., a graduate of the Royal Military College, is appointed architect of the Militia Department. The young lieutenant is a son of Justice Weatherbe, Halifax

F. H. Mason, M.E., has been made consulting metallurgist to the Brookfield, N.S., Mining Co., Ltd., and is in a position to make chlorination tests of samples of tailings and concentrates, in the new works at that mine.

McGregor Patterson, who has been in the employ of the Chambers Electric Light and Power Co., Truro, N.S., for some time, has been appointed to the position of superintendent of the Amherst, N.S., Electric Light Works.

George Emmett, who has had charge of the Metropolitan Street Railway, North Toronto, plant for the past three years, has gone to take charge of the works of the British Columbia Iron Works Company at Vancouver, B C

The Winnipeg Man., city council has engaged Rudolphe Hering, C.E., New York, as consulting engineer to make examinations and report on the questions submitted to him on the subject of water supply and water works for that city.

John Brow, one of the oldest engineers on the Grand Trunk Railway, died at Galt, Ont., March 14th, aged 77 years Deceased was the engine-driver on the line between Berlin and Galt, and was in active service up to within a short time of his death.

Henry Dabregon, C.E., a French-Canadian who was educated in Paris and Belgium, in his profession, for many years administrator of Parque Alto, one of the largest sugar estates in Cuba, was murdered last fall at his home in Cartagena, near Cienfuggos.

Alexander Currie, of St. Luke street, Montreal, died on the 25th March. The deceased came to this country about thirty years ago, from Lanarkshire, Scotland. Since his arrival in Canada he has been associated with his brothers in the firm of W & F. P Currie, wholesale general merchants on Grey Nun street.

Charles J. Saxe, Montreal, who for twelve years past has studied architecture, has in company with John Archibald, Edinburg, Scotland, opened an office in the Imperial Building, St James St., Montreal. Mr. Saxe has been already successful in the Bisley Club House competition, while he was still a draughtsman, and Saxe and Archibald took second prize in the recent Royal St. Lawrence Club House competition

James Cadman, C.E., died at Woodstock, N.B., March 29th, of paralysis. He was born in England, coming to New Brunswick in 1862 to take the charge of the Woodstock Iron Works. Afterwards he was engaged on the European and North American and Intercolonial Railway construction, and then on engineering work in Newfoundland. His principal work was as engineer of the Quebec and Lake St. John Railway, with which he was associated from its commencement.

A number of changes have been announced in the mechanical department of the Grand Trunk Railway. J. W. Harkon, master mechanic at Toronto, has been appointed master mechanic of the eastern division, with headquarters at Montreal. W D. Robb, who occupied a similar position at London, Ont., has been transferred to Toronto to take Mr. Harkon's place. W. Ball, locomotive foreman at Belleville, Ont., has been promoted to the position of master mechanic of the northern district, with headquarters at Allandale, Ont. A. A. Scott, foreman at Allandale, will succeed Mr. Ball at Belleville.

Mining Matters.

A smelter is proposed for Wabigoon, Ont.

Metallic tin has been discovered on the North Fork of the Salmon River, B.C.

A find of petroleum is reported on the farm of John Rasberry, West Flamboro, Ont.

A salt mining outfit was taken to Dauphin, Man., recently and will be set in position at once.

The Two Friends mine in the Slocan district paid a dividend of 2½ per cent. on March 31st.

The mining convention which was called for April 6th, 7th and 8th, at Rat Portage, Ont., has been postponed till June.

A. M. Chisholm has made his first shipment of actinolite from the mine in Kaladar, Ont., to New York—a full carload.

THE Ledgerwood hoist and boiler have been successfully transported to the Hawk Bay mine The compressor will shortly be installed.

THE U. S. Court of Appeals has decided that natural gas from Canada is not dutiable The collector at Buffalo brought the matter up.

THE boring for oil at Parkhill, Ont, will be continued for some time. The present depth is only 350 feet Surface oil was discovered at 250 feet.

ACCORDING to the Nanaimo, B.C., *Free Press* the mines of Texada Island are being opened up, and British and American capital is becoming interested.

SPECIMENS from the Bannockburn mine, in Hastings county, have averaged as high as $2,000. A test of five tons is being made at the School of Mines, Kingston, Ont.

DURING the past six months as many as 150 samples of gold-bearing quartz mined in Frontenac county have been brought into Kingston, says the Kingston, Ont., *Whig*.

ALLAN AND ALBERT MOON, A. Coe and J. Golding have 200 acres of land in Tudor township, Hastings county, Ont., and are sinking shafts on the property. The ore has been assayed at $20 per ton.

THE incorporation of the towns of Nelson, Rossland and Grand Forks, B.C., which was assented to by Lieutenant-Governor Dewdney, March 4th, is an evidence of what mining is doing for British Columbia.

THE Union Colliery Co., of Comox, B.C., has entered into contract with the Kootenay smelting companies to supply 1,000 tons of Union coke per month for the next twelve months, and even this amount may be increased.

THE recent advance in lead in the United States should materially enhance the value of the Slocan, B.C., as a mining district. Its galena ores, which carry a large percentage of lead, should be now more valuable.

THE Chatham Oil Company is pumping the second well at Bothwell, Ont The first well has already given good returns, but will be put down deeper. Boring operations will then be begun for the third well, and when it is completed the three will be operated by a jerking plant.

R. G. MCCONNELL, of the Dominion Geological Survey, has notified Martin King, manager of the Trail Mining Company, that specimens of the ore from the company's mine contain gersdorffite, a rich nickel mineral, and that it is possible the ore contains a nickel value worth considering.

It is stated that an American syndicate has offered Col. S. S. Lazier, of Belleville, $100,000 for a half interest in his silver-lead property in Barry township, Frontenac county. An expert who looked over the vein on this location spoke of it highly, stating that it resembled Australian deposits.

IT is impossible to keep track of the companies obtaining incorporation in British Columbia. One week forty-two companies, with a total capital of about $44,000,000, gave notice of incorporation in the British Columbia *Gazette*, and the next 57 companies representing capital of over $51,000,000, gave notice of incorporation.

THE Minden, Ont., *Echo* says "Within four miles of Kinmount, Ont., we have six mines, a rich mineral belt extends for 18 miles from Kinmount to Gooderham, waiting for men with money to open it up and get wealth. Minerals in great variety are here in abundance, and at present mining operations are active in Galway township."

J. R. MINHINNICK London, Ont., has struck another large flow of oil on his property at Bothwell, Ont. The new gusher yields 75 barrels of oil per day. A company has been formed under the name of the London Petroleum Company, with Mr. Minhinnick and E. W. Scatcherd as members They have purchased land adjoining Mr. Minhinnick's property, and will begin operations at once.

IN applying to the Ontario Government for the construction of a reduction plant at Trenton, Ont., the town council enumerated the ores in the district awaiting treatment thus: Gold, including mispickel and free milling ores, galena, including lead, lead sulphides, silver, antimony; nickel, including linneaites, sulphides of cobalt and nickel, graphite, corundum, asbestos, including actinolite, talc, soapstone; mica, sulphur, arsenic, phosphorus.

MICA MANUFACTURING COMPANY, LIMITED, has been formed with a capital of £80,000 in £1 shares, this company to acquire all the mineral rights of the Lake Girard group of mica properties, covering about 1,700 acres, and situated in the Provinces of Ontario and Quebec. Sir Samuel Canning, C.E., is one of the directors, and the purchase money has been fixed at £63 000, payable as to £3,000 in cash and the balance in cash or shares. The entire capital is now offered for subscription in the London, Eng., market.

MCGILL UNIVERSITY is a fortunate institution. Mr. W. C. Macdonald, the millionaire tobacco manufacturer, who has already given $1,500,000 to the institution, has added to his previous munificent gifts the sum of $1,185 for the purchase of certain apparatus for the engineering department, $150,000 for the maintenance of the engineering and physics buildings, and $475,000 for the erection of a building for chemistry and mining and metallurgy, and for the endowment of the chairs of architecture and mining and metallurgy.

THE Algoma *Herald* announces that the East End Silver Mountain mine is to be worked by the Argentite Mining and Reduction Co. It is also proposed erecting a reduction works on the location to treat the ores, thus saving the heavy transportation charges that were paid in former days. The Argentite Company is also endeavoring to arrange with the West End Company whereby the ore from the latter company's mine will be treated in the proposed reduction works. Silver Mountain East End was in the old days a constant shipper of rich ore.

THE first clean-up of ore at the Deloro mines, Marmora, Ont., was made March 19th. The officials of the Canadian Gold Fields Company, who own the property, stated that the mill run turned out most satisfactorily, but they refused to divulge the exact results thereof. It is understood, however, that the run turned out much after the manner of the five-ton test made in London, Eng., over a year ago, and before the company began their $2,000,000 operations in Canada The London test, it was reported, saved 92 per cent. of the gold at a cost of $2 per ton. If, as is believed, the run at the new Deloro mill gave the same results, the future of Hastings County as a mining region is assured.

THE third annual meeting of the Ontario Mining Institute opened in the reception room of the Parliament buildings, Toronto on Wednesday, March 31st The following papers were read and discussed: "The Western Ontario Gold Fields and their Genesis," by F. Hill, M.E., Port Arthur, "A New Use for Scrap Mica," by C H Mitchell, Toronto; "Notes on Moss Litter," by T. W. Gibson Toronto. The following officers were elected: President, Judge J. J. Kingsmill; vice-presidents, W. Hamilton Merritt, James McArthur, John F. Caldwell and John Leachman; secretary, B. T. A. Bell, Ottawa; treasurer, Thomas Gibson, Toronto. Council, A. Blue, Dr. Coleman, H. C. Hammond, J. H Chewett and E. R. Mickele, Toronto; Dr. Goodwin, Kingston; F. S. Wiley, Port Arthur; A. J. G. Swinney, Deloro, and J. Burley Smith, Rat Portage The treasurer's report showed a balance in hand of $71.

AT two o'clock on Feb. 23rd, Mrs. Hall, wife of Superintendent Hall, of the Le Roi mine, turned the steam valve on the new 40-drill compressor lately built by the Canadian Rand Drill Co., and broke a bottle of Mumm's extra dry on the fly-wheel, christening the magnificent engine the "Senator," in honor of George Turner, the general manager of the company The immense machine quickly responded to the steam and worked beautifully in every detail. The compressor is one of the three large machines of the North-West. It is a cross compound condensing Corliss air compressor of 450 indicated horse-power. It is of Rand make, fitted out with the latest type of mechanical air valves, automatic governors, etc., and will be utilized for running all the pumps and hoists at the mine, in addition to operating 40 drills in the mine. The event was made the occasion of considerable speech-making. John M. Burke, Ross Thompson, Ed. Saunders and Captain Hall all spoke in a happy strain, Mr. Burke saying that "the operation of such a large and magnificent piece of machinery in so young a camp, stamps Trail Creek as one of the greatest mining camps anywhere." It was a field day for the Le Roi company, as the new gravity tramway between the mine and the Red Mountain Railway was put in operation and found to work like a charm.

DURING the past year the following companies have been incorporated in England to mine in Canada: B.C. Exploring Syndicate, £20,000; Big Valley Creek Gold Mines, £125,000; Bozedown Silver, £3,000; British Columbia Agency, £100,000, British Columbian Exploration Syndicate, £25,000; British Columbia Finance and Mining, £500; British Columbia Gold Discovery, £100,000, British Columbia Gold Syndicate, £5,000; British Columbia Land Exploration and Development, £250,000; British Columbia Mining, £20,000; British Columbia Proprietary, £6,000; British Columbia Prospectors, £10,000; British Columbia Venture Syndicate, £1,000; British Queen Gold Mines, £300,000; Consolidated Gold Fields of Canada and British Columbia, £100; Cottonwood River,

B C, Alluvial Gold, £65,000; Dawson's Development Syndicate of British Columbia, £6,000; Dominion of British Columbia Mineral Syndicate, £3,000, Galena Mines, £550,000; Gold, Exploration and Development Syndicate of British Columbia, £12,000; Golden River, Quesnelle, £350,000; Gold Fields of British Columbia, £1,000; Hall Exploration of British Columbia, £150,000; Incorporated Gold Mines of British Columbia, £300,000; International Development Corporation of British Columbia, £300,000, Island Mountain Gold Mines, £120,000, Kootenay and Cariboo Mining Syndicate, £5,000; Kootenay Goldfields Syndicate, £20,000; Kootenay Ore Company, £25,000; London and British Columbia Goldfields, £200,000, Mines Trust of British Columbia, £10,100, Mining and Exploration of British Columbia, £25,000; New Goldfields of British Columbia, £100; Oriole Syndicate, £2,000; Pioneer Development and Exploration of British Columbia, £150,000; Vancouver and British Columbia General Exploration, £25,000; War Eagle Gold, £2,000; Wintrop Syndicate £2,000.

Electric Flashes.

RENFREW, ONT., will instal a fire-alarm system.

THE North American Telephone Co. will connect Lanark, Ont., with Perth, Ont.

THE town of Dartmouth, N.S., will buy out the Dartmouth Electric Light Co.

THE B. C. Electrical Construction Co, Vancouver, has dissolved. W. Brown continues the business.

GOLDIE & MCCULLOCH, Galt, Ont., recently supplied a large boiler for the power-house at Preston, Ont.

W H CONE, Little Current, Ont., will in future carry on an electrical supply business in North Bay, Ont.

THE St John, N.B., Street Railway Co. has put two new Babcock & Wilcox boilers into the Nelson St. power house.

THE St John, N B, Railway Co. has placed an order for a number of additional motors of the Westinghouse 12-A type.

BELLEVILLE, ONT., returned to horse power on its street railway system recently, when a rise in the river flooded the power-house.

THE town of Waterloo, Ont, has agreed with the Waterloo Electric Light Co for 15 street lights to be provided as soon as possible.

THE Berlin, Ont., Electric Light Co. has installed a new 150 h p. engine. The changes were planned by the late manager, E. Carl Breithaupt.

THE sewers committee, Hamilton, Ont., recommend for acceptance the tender of E. T. Simpson for a dynamo for the sewage disposal works at $175.

THE Sherbrooke, Que., electric lighting station is now being supplied with a new and improved switch-board from the Royal Electric Co., of Montreal.

THE Packard Electric Co., Ltd., has closed down its factory at St. Catharines, Ont, for the first two weeks in April, owing to the unwatering of the Welland Canal.

THE St. Hyacinthe City and Granby Railway has elected the following officers: H. Pagnuelo, president, H. F. Chalifoux, vice-president; directors, M. St. Jacques and P. F. Payan, and Mr. Perreault, general manager.

NOAH L. PIPER & SON, of Toronto, have invented a new sand-box for electric railway cars. The difficulty of using wet sand has been entirely overcome, the sand being distributed equally well whether wet or dry.

A BRANCH company of the Lachine Hydraulic and Land Company is to be formed to let electric motors. The letting out of motors is quite a business in some parts of the United States and Europe, but is novel so far as this country is concerned.

THE incorporation measure which was passed by the British Columbia Legislature recently giving charters to a number of the new mining towns, such as Rossland, etc., contained a clause allowing the municipalities to put in electric light systems on the same basis as water systems.

WORK will be begun at once by the Carborundum Company, of Niagara Falls, N Y., on its Canadian plant. The product must be turned out by June to protect the Canadian patents. The capacity of the present plant in the power district at Niagara Falls, N.Y., will be doubled, the directors having decided to make the amount 2,000 electric horse-power, twice the amount used now. This will enable the company to turn out four and one-half tons of carborundum a day.

A. HOLLAND, T Askwith, J A. Armstrong, G. S. May, J. A. G. Trudeau, P. McGregor, J. J. MacCraken, Ottawa, Ont., are applying for a Dominion charter as the Dominion Electric Heating and Supply Company, Ltd., capital, $100,000; chief place of business, Ottawa.

THE H.G. & B. Railway paid a quarterly dividend of 1¼ per cent on April 1st. New stations will be built at Grimsby Park and Beamsville, and a large open car will be added to the rolling stock for summer traffic. Arrangements have been made for the wiping out of the floating debt of about $25,000.

THE Hull, Que., Electric Company has served the Ottawa Electric Company with notice of a claim for $20,000 damages of infringement upon the territory and rights of the Hull company in the city of Hull. In default of payment an action will be entered in the Superior Court to recover the amount.

WM. E. CROWE, Henry J. Crowe and A. E. Sulis, Halifax, N.S., have applied for a charter for the incorporation of the Halifax & Bedford Electric Railway Co. Capital, $300,000. Electricity will be generated from water-power from the Birch Cove Lakes, where experts have ascertained 1,000 horse-power is available at all seasons.

ADAM RUTHERFORD, ex-secretary-treasurer of the H., G. & B. Railway Company, has issued a writ against the H. G., & B. for $833.33 arrears of salary alleged to be due to Mr. Rutherford, and for $5,000 damages for alleged wrongful dismissal. It will be remembered that when C. J. Myles came into power after the last annual meeting, Secretary Rutherford's resignation was asked for.

IT is said that two companies are ready to build an electric road between St. Johns, Que., and Longueuil and St. Lambert, and there is a reasonable prospect of such a line being constructed. Utilizing the ferry, which runs eight months out of the twelve, as good time could be made between St. Johns and Montreal as is made by either the G. T. R. or C. P. R., and fares would be reduced.

THE shareholders of the Hamilton & Ancaster Radial Railway recently passed a resolution to obtain the necessary powers from the Legislature to extend the road to Brantford, and to increase its capital stock to meet the expense. The cost of the extension, it was calculated, would be about $200,000. The cost of surveying the road and of obtaining the preliminary charter has amounted to $1,500.

THE Hamilton and Dundas Railway are renewing their bridges in steel on masonry foundations. Medler & Arnot have the contract for piling work, and the Central Bridge and Engineering Co. for super-structures. A new combined passenger and baggage car has been built at the Toronto Railway Co.'s shops for the road. The new work is being carried out under W. T. Jennings, C.E., Toronto, consulting engineer for the company.

E. B. OSLER has instructed Manager Thomas, of the H. & D., to inform the Dundas councillors that he had made a deal with the C P R and M C R, whereby these corporations pay him interest on $15,000, percentage of depreciation of roadbed, a certain share of the profits of the freight handled, and assume a portion of the cost of maintaining the freight section of the road, and, in return, freight is to be delivered to them at the junction of the H. & D. and T., H. & B. Railways several times daily.

THE Hamilton Radial Railway Co. are having four new cars built to be ready by the first of May. These cars will be equipped with the Canadian General Electric motors, there being four motors of 40 h.p. each, one motor to each axle. The traffic of the past winter on this road has been much beyond the expectations of the promoters. The road at present terminates at the outskirts of Burlington village, but is now being extended into the heart of the village, and it is the intention of the company to give a fifteen minutes service in the busy parts of the day during the summer.

MCGIBBON, Hogle & Mitchell, Montreal, are solicitors for the incorporators of the proposed Continental Heat and Light Company, which is asking for a Dominion charter "to generate heat, light and power by any means, and supply the same to municipalities, corporations and individuals in Canada and elsewhere, with all the powers, rights and privileges necessary, incidental or conducive to the attainment of the said objects." A joint stock company to take over the business of the sun, moon and stars is the only more extensive scheme we can think of. Who will organize it?

R. S. KELSCH, of Chicago, will enter upon his duties as electrical engineer for the Lachine Rapids Hydraulic and Land Company, Ltd. At the present time, Mr. Kelsch is in charge of the High Tension System of the Chicago Edison Company. For eight years he occupied the position of division superintendent of the Chicago Telephone Company; was in full charge of the lighting plant in the stock yard district for the Chicago Arc Light and Power Company for four years. He was then made general superintendent of that company, which position he still held at the amalgamation of that company with the Chicago Edison Company, when he was retained. He was next made superintendent of high tension and repair shops.

A GOOD deal of discussion is taking place in British Columbia upon the applications of the Okanagan Water Power Company and the South Kootenay Water Power Company for incorporation. The names of the incorporators are the same in both bills, viz., J. R. Mitchell, mining engineer, Vancouver, B.C.; L. H. Webber, financial agent, Rossland, B.C.; and P. C. Stoess, mining engineer, Spokane. These companies propose to supply electricity in almost the entire area of West Kootenay and the southern portion of Yale district. The Okanagan Water Power Co. asks for a franchise covering a territory 140 miles by 35, and containing about 5,000 square miles. The South Kootenay Water Power Co. would embrace an area of 100 by 80 miles, or 8,000 square miles. The first named asks for authority to use and divert from the Okanagan River and tributaries thereof "so much of the waters as may be needful for their undertaking." The other company wants the water of Kootenay River, Murphy Creek, Kettle River, Boundary Creek and tributaries thereof, to furnish the power to operate tramways, generate electric energy, etc. A monopoly so extensive would be better than a gold mine.

JOHN YULE, president of the Canadian Electric Association and manager of the Electric Light Company, of Guelph, Ont; C. P. Hunt, manager of the London Electric Light Company, of London; E. E. Cary, manager of the Packard Electric Company, of St. Catharines; A. B. Smith, superintendent of the Great North-Western Telegraph Company, at Toronto; F. C. Armstrong, Toronto, general agent of the Canadian General Electric Company, met at Niagara Falls, Ont., March 28th, Wilfred Phillips, manager of the Niagara Falls Park and River Railway, to perfect arrangements for the annual meeting of the Canadian Electric Association, which will be held at Niagara Falls on June 2nd, 3rd and 4th. It is expected that this convention will call together the chief representatives of the electrical manufacturing concerns of Canada, besides all the leading electrical engineers, and be a distinctly representative body It was decided to devote the first two days to the business of the convention, and the third day to sight-seeing. One of the chief objects of holding the convention here is to give all electrical engineers a chance to inspect the electrical power works of the Niagara Falls Power Company, where is to be found the most modern of electrical apparatus and devices, as well as one of the most perfect installations of long distance transmission of electricity to Buffalo. Manager Phillips has promised to give the association all the power necessary to run the exhibits, as well as to make some remarkable displays. On the second evening of the convention a banquet will be given at the Dufferin cafe in the park. All the electrical roads in the vicinity will tender the visitors complimentary trips.

Marine News.

THE C.P.R. will build a dock on the lake at Slocan, B.C.

CAPT. T. J. CRAIG, of the R. & O. str. "Passport" has resigned.

THE Welland Canal is expected to be open for navigation about 20th inst.

WM. KENNEDY is engineer of the steamer "Queenstown," of St. John, N.B., this season.

J. B. MILLER, Toronto, Ont., officers str. "Seguin," Capt. James B. Symes, Engineer Samuel Gillespie.

CAPT. H. SMITH will be master of the barge "Ceylon," of Garden Island, during the coming season.

THE Gilbert Boat Co., Brockville, Ont., is building three yachts for members of the Kingston, Ont., Yacht Club.

STEAMER "Lakeside," Captain N. J. Wigle, began her season's runs between St. Catharines, Ont., and Toronto, on March 24th.

THOMAS MYLES, Hamilton, Ont., str. "Myles," will have as officers this season, Capt. G. Mackey, Engineer James Smeeton.

THE schooner "Zebra" cleared light for Port Credit from Toronto, March 23rd, she being the first boat to leave the harbor this season.

D F. MAXWELL, C.E., has planned a new wharf at St. Stephen, N.B. It will be 265 feet long and 70 feet wide. Tenders will be called for.

LABREQUE & DOBSON are arranging for the construction of a steam tug to ply on Eagle Lake, situated between Rat Portage and Wabigoon.

THERE will be 400 tons of steel used in the new barges to be built by the Canadian Engine and Locomotive Works Company Kingston, Ont.

THE steamers "Chicora," "Rosedale," "Algonquin," "Persia" and "Niagara" are being fitted for the season's business in Toronto harbor.

W. BEATON, president of the Marine Engineers' Association, St. John, N.B., will be chief engineer on the new Star Line steamer which is now building.

HURD PETERS, city engineer, St. John, N.B., is preparing plans for new wharves at that port. The wharf will be 50 feet wide at the bottom, without counterforts.

CAPT. PETER MCINTOSH, of the tug "Coponaning," Ontario Lumber Co., has accepted a similar position with the French River Boom Co., taking charge of the tug "Eveline."

J. & T. CONLON, Thorold, Ont., officers str. "Erin," Capt. P. Sullivan, Engineer Wm. McMaugh; schooners—"F. L. Danforth," Capt. John Cornwall; "Maggie," Capt. John Rosie.

THE North West Transportation Co., Sarnia, Ont., officers str. "Monarch," Capt. E. Robertson, Engineer E. W. McKean; str. "United Empire," Capt. John McNab, Engineer S. Brisbin.

GEO. PEARSON has been appointed captain of the Dominion Government cruiser "Dolphin," and F. W. Cornish, engineer. The cruisers will go into commission as soon as navigation opens.

THE services of James Wilson as superintendent of Kingston Graving Dock ended on March 31. Frederick S. Rees was appointed in his place. The salary will be reduced from $1,500 to $1,000.

THE Furness Line is now building four 10,000 ton freight and cattle steamers, 470 feet by 60.6 feet. The steamers will be of the Cambrian type, speed of 14 knots, and have four masts and nine hatches.

THE Playfair Barge and Tug Line, Midland, Ont., officers str. "St. Andrew," Capt. W. H. Featherstonhaugh, Engineer Jno. McRae, str. "Metamora," Capt. R. H. Gilbertson, Engineer E. A. House.

THE Dominion line will immediately begin the construction of a new steamship for the St. Lawrence trade. The builders will be Harland and Wolff, Belfast. She will resemble the "Scotsman," only of larger size.

THE stream connecting Kootenay Lake and Upper Kootenay Lake, generally known as the Lardeau River, is being freed from obstruction at a cost of $3,000. B. S. Gallop, Kaslo, B.C., is in charge of the work.

THE Lake Ontario and Bay of Quinte Steamboat Co., Kingston, Ont., officers: str. "North King," Capt. John Jarrell, Engineer O. J. Hickey: str. "Hero," Capt. Wm. Bloomfield, Engineer Robt. Marshall.

IT is said that the Canadian Pacific Navigation Co. will place a steamer on the island route connecting Victoria, B.C., Texada, Phillip's Arm and other points among the islands to which prospectors are now crowding.

SYLVESTER BROS.' officers, Toronto, Ont.: Str. "L. Shickluna," Capt. H. O. Jackson, Engineer W. H. Cunningham; str. "Eurydice," Capt. J. Jackson, Engineer Geo. Munroe; schooner "St. Louis," Capt. Geo. Williamson.

D. ARMSTRONG, Welland, Ont., recently launched a new tug, the "A. D. Cross," which is 50 ft. keel, 16 ft. beam, and 10 ft. 11 in. hold. The engine was made by a Buffalo firm and the boilers by the Waterous Engine Works, Brantford, Ont.

THE Niagara Navigation Co. officers, John Foy, manager, Toronto, Ont.: Steamer "Chippewa," Capt. J. McGiffin, Engineer R. McCaul; steamer "Corona," Captain W. H. Tolmes, Engineer Wm. Walsh; steamer "Chicora," Capt. to be appointed, Engineer H. Parker; steamer "Ongiara," Captain H. J. McIntyre, Engineer M. Carl.

THE Donnelly Wrecking & Salvage Co., Kingston, has purchased the wreck and salvage (including all the equipments and outfittings saved) of the propeller "Acadia," wrecked on the north shore of Lake Superior in September last.

THE following have been appointed officers on the Dominion Government cruiser "Petrel":—Captain, Ed. Dunn; first mate, A J. Frame, second mate, F Arnold Jarvis; chief engineer, A. J Brown, second engineer, W. H. Linter

THE St Lawrence & Chicago Steam Navigation Co., John H. G Haggerty, Manager. Toronto, Ont. Str. "Algonquin," captain, James McMaugh, engineer, James H Ellis Str "Rosedale," captain, James Ewart; engineer, Richard Childs.

THE Great Northern Transit Co officers, Collingwood, Ont. Str. "Majestic," Capt P M. Campbell, Engineer W. Lewis: str. "Pacific," Capt. R D Foote, Engineer J. W. Aston, str. "Northern Belle," Capt C Jaques, Engineer F. Cleland.

CAPT. J. K HARBOTTLE, for the past four years captain of the Niagara Navigation Co.'s steamer "Chicora," and previously captain of the steamer "Onigara," died suddenly in Toronto, April 1st. He was a son of the late Capt. Thos. Harbottle.

CANADIAN PACIFIC STEAMSHIP Co, Owen Sound, Ont.: Str. "Manitoba," captain, E. B Anderson, engineer, Robt. Kenny. Str. "Athabasca," captain, Geo McDougall; engineer, Wm. Lockerbie. Str. "Alberta," captain, Jas. McAllister, engineer, A Cameron.

THE Allan line will add the steamer "State of California" to the fleet on the St. Lawrence route, between Montreal and Liverpool The "State of California," since she was built in 1891, has been run in the service of the Allan State line, plying between New York and Glasgow

J JOLLY will be the Toronto agent of the Hamilton Steam. boat Co this season Str "Macassa, Captain Crawford, will be the first boat on the route, about April 1st, the "Modjeska" taking her place as soon as the business warrants. Captain Crawford will sail the "Modjeska"

THE Hillside Shipping Company, Ltd., applies for Dominion incorporation to do a general shipping business, with head office in Yarmouth, N.S., capital, $30,000 The incorporators are: W. L Lovitt, G C. Lewis, T. V B. Bingay, Catherine M Lovitt, I. Chipman, Yarmouth, N S

CANADIAN Pacific freight, which last season was delivered to the Soo line steamers at Windsor, Ont., will hereafter be carried to Midland, Ont., and there transferred. This is the new run had in view for the steamer "Lora," which is now being lengthened and partially rebuilt at Milwaukee

IT appears as if there will be a number of new steamers plying on the Lake of the Woods the coming summer. There is the Ross-Graham steel boat, F. Kendal is building one, so also are F. Hemmings, Capt. Johnson, the owners of the Mikado mine, and the Diamond Drill Company

THE Mathew's Line officers, Toronto, Ont Steamer "Niagara," Capt James Morgan, Engineer John Gray, steamer "Clinton," Captain John Joyce, Engineer P. J Carr, schooners "Emerald," Captain John McCribbon, "Clara Youell," Capt. W. J Colwell, "Lisgar," Capt John Fahey; "Grimsby," Captain Grant Horne.

THE North Shore Navigation Co. officers, Collingwood, Ont. Str. "City of Collingwood," Capt. W. J. Bassett, Engineer C Robertson, str. "City of Midland," Capt. F. X. La France, Engineer W. Whipps; str "City of Toronto," Capt. A C. Cameron, Engineer D McQuade, str "City of Parry Sound," Captain E Walton, Engineer J L Smith

THE line of boats running from Golden, B.C, on the Canadian Pacific Railway, down the Columbia River, with that navigating from Jennings, on the Kootenay River, north into the Fort Steele country, has been consolidated The combined concern will be known as the International Navigation Company, but it is in reality a branch of the Canadian Pacific Railway service.

W A MURRAY, of Murray & Williams, 17 St. John street, Montreal, has gone to Liverpool with a launch built by his firm, which is the first Canadian craft of the kind to go to England. It will be entered in the yachting exhibition to be held this summer at the Imperial Institute, London, Eng. It is 21 feet long, 5 feet 3 inches beam, and is fitted with a 2½ by 3 inch stroke high speed engine, and the Moore steam pump The boat is built of cedar and is finished throughout in mahogany, with fancy oak gratings in fore and aft cockpits The boiler and engine rooms are finished throughout in polished brass

A WATERWAY to connect Red River with Rainy Lake is proposed by building a dam at the outlet of Red Lake, thus creating a water line of transportation extending from Thief River Falls to the head of Red Lake, a distance of 84.6 miles on the river and 50 miles on the lake. From the east end of Red Lake a canal can be very cheaply cut through to Rainy River—a marsh covers the whole distance—thus, it is said, opening a great stretch of country bordering a navigable river, including the Lake of the Woods.

THE Canadian commissioners, under the Deep Waterways Commission, have completed their report to the Dominion Government of their joint deliberations with the United States representatives Much information has been gained and plans formulated, with accompanying sketches and maps The United States Government will be asked, however, to appropriate $150,000 for further surveys and deliberations The Canadian commissioners, O A Howland, C. T. Keefer, and Thomas Munro, will ask for about $15,000 to make surveys.

CAPT. F P ARMSTRONG, of East Kootenay, is the pioneer steamboat man of the Kootenay and Columbia Rivers between Golden B.C., and Jennings, Mont. He and James F. Wardner have just organized the International Transportation Company, which is to operate a line of steamers between Fort Steele and Jennings on the Kootenay River. A steamer of 100 tons capacity will be run every day between Fort Steele and Jennings. Captain Armstrong will be the manager and will also manage the Upper Columbia Navigation Company, which will have a line of steamers between Fort Steele and Golden.

THE Canadian Marine Association met in Toronto recently. President R O. Mackay, Hamilton, in the chair. A committee was appointed to proceed to Ottawa and lay several requests before the Government, the principal being that the Government in future refuse permission to anyone to build a bridge across navigable waters. The Government will also be asked to keep the bridge across the Murray Canal open on Sundays. The contention of the vesselmen in this is that the Murray Canal was constructed to allow vessels passage by the way of the Bay of Quinte when it was too stormy to go out into the open lake, and that the closing of the bridge on Sunday does away with a great deal of the value of the route They would like the duty on manilla cordage reduced to about 12½ per cent., the same as prevails in the case of binder twine

J. R. ROY, C.E., who is in charge of the Government survey of the Fraser River, B.C., has twenty men in his party. R. C. Lowry, A.M.I.C.E., being chief assistant engineer; W. C. Mitchell, C.E., second assistant The preparing of the plans from the field notes sent in will be done at New Westminster, under the direction of A. J. Hill, M.A., M.C.S.C.E. A complete triangulation survey of the river will be made. It is Mr. Roy's intention to first of all make a survey of the whole of the Lower Fraser, to establish a basis, a survey also being made of the nature of the river banks, and also the various tributaries of the Fraser. After that considerable time will be devoted to examining the river by cross-sections from the basis already established. The various points will also be recorded; the depths, bed formation, etc., will also be carefully noted; as also those of the numerous streams and lakes tributary to the Fraser. The work is expected to take two years

THE officers of the Toronto Ferry Co steamers for the present season are: "Primrose," captain, C. Tafford; mate, H. Cotter, engineer, H Brownley; 2nd engineer, J. Armstrong. "Mayflower," captain, George Moulton; mate, M. Livingston; engineer, S A Mills; 2nd engineer, J Pickard. "Shamrock," captain, T. Jennings; mate, T Churchill, engineer, E. Abbey. "Thistle," captain, A. Martin; mate, N Osborne; engineer, C. Lerally. "Kathleen," captain, J. Fertile; mate, McLaughlin; engineer, Paddy Carr. "Gertrude," captain, J. Tymon; mate, P. M. Olsen, engineer, Wm. Hopkins. "Island Queen," captain, J. Titus; mate, Olwood; engineer, T. W. Wood. "Luella," captain, T. Hinton, mate, Wm Joice; engineer, John Smiley. "J. L. McEdwards," captain, William Scott; mate, Henry Brown; engineer, John D McGinnis. "Arlington," captain, H. Farr; mate, Ed. Lawrence; engineer, J. Wesley. "Mascott," captain, Henry Florio; mate, Henry Hanna; engineer, Wm. Food

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We have received the proceedings of the sixth annual convention of the Association of Railway Superintendents of Bridges and Buildings, held in Chicago, in October, 1896. Committees reported on a number of most interesting subjects, and the ensuing discussions are very fully reported. Drawings and plans accompany many of the reports.

Railway Matters.

THE people in Manitoulin Island are protesting against an extension of time in which to build the Manitoulin and North Shore Railway.

IT IS generally understood that the superintendent of the Grand Trunk car shops at London will be Samuel King, Montreal, formerly chief draughtsman of the Hamilton car shops.

THE London, Ont., Board of Trade is urging the building of a line connecting Ridgetown, Ont., and the Port Stanley Railway at some point between St. Thomas and Port Stanley.

THE purchase of 65,000 tons of steel rails from the Carnegies, at Pittsburg, by the Canadian Pacific Railway, is confirmed, and it is said the company obtained the rails at $17 per ton.

THE city council of Levis, Quebec, are opposing the extension of the Intercolonial Ry. from Levis to Montreal, as announced in the speech from the throne on the opening of Parliament.

DURING the coming season the Grand Trunk will make extensive renewals in the masonry between Toronto and Montreal, and on the Midland. It is intended to rebuild the bridge over the Rouge river near Port Union.

THE draft of the order of the Railway Committee of the Privy Council on the spur line crossing of York street, Hamilton, Ont., extinguishes the rights of the Hamilton & Milton Toll Road Company on payment of $20,000 each by the city, county and T., H. & B.

F A. HEINZE, of the Columbia & Western Railway, has mortgaged his Montana property for a million and a half, for the purpose of building an extension of the Columbia & Western to Penticton, B C Work on the new line will begin immediately at Robson.

THE Temiscouata Railway Company is applying to Parliament to enlarge the time for commencing the work of extending the railway from Edmundston to a point on the Intercolonial Railway, and also to authorize the company to build a railway connecting such proposed extension with the Central Railway at Chipman, in Queen's county.

FIFTY of the Canadian Pacific freight locomotives are being equipped with the Westinghouse air-brake, having been the first shipment of the brakes manufactured in Hamilton made to Montreal recently. The company has arranged to spend $300,000 a year for three years in equipping the rolling stock with the Westinghouse appliance.

HARRY ABBOTT, who has been general superintendent of the Pacific division of the Canadian Pacific Railway since the line was built to the coast, has resigned. Mr. Abbott, who is a brother of the late Sir John C. Abbott, has been connected with the Canadian Pacific Railway since its inception, and previous to that was engaged on engineering work in connection with numerous railways in Eastern Canada.

WORK on the Coast Railway, which will run from Yarmouth to Lockeport, N.S., is progressing very satisfactorily. The road is graded for a distance of 32 miles from Yarmouth, and the rails are down on 20 miles of that stretch. There are on the spot 1,000 tons of rails, which it is estimated will carry the line to Lower East Pubnico The railway will be completed to Lockeport in 1898, and subsequently 100 miles to Halifax.

AN influential deputation waited on the Ontario Government recently in support of the proposed Ontario and Rainy River Railway, which would commence at the junction with Port Arthur, Duluth and Western Railway, near Kakabekha Falls, 23 miles south-west of Port Arthur, and runs through the Seine River Valley to Seine Bay, a distance of 150 miles. Along the route are many valuable mineral properties.

As good an authority on the subject of the width of the Crow's Nest Pass as can be obtained is W.T. Jennings, C.E., Toronto, who has gone over the route from Fort Macleod to the East Kootenay four times in all, and has walked over the Pass and ridden and driven through it. His last visit was in the autumn of 1893, when he was there in the interests of the British Columbia Southern Railway. To a *Globe* reporter recently Mr. Jennings showed a plaster cast of the Pass and the adjacent mountain district, which he is making, and traced the course of the Pass across the mountains. Up the Crow's Nest Creek the Pass, though contracted, is not unduly narrow, and the gradients are easy, much easier in fact than those on the C.P.R. track at present used. At the Crow's Nest Lake the main difficulty occurs. The C.P.R. had at the time of Mr. Jennings' visit graded the Pass up to this point, and had made a comencement at a rock cutting in the steep bank of the lake. The line laid out by the C.P.R. is located along the north side of the lake, at the foot of minor mountains forming the spurs of Crow's Nest Mountain, these are very steep on the lake side. Another line to run along that side of the lake would have either to widen the cutting thus started by the C.P.R. or to get running powers over the rails. The southern side of the lake is of much the same nature as the northern, and a similar cutting might be made along it. A bay of the lake at the western end trends south, and the southern banks of this bay are more precipitous than the banks elsewhere. If this bay should not prove too deep, it could be bridged; in this case the southern bank would be just as practicable as the northern. From Crow's Nest Lake to Summit Lake is a rise of about twenty feet. Either shore of Summit Lake affords an equally good location for a line. Summit Lake marks the apex of the Pass. The descent of the Michel Creek and Elk River valleys is easy. On leaving Summit Lake the line descends into Michel Creek valley, and finds in front of it the immense horn-shaped mountain—or rather a timber-clad hill—the tip of the curving horn lying to the north and Michel Creek running along its southeast side to empty at the apex of the ridge into the Elk River, which passes along its northwest base. This timbered, hilly ridge contains the great coal beds, and the line of the C.P.R. is accordingly laid on the left bank of the Elk River, next to this hill. Down the Elk River both sides are practicable for railway construction, the side selected being perhaps the easier; it is certainly the most suitable, as it skirts the mountain side containing the principal body of coal.

THE short line from Montreal to Ottawa, which is being built by the Canadian Pacific along the south side of the Ottawa River, will be finished by the middle of the coming summer, only some 40 miles at the Ottawa end yet remaining to be built. With regard to the entrance into the City of Ottawa, very little has yet been given out, but it is stated that the new C.P.R. road will join the Canada Atlantic about three miles from Ottawa, using that company's tracks to get into the capital. The distance from Montreal to Ottawa will be reduced to 106 miles, and as the company are having six magnificent new engines built in Montreal, and the rails on the M. & O. being of the heaviest kind, the time between the cities will be reduced to 2½ hours.

Industrial Notes.

A PUBLIC library is to be built in Goderich, Ont., to cost $5,000.

T. B. CALDWELL, Lanark, Ont., is enlarging the cheese factory at Balderson.

THE Walker Foundry Company, Ltd., Belleville, has been succeeded by J. Gordon.

THE Toronto estimates for 1897 call for $56,000 for a new bridge on Queen street east.

THE bridge over the River Credit, at Huttonville, Ont., was carried away recently by a flood.

JOHN PALMER wants to buy a new engine for his tannery, Westmoreland St., Fredericton, N.B.

H. MCELROY & SONS, Carp, Ont., are enlarging their roller mill from 50 barrels daily to 100 daily.

A. BELL, C.E., Almonte, Ont., has prepared plans for a new public school building in Arnprior, Ont.

THE town council of Renfrew, Ont., recently passed a resolution in favor of buying a steam fire engine.

THE Cant factory at Galt has been purchased by the McEachren Heating Co., who take possession this month.

A NEW cheese factory is being built at Woodlawn, Carleton county, Ont.; Jno. Bradley has the contract.

J. KREINER & Co., Berlin, Ont., are building an addition to their furniture factory 40 by 50 feet, and three stories high.

JAS. EVANS & Co., iron founders, Omemee, Ont., are supplying the boiler, etc., for a new cheese factory at that place.

THE Milton Wire & Roofing Company, Ltd., Milton, Ont., is fitting up the premises formerly occupied by the Novelty Works.

WENTWORTH county council are to call for tenders for an iron bridge across the marsh, west of Hamilton, to cost $3,000 or less.

PIGOTT & INGLIS, contractors, Hamilton, Ont., have been awarded the work on the Grenville Canal, between Ottawa and Montreal.

THE old Dick & Banning water power near Keewatin has been sold by the Rat Portage Lumber Co. for $25,000 to an Ottawa syndicate.

THE Montreal Rolling Mills Company, manufacturers of iron and steel nails, etc., has closed down the works at Ste. Cunegonde, Que., temporarily.

BAKER BROS., Casselman, Ont., have a contract to supply C. Ross, Ltd., Ottawa, with 275,000 bricks, to be used in the new departmental store.

JOHN J. GARTSHORE, railway supplies, Front st. west, Toronto, has recently shipped rails for tramways to several mines in the Rainy River district.

THE machinery is being removed from the beet sugar factory at Farnham, Que., and shipped to Rome, N.Y. There will be from 80 to 100 car loads in all.

D. MOORE & Co., iron founders, have made a ten per cent. cut in their moulders' wages, as it is claimed, to meet the taxation imposed by the city of Hamilton, Ont.

THE Department of Railways and Canals, Ottawa, has given a contract for 3,000 tons of steel rails for the Intercolonial Railway to the Maryland Steel Company.

THREE shifts of men are engaged at the acetylene gas works, Merritton, Ont. The shifts work eight hours each, so that the works are kept running day and night.

AN application for letters patent for the incorporation of the Romaine Automatic Agricultural Machine Company, Ltd., with headquarters in Montreal, has been made.

A. BELL, C.E., Almonte, and J. H. Moore, C.E., Smith's Falls, recently apportioned the $16,000 voted by the late Parliament for land damages along the Tay Canal.

AT the annual convention of the International Sheet Metal Workers' Amalgamated Association, held last month at Cincinnati, M. Kennedy, of Toronto, was elected third vice-president.

A STATIONARY ENGINE on the farm of Peter McGarvin, Creek Road, Harwich, Ont., exploded March 27th, killing James McGarvin and seriously injuring John Houston, who was standing near. The boiler had been in use for 15 years.

A NEW buckwheat and corn meal mill has been erected at Merrickville. It is owned by P. Kyle, who will do business under the name of the Merrickville Milling Co. It is operated by water power and the proprietor is putting in an electric plant to light the village.

IN moving the second reading of his bill respecting technical schools, Hon. G. W. Ross informed the Ontario Legislature that it was intended to establish technical schools for adults, as well as to provide for the alteration of a high school building into a technical school if the municipality so desired.

THERE is a bill before the Ontario Legislature providing that provincial railway bonuses may, in future, be paid by the Government in iron or steel manufactured in the province, from ore of which two-thirds was mined in the province, and the money voted for the bonus paid to the manufacturers instead of the railway.

THE following officers were elected at the annual meeting of the St. Hyacinthe Board of Trade: J. N. Dubrule, president; J. B. Brousseau, vice-president; Dr. Ostigny, secretary-treasurer; board of direction, G. H. Henshaw, jr., E. R. Blanchard, S. T. Duclos, J. L. Seguin, J. A. Cote, J. Laframboise, E. H. Richer, and F. St. Jacques.

THE boiler compound business formerly carried on by William Sutton alone was recently turned into a joint stock company called the William Sutton Compound Co., Ltd., with offices at 206 Queen St. east, Toronto. Mr. Sutton reports that the compound has greatly increased in popularity among steam users, the sales for the past year being much larger than for any period since it was placed on the market. No compound yet introduced into Canada has had so many strong endorsements.

THE Dominion Government has passed an Order-in-Council granting $300,000 to the G.T.R. towards the extension of the Victoria Bridge at Montreal. The scheme of enlargement includes a double railway track and a road for vehicles and foot passengers. It also provides for a double electric track. And the Electric Railway Company will run lines to Laprairie, St. Johns, Vercheres and Longueuil, making a loop line. The present intention is to call for tenders by April 15, and begin work on May 1st, so that it may be completed in eighteen months. It is estimated that the bonuses granted will amount to about one-third of the cost of enlargement.

CLATWORTHY & Co., of 46 Richmond street west, Toronto, have secured from W. M. Watson his invention for cleaning sewage, which is specially arranged for private hotels, hospitals, asylums, and other isolated institutions. The invention is very simple in construction, easily understood and managed, being self-acting, requiring attention only for the purpose of clearing the screen and discharging the sludge about once a month, which takes only a few minutes to perform. It is perfectly odorless, can be worked during the hardest frost, and the plant can be efficiently constructed to work on level premises without the aid of pumps, besides being less costly, more permanent and durable than other systems adopted to clean sewage water. It also gives a purer effluent. A description of this system will appear in another number of this journal.

"*The Land of the Maple*," *a patriotic song, words and music* by H. H. Godfrey; published by the Mason & Risch Piano Co., Ltd., Toronto. This is a charming song and speaks not only of the rose, the thistle, and the shamrock, but also the lis, the national emblem of Old France, which long ago adorned the British banner as a sign that France was conquered by British arms, but now is a happy memento of the united hearts of the descendants of the former enemies