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MISSING

The Canadian Engineer

ESTABLISHED 1893.

WITH WHICH IS INCORPORATED

THE CANADIAN MACHINE SHOP.

VOL. XIV.—No. 5. TORONTO, MAY 3rd, 1907. PRICE 15 CENTS $1.00 PER YEAR.

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THE CANADIAN MACHINE SHOP

ISSUED WEEKLY IN THE INTERESTS OF THE

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

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TORONTO, CANADA, MAY 3rd, 1907.

CONTENTS OF THIS ISSUE.

ELECTRICITY FOR STEAM.

The Ontario Hydro-Electric Commission is considering the use of the Grand Trunk right-of-way for Government transmission lines from Niagara Falls to the municipalities whose enterprise is to destroy the monopoly of corporation producers of electricity. The railway, it is said, will use a considerable quantity of power, which will reduce the cost of the right-of-way to the Commission. Mr. Hays has spoken in a non-committal way of the possibilities. The time has not yet come for using electricity as a motive power on the Grand Trunk lines in Western Ontario. But the time may be nearer than is generally supposed.

Before adopting electrical motive power, the principal question a railway company will consider is whether electric locomotives will reduce operating expenses and increase earning capacity. Some of the advantages of electric locomotion it is almost impossible as yet to place an accurate monetary value upon, such as the decreased wear and tear on tracks, bridges, and roadbed, due to the absence of lateral swaying and hammering which accompany the steam locomotive. Then, again, smoke, cinders, and the gases resulting from combustion are eliminated, which makes travelling, especially in tunnels, much more pleasant, and which will more or less reduce the cost of cleaning and painting rolling stock generally. Another great advantage attained through the use of the electric locomotive is that a train may be got ready on the shortest possible notice. There are no fires to light, and no time wasted in getting up steam or coaling-up.

The electric locomotive has a much greater horse-power capacity per ton weight than the ponderous steam locomotive, which may be doubled and trebled by multiple unit control. This allows of higher accelerations, speedier running, and the hauling of heavier trains. A valuable adjunct to the electric railway is the three-phase system, which adds considerably to the service capacity by helping to maintain a given schedule independent of increased train weight or grades.

Increased earning capacity must not be taken as the final argument for the electrification of a steam railroad, since this depends largely on local conditions. Such is the competition of suburban electric railways, which in many large cities, especially in the Old World, have made local passenger traffic on the steam roads all but unremunerative.

The main point is, Will electricity reduce the cost of operating expenses sufficiently to warrant a change that involves the scrapping of enormous quantities of rolling stock?

No steam system has yet, in any considerable section, superseded steam by electricity. But elaborate investigation has shown that the operation of electric locomotives gives a considerable saving over the steam locomotive. On a double-tracked line, through fairly mountainous country, on which the passenger trains averaged 250 tons, and made a speed of about 27 miles per hour, the cost of steam locomotive operation was 36.85 cents per revenue train mile, while in the conservative estimate for the same road the cost of electric operation was only 28.94 cents per revenue train mile. The saving of 7.91 cents per mile, or 21.05 per cent. on

a road 78 miles long, with 2,211,000 train miles per year, meant a total in one year's operation of $174,890.

When steam was used 60 locomotives were required, since 20 per cent. of this number were continually undergoing repairs, or otherwise out of service, and 11 per cent. of the number were required for switch service, so that only 43 out of 60 locomotives were required for the revenue bearing service. Only 28 electric locomotives would be required on the line, six being of the 60-ton passenger type and 22 of the 90-ton freight type. The electric locomotive is much less liable to get out of order than the steam locomotive. The decrease in the cost of operation would give an additional dividend of about 7 per cent. over and above the 4 per cent. interest charged on the capital invested when electrifying the road. Here is a comparison of detailed cost per revenue train mile:—

	Steam. Cents.	Electric. Cents.
Repairs to locomotives	8.32	1.67
Wages, engineers and firemen	8.75	
Wages, roundhousemen	1.62	
Wages, motormen and helpers		5.38
Roundhouse expenses	0.31	
Roundhouse and shop, repairs and renewals	1.07	1.25
Shop expenses	0.20	
Shop machinery and tools, repairs and renewals	0.91	
Fuel	9.77	
Fuel-station operation	0.28	
Water supply	0.31	
Fuel and water station, repairs and renewals	0.26	
Power delivered at locomotive		17.62
Oil, waste, grease, and supplies	0.99	0.23
Interest	1.41	9.76
Insurance and risks	0.53	0.63
Depreciation	2.12	1.40.
Total	36.85	28.94

The dominating factor in this comparison is, of course, the price of power. Coal costs this railroad company only $1 per ton. The cost of generation per kilowatt hour is .46130 cent, and for distribution .2550 cent, or a total, delivered at the locomotive, of .71630 cent per kilowatt hour. The farther a railroad is from the coal supply the more costly will its electricity be; but, of course, that will make no difference to the gain arising from the supersession of steam, because the coal has to be hauled to the place of consumption whatever the ultimate motive power.

The figures given would not apply minutely, of course, to Canadian conditions. But Canadian railways, speaking broadly, have advantages with regard to electrification over those of most other countries. We have unequalled water powers available, not only in the country contiguous to Niagara, but over the greater part of the territory likely to be traversed by railroads. Indeed, with improvements in long distance transmission it may presently be a simple matter to transmit power from the Winnipeg River more than half-way to the Rocky Mountains, and to utilize some of the mountain torrents for power, to be sent eastward to the limit of transmission from the eastern supplies of energy.

The electrification of steam railroads is predominantly a question of finance. The electrician and the engineer will increase the efficiency and economy of existing methods. But it is just on this certainty of improvement that the apparent hesitancy of railroad chiefs is founded. Besides the scrapping of enormous quantities of steam plant and its accessories there is the unknown factor of electrical improvement likely to involve the scrapping of enormous quantities of electrical plant, which Mr. Moyes, of Toronto, who has had great experience in operating electrical systems, describes as "Obsoletism." Street railway men are finding that in calculations made in the infancy of their enterprises they did not allow sufficiently for changes in equipment; for charges likely to arise from electrolysis and a dozen other things which, absent from the childhood of an industry, may become as permanently costly with maturity, say, as shaving is to a man.

It is possible to buy secondhand electric cars in good running condition at very low prices, simply because they have been put out of business by larger and more economically managed conveyances. Of course, there will not be an indefinite enlargement of cars; but it is impossible to set a bound to the changes, more or less expensive and revolutionary, which may, within the next decade, upset the best-based calculations.

Take one aspect of the chances of obsoletism. Messrs. Stillwell & Putnam have recently presented to the American Institute a paper on "The Substitution of the Electric Motor for the Steam Locomotive," in which the standpoint is taken that the single-phase system is the only one worthy of consideration for railway electrification, and the suggestion is made that in ten years from now the 1,200 volt or 1,500 volt continuous current systems, which have been suggested as substitutes for larger potential alternating current systems in heavy electric traction, will be virtually extinct. The implied prophecy has produced an article by H. M. Hobart in the Engineering Supplement of the London Times, which predicts that within ten years continuous current systems, as applied to railway electrification, will employ line pressures up to 3,000 volts, the single-phase "delusion" having meanwhile been exposed and the system discredited, at the expense of the capitalists who will have been induced to utilize it.

The single-phase apparatus will require for 300 passengers travelling at a speed of 25 miles per hour, with one stop per mile, a train weighing 550,000 pounds, against a train of half the weight, if it is equipped for continuous current operation; and the average consumption under single-phase conditions will be twice as heavy, and the brake equipment, maintenance, and the wear and tear on the roadbed much greater than where the continuous current prevails. But Mr. Hobart, champion of the continuous current though he is, considers it possible that an efficient and satisfactory single-phase motor may in the near future put in its appearance.

It is just because nobody knows what the electrician will accomplish next that on the steam railroad, at least, he is regarded as an object of veneration, amounting almost to suspicion. Whatever happens, there is no subject of more absorbing interest to the engineer and business man, who watch the development of industrial methods, than the possibility of eliminating smoke and cinders from land travel.

THE PRICE OF EXPANSION.

There is to engineers a consolatory element in the deplorable railway situation in the West. For years the demand for equipment has exceeded the expectation of the extreme optimists of a decade ago. But the position to-day only reveals the inadequacy of contractors' facilities to supply equipment. The position is an incitement to patience—and to production.

To patience, because the railroads have done their best. If they laid out a bigger programme than they could immediately carry out, they have only done what most of us do at some time or other. The more unfortunate system is the Canadian Northern. If the C.N.R. were an old company, operating through well-settled country, there would, of course, be no excuse for it. But the wonder is, not that the C.N.R. has been unequal to the unprecedented conditions, but that it is there at all. It is true, of course, that the governing powers in the Canadian Northern are more skilled in laying track than they are in accommodating traffic. Looked at from to-day's viewpoint, the acquisition of the Regina to Prince Albert line was an unfortunate

enterprise. Observed in its true perspective, it was characteristic of the expansion of a transcontinental system, aiming to have feeders from every part of the prairie country. President Mackenzie only learned at 11 o'clock one morning last summer that there was a chance for him to acquire the road. At four that afternoon the bargain was concluded.

There is talk of asking the Federal Government to operate the road; and the Railway Commission's officer proposed that the Grand Trunk and Canadian Pacific should lend engines and cars, mainly for the Regina to Prince Albert section. It is useless to go to the sick for healing. The C.P.R. itself had an exceptionally large proportion of rolling stock disabled during the winter, and now has all it can do to get immigrants into the promised land over roads affected by spring freshets.

The C.N.R. ought to have had better repairing shops, and should have built less and bought more, no doubt. But, things being as they are, even Mr. Mackenzie cannot produce engines and cars faster than they are made. He and his colleagues have an opportunity of seeing how rapidly a service can be revolutionized, especially as the construction of new lines this summer will be reduced to a minimum; and the authority recently given by Parliament to increase the bonded indebtedness of the road by $5,000 per mile will do much to improve the roadbed and otherwise strengthen the service.

In any event, there would have been inconvenience on Western railroads this spring. The exceptionally cold winter was accompanied by exceptionally heavy snows, and every weak place in the track has been mercilessly exposed and made weaker as the weather has become warmer. There seems to be an epidemic of broken rails all over the continent. Trains have become heavier without everywhere corresponding increase in the weight of metal beneath them. The price of phenomenal growth is being paid.

While improvements are being made it is interesting to verify how much has been spent within recent years to improve Canadian railways. In 1906 the C.N.R. expended $3,750,000 on rolling stock, and no more such work could be secured from Canadian workshops. One hundred and sixty-three engines were on the lines west of Port Arthur, and with 6,000 freight cars and a large number of passenger coaches they were able to handle the traffic.

For 1907 delivery the Company has placed orders for 120 new engines, 1,500 box cars, 200 stock cars, 200 dump-cars, 200 flat cars, 50 steel ore cars, 25 cabooses, 4 snowploughs, 20 refrigerator cars, 20 express and mail cars, and about 80 passenger coaches. This new equipment will cost in the neighborhood of $5,550,000, and, with the exception of eight sleeping and dining cars, will be made in Canada.

In a letter to Ottawa regarding the car shortage in the West, Sir Thomas Shaughnessy gives some very interesting information regarding the C.P.R.'s outlay for property during the last five years. At the end of 1901 the Canadian Pacific had 732 locomotives and 22,473 freight cars. At the end of 1906 the Company had 1,204 locomotives and 37,467 freight cars, an increase in five years of 472 locomotives and 14,994 freight cars; and it must be remembered that this new equipment is of much greater capacity than the old. The value of rolling stock purchased during the five years ending in December 1906 was $28,000,000, which amount, together with $44,000,000 spent on line improvements and operation, make a total of $72,000,000. This amount is exclusive of $35,000,000 spent during the same years for new lines and the development of the steamship service. This means that over $14,000,000 has been spent annually on improvements to the different lines, about two and a half times what the shareholders have received in dividends on their shares.

This is a vast amount of money to spend in five years, but much more would have been spent had it been possible to get the work done. In fact, the Company has on order, for delivery within four months, rolling stock to the value of $11,808,751, and it is expected that by next autumn this will all be in service.

BOUNTIES FOR ELECTRICAL SMELTING.

The Minister of Finance has introduced a resolution at Ottawa in which he states that it would be expedient to make provision for the payment of bounties on pig iron and steel manufactured by electrical processes. It may almost be taken as a certainty that this resolution will sooner or later be transmuted into law. There is nothing very special about the bounties which the resolution proposes, since they are only an application and extension of time on the iron and steel bounties as now paid. The resolution is as follows:—

That it is expedient to provide that the Governor-in-Council may authorize the payment out of the consolidated revenue fund of the following bounties on pig iron and steel ingots manufactured in Canada for consumption therein, when such pig iron and steel is the product of Canadian iron ores smelted in Canada by electricty—viz., on pig iron manufactured from Canadian ore by the process of electricity smelting during the calendar years: 1909, $2.10 per ton; 1910, $2.10 per ton; 1911, $1.70 per ton; and 1912, 90 cents per ton. On steel ingots manufactured by electric process direct from Canadian ore, and on steel ingots manufactured by electric process from pig iron smelted in Canada by electricity from Canadian ore during the calendar years: 1909, $1.65 per ton; 1910, $1.65 per ton; 1911, $1.05 per ton; and 1912, 60 cents per ton.

From this it will be seen that Mr. Fielding merely wishes to extend to manufacturers of iron and steel by the electrical process a period of four years' bounty assistance similar to that which owners of blast furnaces and steel works now get. The bounties to be paid for pig iron, as made at present from Canadian ore, is as follows: In 1907, $2.10 per ton; 1908, $2.10; 1909, $1.70; 1910, 90 cents. When not less than 50 per cent of the weight of steel ingots is composed of pig iron made in Canada, the following bounties will be paid: In 1907, $1.65 per ton; 1908, $1.65; 1909, $1.05; 1910, 60 cents. The same rates apply to iron and steel produced by the electrical process, the only difference being that the four-year period for the electrical products commences in 1909, whereas that for the present iron and steel products commenced in January last.

It has been practically demonstrated that the refractory ores of this country can be successfully treated by the electric process. It is believed that before very long there will be a number of electric smelting plants in operation. One is already under construction at Welland.

In this connection reference may be made to the experiments which were conducted during the early part of last year at Sault Ste. Marie under the supervision of the Dominion Government, a full account of which appeared in the Canadian Engineer. It was shown that the refractory ores of Canada, which it is impossible to reduce in the blast furnace, can be successfully treated in the Heroult electric furnace. It now only remains for Canadian capitalists to take up the question of electric smelting. The power and the ore are to be found in abundance. They await the enterprizing man to turn them into commercial product. A plant using the Heroult process is now being installed in California. After what has been done in the way of experiment there need be no hesitancy in making use of the electric furnace.

EDITORIAL NOTES.

An English journal lays stress on the numerous opportunities that there are for electrical engineers and electrical men generally in Canada, thanks to our enormous water powers. If anyone must benefit from this great natural resource, young Canadians should have first place. In many places throughout the Dominion

coal is very costly, and, therefore, makes the production of power an expensive undertaking when done by this means. Kind nature, however, has provided another source of power generation, and it remains but for Canadians to see to it that this natural resource is taken advantage of wherever possible. Many of the larger water powers have already been developed to a considerable extent, but there yet remain almost incalculable water powers to be developed. As our contemporary says, after making reference to some of the larger developments: "But other parts of the Dominion are similarly blessed with inherent resources." British Columbia is fast coming to the front in the matter of its water power development, and, although the projects are not to be compared with the great plants at Niagara, yet they are very considerable when the sparsely populated Western Province is compared with the two million population of Ontario. The demand for electrical engineers is on the increase, and will be continually increasing for many years to come. The North-West Territories are being opened up, and the population is growing by leaps and bounds. This means that manufacturing centres will spring up rapidly throughout Western Canada. The varied industries will require power to an amount which it is impossible to estimate, and men will be required who are capable of designing, constructing, and operating numerous power plants in order to meet the great demand. But the West is not the only part of the Dominion that is advancing very rapidly. The other Provinces are all calling for more power, and the demand will become heavier from year to year. The need of capable men with executive ability, who are ready to take the initiative, is constantly on the increase.

* * * *

A short account in the Canadian Engineer of March 29th of the proposed railway entrances into Toronto from the east has attracted the attention of a reader in Omaha, Nebraska, Mr. Alfred J. Roewade, a consulting engineer and civic designer. Mr. Roewade writes that Toronto made a step in the right direction when this question of railway entrances was taken up, and from what he says it is evident that his ideas are the same as those already entertained by Toronto's Guild of Civic Art. Toronto, along with many other cities on this continent, is desirous of becoming a "City Beautiful," but, as the others are doing, has overlooked the fact that beauty should be the natural result of the work that is being done everywhere, and not be secured at great expense by the changing of the "old settings." Toronto is losing opportunities everyday, which, if taken up at the proper time, would gain for her the desired beautification, with a minimum of cost and exertion. The dominant force in the building of all American cities, says Mr. Roewade, is the railroad, and many of their misdeeds are due to political conditions. Certainly a railroad is interested in its own development, but only from its own standpoint, while the general public are interested in an impartial development of the entire service, and will, therefore, desire to have the best service possible. From this it can be readily understood that a city will only be too glad to give to a railway every facility to enable it to give a maximum service, and the railway will go to any reasonable expense to make its service as efficient as possible. Toronto's Guild of Civic Art is doing good work in raising the public spirit for the improvement of the city. Now is the time for citizens to take up this question of civic improvement. There should be no delay. Each year the work of formulating a plan will become more difficult, and the expense incurred in carrying out the work will increase rapidly. The future must be considered, and if the city is to be what it should be, plans must be prepared now, and followed.

* * * *

Municipal engineers will pray to be delivered from inclusion in agreements between civic authorities and public utility corporations, if the experience of Mr. Rust, of Toronto, at the hands of the Judicial Committee of the Privy Council, is any guide to opinion on the matter. For half a generation the citizens of Toronto have regarded their engineer as the man who could stand over the Street Railway Company and use a big stick at will. He was to decide routes, extensions, time-tables—and in the public opinion everything relating to the management of the Street Railway. The Railway Company always acted as if the City Engineer had very little authority over them, and now the Privy Council has given a modern demonstration of the saying, "From him that hath not shall be taken away, even that which he hath." The personal position of Mr. Rust is not affected by the Privy Council judgment, which relieves him of a great incubus. The Street Railway is justified of its disputes with the city, which should, for a year at least, refrain from all pretence to control the corporation, and let it make good its promise that it will give the public a first-class service, if only it is left alone by demagogues in the City Hall and irrelevant abusers in the newspapers. The manager wants the City Council to step out of the way and leave the Engineer and himself to make new arrangements. Which means that those who know how to handle transit systems think more of one engineer than of a whole company of civic fathers.

* * * *

The uninformed suppose that electricity causes many fires in large cities. Writers in the daily press have done not a little to bring about this situation. Whenever there is a fire, the origin of which has not been discovered, in nine cases out of ten it is put down to faulty electric wiring or other negligence by the electrician. But, though electricity is being used more and more every day, the proportion of fires from this cause is decreasing. Statistics of conflagration losses in Chicago for the four years, 1903 to 1906 inclusive, show that only 1.08 per cent. of the fires during that time resulted from electricity, while in 1906 the percentage was only about .6. Here are the figures:—

	1903.	1904.	1905.	1906.
Total fires	6,054	6,661	6,522	6,387
Total fires caused by Electricity	102	79	53	43
Total loss $3,062,931	$2,950,254	$3,303,929	$4,179,235	
Total loss caused by Electricity	*$84,275	†$58,400	$2,110	$300

* Includes the Iroquois Theatre fire ; loss, $80,000.
† Includes one fire caused by lightning ; loss, $50,000.

The figures were prepared by Mr. William Carroll, City Electrician of Chicago, taken from the records of the city and insurance companies. It is interesting to note that the average cost of fires by electricity for 1906 was only $6.98.

MARKET CONDITIONS.

Montreal, May 2nd, 1907.

Pig-iron market conditions are very encouraging. The English markets have shown an advance almost every day during the past week, the aggregate of such advances being six shillings per ton over the low point of a few weeks since. It is impossible to say how much greater, if any, the advance will be, as the demand upon the available stock is exceptional, not only at home but also on the continent. Shipments from the Middlesboro district are limited only by the capacity of the docks. Many steamers are waiting to be loaded, and as a matter of fact some of them are being kept waiting as much as four and five days before they can get dockage space. English steel making irons have also advanced, owing to the great strength of foundry grades. They are now quoted about three shillings more than a few weeks ago. The scarcity of steel making iron, however, is even greater than in foundry grades, and if the heavy demand continues there is a strong probability of even higher prices being asked for near deliveries as well as for those

more distant. So far as United States markets are concerned, conditions have not materially changed since last week. Indications, however, are that a stronger market will develop, and prices are at present being held very firmly. Although quotations are generally considered unchanged, when special lots are required for particular delivery, 50c. to $1 per ton over regular prices is easily obtained. Production is larger than ever. Consumption continues at an unprecedented rate without any apparent likelihood of cessation. So far as Canadian markets are concerned, very little change is noticeable. This applies more especially to iron for immediate delivery, that for later delivery being about 50c. higher than a week ago. This advance has to some extent been influenced by the strength of the English markets. Most consumers in the local market are protected for several months to come, so that business for the second half, only, is affected. It is expected that a very heavy tonnage of pig-iron will arrive in Montreal shortly after the opening of navigation, several cargo lots being already en route. This tonnage should relieve the local situation, considerably, as the market is just now depending upon the very limited stocks, and the small supplies arriving from winter ports. Occasionally some one runs out of iron and has to go scouring all over the country for it, and is, of course, compelled to pay very high prices.

Antimony.—There is practically no change in the situation, and the tone is firm, notwithstanding the high level of the market. Quotations are 26½ to 27c.

Bar Iron and Steel.—Bar iron and steel are both in splendid demand, and merchants are kept busy attending to the filling of orders. Quotations are:—Bar iron, $2.20 per 100 lbs., best refined and horseshoe iron, $2.60, and forged iron, $2.45; mild steel, $2.25 per 100 lbs.; sleigh shoe steel, $2.25 for 1 x ⅜-base; tire steel, $2.40 for 1 x ⅜-base; toe calk steel, $3.05; machine steel, iron finish, $2.40, base and reeled, $2.85.

Boiler Tubes.—The market continues very firm. As reported last week, American mills withdrew quotations for a time. New price-lists have been issued, and these quote the market from ½ to ¾c. higher than a week ago. Deliveries from the United States are still light. In the local market, prices are a shade higher in some lines. Demand continues active. Quotations are:—2-inch, 8 to 8½c.; 2½-inch, 10¼ to 10¾c.; 3-inch, 12c.; 3½-inch, 14¾ to 15c.; 4-inch, 19¼ to 19¾c. Demand continues good.

Cast Iron Pipe.—One of the largest importations of cast iron pipe and columns ever landed in Montreal will arrive on the Marina. It is consigned from Robert MacLaren & Co., of Glasgow—to their Canadian sales agents, L. H. Gaudry & Co.

There is an enormous demand for all sorts of hydrants and cast-iron gas and water pipes, not only from the larger cities but also from the smaller towns and the villages, all of which appear to be growing rapidly. Water pipe is quoted as selling at $36 per net ton at the foundry, and at about $37 to $38, Montreal, gas pipe being about $1 more.

Copper.—The tone of the copper market is about steady, and prices are quoted at 26 to 26½c., Montreal.

Canadian and American Cement.—The market shows a slight advance, the demand being in excess of the supply. Canadian prices are $1.85 to $1.90 per barrel, in cotton bags, and $2.15 to $2.25 in wood, weights in both cases 350 lbs. There are four bags of 87½ pounds each, net, to a barrel, and 10 cents must be added to the above prices for each bag, the bags being, however, accepted back at the same figure. Where paper bags are wanted instead of cotton, the charge is 2½ cents for each, or 10 cents per barrel weight.

American cement is steady at $1.10 per 350 pounds, basis Lehigh mills, conditions being the same as in the case of Canadian mills, save that when the cotton bags are returned only 7½ cents is allowed for them.

English and European Cement.—English cement is unchanged at $1.80 to $1.90 per barrel in jute sacks of 82½ pounds each (including price of sacks), and $2.10 to $2.20 in wood, per 350 pounds, gross. Belgian cement is quoted at $1.75 to $1.90 per barrel, in wood.

Iron.—Prices are slightly higher for delivery during second half of the year, and steady for immediate delivery. Londonderry iron is unobtainable for immediate shipment, while prices for second half are on a basis of about $23.50 to $24, f.o.b., Montreal. Toronto prices are about $1.25 more. Summerlee is practically the same as Londonderry, and is quoted $25.50 to $26 for immediate delivery, and at $23 to $23.50, f.o.b. cars, Montreal, for delivery after the opening of navigation. No. 1 Cleveland is quoted at $19 to $19.50 for delivery at Montreal, by water freights, while for immediate shipment it is $24.50 to $26.

Lead.—The market holds quite steady, and the tone is firm. Present quotations are $5.35 to $5.45 per 100 lbs.

Nails.—Demand is extremely active, and prices of cut nails have advanced during the week. Rolling mills cannot turn supplies out fast enough. Prices are $2.50 for cut and $2.50 for wire, base prices.

Spikes.—There is a good demand for all kinds of spikes. Railways are calling for a large supply for both new construction work and repairs. Railway spikes are quoted at $2.75 per 100 lbs., base of 5½ by 9-16. Ship spikes are also in good demand, and prices are $3.15 per 100 lbs. base.

Steel Shafting.—Prices are firm, and demand holds good. Some big contracts are in sight. Prices hold steady at 30 per cent. off the price list.

Steel Plates.—The market for these is very firm. It is doubtful if mills would accept orders for delivery in less than two or three months hence. Prices for small lots are $2.75 for 3-16 and ⅛, and $2.50 to $2.55 for ¼ and thicker.

Structural Steel.—Some merchants are experiencing a very active demand, while others are finding trade just about steady. Prices are unchanged. Beams weighing 55 lbs. per foot are quoted at 3c. per lb, and those upon which work, such as punching holes, has been done at 3½ to 4c., while columns with caps bring 4c. Heavy sections, weighing 35 lbs., and upwards are quoted by some at 2¾ to 3c., and light sections at 3 to 3¼c., plain.

Tin.—The market holds fairly steady. Prices are 45c. to 45½c., in jobbing lots.

Tool Steel.—Demand is excellent, and prices hold steady. Dealers look for increased activity a few weeks hence. Base prices are as follows:—Jessop's best unannealed, 14½c. per pound, annealed being 15½c., second grade 8½c., and high speed, "Ark," 60c., and "Novo," 65.

Wire Rope.—Quite a large quantity of wire rope is being used throughout the country, and demand is consequently very good. However, it is expected that before very long there will be an enormous increase, when the season opens up fully. There is a very considerable divergence of views as to prices, but the following are from a reliable source. For any quantity below 1,000 feet of 6-19 size rope, of fine quality: ⅜-in., 3¾c.; ½-in., 4¾c.; ⅝-in., 6¾c.; ¾-in., 8½c.; ⅞-in., 11c.; 1-in., 12¼c. Rope, 6-24 size, is from ½ to 1c. more than quotations. Other qualities of rope may also be had at lower prices.

Wrought Pipe.—Demand appears to be fairly active and prices are holding steady. Quotations for small lots, screwed and coupled, are as follows:—¼-inch to ⅜-inch, $5.50 with 59 per cent. off for black and 44 per cent. off for galvanized; ½-inch, $8.50, with 68 per cent. off for black, and 58 per cent. off for galvanized. The discount on the following is 69 per cent. for black and 59 per cent. for galvanized; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27, and 2-inch, $36.

Zinc.—There is nothing new in the situation, and prices are quoted firm, at 7¼ to 7½c. here, in a jobbing way.

* * * *

Toronto, May 2nd, 1907.

Since the first of the year the total orders for fabricated steel taken by establishments in the United States has been about 375,000 tons. The placing of larger contracts for structural shapes and fabricated steel has been the main feature of interest in steel products during last week, says a New York advice. This assures a larger total volume of business in April than in March, whereas March is usually the heaviest month of the year. From present prospects the April tonnage of all interests will be between 90,000 and 100,000 tons. Three big railroads have taken about 4,400 tons during the month. As usual, during April, interest has been largely centered in light product, says the "Journal of Commerce,"

such as black and galvanized sheets, pipe, tubes, and wire products.

There is a rather firmer tone in both foundry and steel-making iron. More pig has been imported. One feature of interest has been the transfer of one or two basic furnaces to foundry ores recently. The advance and excitement in the market for British iron has been attributed to heavy purchases on American account, as well as to exports to Germany. . . . However, the withdrawals from English warrant yards have been of sufficient volume to increase the confidence of holders and whatever the cause, a stronger feeling has been developed in all makes. The advance in Cleveland warrants was about 3s. in the week.

It would seem that Canada is getting an increased proportion of orders for iron and steel goods filled in Britain that would naturally have gone to the States if promptly filled. We hear that the largest importation of cast iron pipe and columns ever landed in Montreal arrived on the "Marina" on Sunday last from Glasgow.

Metals generally are very firm; the speculative markets are pursuing their upward course with no sign of a re-action.

While the sharp advance in tin during the last week had a speculative origin, there has not been wanting a firm foundation in the statistical developments. The market has been wholly under the domination of London operators, with local spot supplies practically cornered. The New York market advanced about 2 cents, and at the close spot tin is difficult to buy at 42.60 cents.

In copper, the market has been somewhat jerky, and transactions last week were not large. Electrolytic sold at 24 to 24¼c., cash, New York; some sales were made of casting grades to domestic consumers for nearby delivery at 22⅞c. London cable on Monday showed £104 opening and £103 5s. closing price for spot Standard. Lead dull and lower, spot held at 6c. in car lots; London shows slight decline, soft Spanish closing at £19 17s. 6d.

Antimony has been freely offered and lower, but it is now claimed that 18c. is bid for Hallett's spot, yet firm offers of 17 and 17½c. for importation would probably be accepted; ordinary brands, 17 to 18c. spot. Nickel is steady at 40 to 47c. for round lots down to a ton, and 50 to 60c. for smaller quantities.

The new steamer "Coruna," built for the Canada Lake Line, left Middlesboro', Eng., for Toronto on Thursday last carrying a cargo of 1,000 tons of pig iron.

At a time like this, when factory-building and house-building is so active, mechanics and builders' laborers have an excellent chance by steady working to lay aside good money at the generally good wages. But it appears that they are resolved to make further trouble. The structural iron workers have demanded higher wages, and the sheet metal workers are having a conference, the marble workers want 5c. per hour increase from 9th June. Then the plumbers, steam and gas fitters have asked from the master plumbers an advance in wages to 45c. per hour after 14th May, the present scale being 37½c. per hour, though in many instances more is paid. The masters are determined to resist the demand. It is a refreshing thing to find, among all this unrest and exaction, one body of workers who are satisfied with their wages: these are the tile layers, who get 40c. an hour.

The lumber market is distinctly firm: demand for all sorts is greater than the supply. It is to be remembered that much of our product that used to go to the United States is now in request among ourselves, and building lumber brings prices here to-day that remove any temptation to sell it to the Americans. Stocks of all kinds are fairly maintained, the thing which is mainly in short supply is sound dressing slips, for which the demand has been abnormal, because of extensive building of railway cars. Hemlock, no longer a despised wood, but of recognized value, takes the place of pine to some extent for joists, rafters, and flooring for cheaper houses. It cannot, however, replace pine for such work as doors and windows.

We quote prices at Toronto as under:—

American Bessemer Sheet Steel.—14 gauge, $2.60; 17, 18 and 20 gauge, $2.80; 22 and 24 gauge, $2.90; 26 gauge, $3; 28 gauge, $3.25.

Bar Iron.—$2.30 from stock to the wholesale dealer.

Boiler Heads.—25c. per 100 pounds advance on boiler plate.

Boiler Tubes.—Lap-welded steel, 2-in., $9.10; 2¼-in., $10.85; 2½-in., $12; 3-in., $13.50; 3½-in., $16.70; 4-in., $21, per 100 ft.

Cement.—Star brand, $1.95 per barrel, t.o.b., Kingston.

Ingot Copper.—Large enquiry for refined, but market easier in New York and London; Toronto price, 26½c.

Lead.—Firmer and supply insufficient; $5.50 for pig.

Steel Boiler Plates.—¼-in. and heavier, $2.50.

Steel Rails.—80 lb., $33 to $36 per ton.

Sheet Steel.—Firm, 10 gauge, $2.70; 12 gauge, $2.80.

Tank Plate.—3-16-in., $2.65.

Tin.—Unchanged in price; 43½ for pig.

Tool Steel.—Jowitt's special pink label, 10½c. per pound.

Wrought Steam and Water Pipe.—Trade prices per 100 pounds are: Black, ¼ and ⅜-in., $2.26; ½-in., $2.72; ¾-in., $3.57; 1-in., $5.12; 1¼-in., $6.98; 1½-in., $8.37; 2-in., $11.16; 2½-in., $18; 3-in., $23.50. Galvanized, ¼ and ⅜-in., $3.08; ½-in., $3.57; ¾-in., $4.72; 1-in., $6.77; 1¼-in., $9.23; 1½-in., $11.07; 2-in., $14.76; 3½-in., blk., $30; 4-in., $34.

Zinc.—Steady at previous prices; slab, $7; sheet, $8; antimony, Cooksons, $25.

MINING IN NOVA SCOTIA.

During the year ending September 30, 1906, the mineral production of Nova Scotia shows only a nominal increase over the previous year. Gold, manganese ore and beyrites decreasing somewhat. In 1905, 73,600 tons of iron ore were produced as against 648,042 tons in 1906. Coal raised in 1905 amounted to 5,050,420 tons, and in 1906, 5,866,605 tons. The total revenue of the mines department for the year was $643,457. This was received from licences, rentals, and gold and coal royalties. The bonuses paid on coal consumed in the manufacture of iron and steel in the province totalled $64,954. There was a slight increase on the amount of coal sold, the total being 5,194,590 tons, of which 1,962,206 tons were sold within the province. 12,123 men were engaged in the industry. From 1857 the coal sales in Nova Scotia have increased from 300,000 to 5,040,000 tons. The greatest increase having taken place from 1897, when the output was 3,000,000 tons.

Gold Output.

The average yearly output of gold since 1862 until 1906 has been 20,000 ounces, the highest output being in 1898 when it amounted to 31,000 ounces. In 1906 the output was not quite 15,000 ounces. Twenty mines were in active operation, and a number of individual mines also contributed to the total output. As near as can be calculated 363 men were engaged in gold mining in the province during the year.

An innovation of the Nova Scotia Mining Department that has proved very successful is the renting out of rock drills. The investment having proved a very successful one. During the year 2,839 ft. 9 inches of holes were bored at a toal cost (including storehouse and miscellaneous expenses) of $5,927. This cost for maintenance would at first sight appear to be rather high, but when the sum of $3,316, which amount is charged to capital account is deducted, the cost per foot is not at all excessive. In 1905 the cost of drilling per foot was $1.26, while last year it was only $1.08, a reduction of 18c. per foot. The department has in operation seven drills.

Taken as a whole, the report of the Nova Scotia Department of Mines is very exhaustive, and should bring to the mind of the lay reader a clear idea of what is being done in the mining industries of that province. Mr. Wm. T. Piper is Commissioner of Public Works and Mines.

OBITUARY.

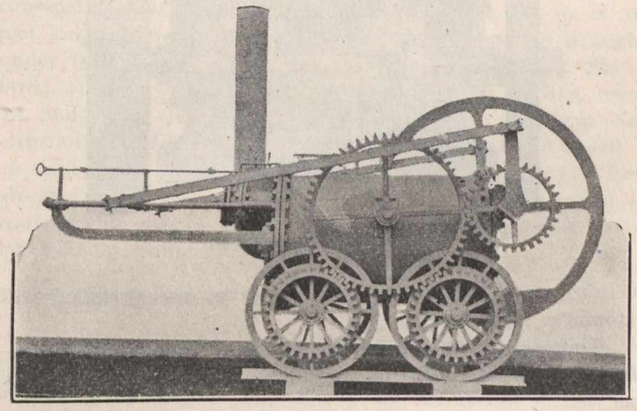
Alfred J. Belcher, C.E., of Peterborough, died on April 29th. Mr. Belcher was a noted engineer, being employed on the Crow's Nest Pass Railway, the Trent Canal, and important municipal works in California. He was 52 years old, the son of a civil engineer, and had four brothers in the same profession.

BRITISH AND CANADIAN RAILWAYS.

(From Our Own Correspondent.)

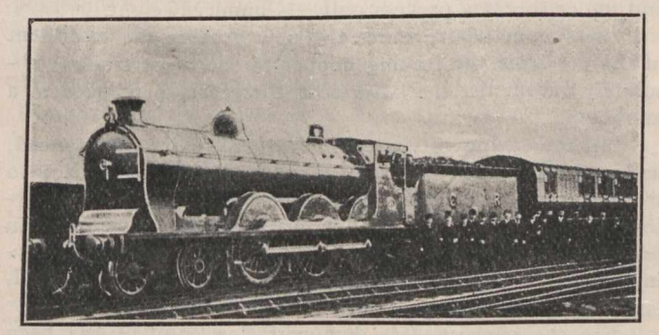
Manchester, April 22nd, 1907.

Ten years ago it could have been said that in two or three important particulars the passenger departments of Canadian and American railway systems were ahead of those of Great Britain. Your correspondent is bound to confess that to-day, in all the essential features that make for safe, regular and comfortable traffic British railways are distinctly superior to Canadian or American systems. I have travelled extensively, for example, on the London and North-Western Railway, which controls the Lancashire and Yorkshire Railway, and which traverses England from south to



Trevithic's Engine, Built in 1803.

north into Scotland, and have marveled at the regularity of the principal trains, the care that is taken for the safety of the passengers and the flexibility of the system from the standpoint of the tourist or pleasure-seeker. At Euston station in London a writing room is provided where travellers may have their correspondence taken by stenographers, or have telegraphic and telephonic service at their disposal, or private rooms reserved for business interviews, with books of reference at their disposal, all for a very modest charge. Dining cars are on the principal fast trains, where meals can be got cheaper than on American railways, and the charges for sleeping cars are also less, and generally speaking the service better. The "West Coast" sleeping cars of the L. and N. W. took the highest awards at the late St. Louis Exhibition. The main line fast trains of all British railways now have corridors and vestibules with lavatories, affording all the advantages of the American system, with the further

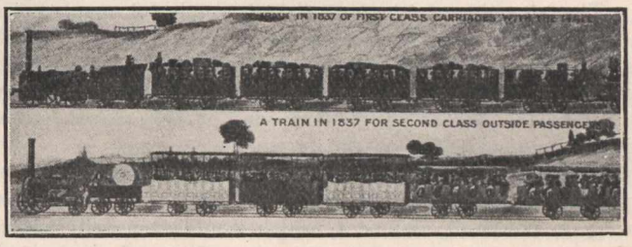


West Coast Corridor Express; Note Rail Chairs.

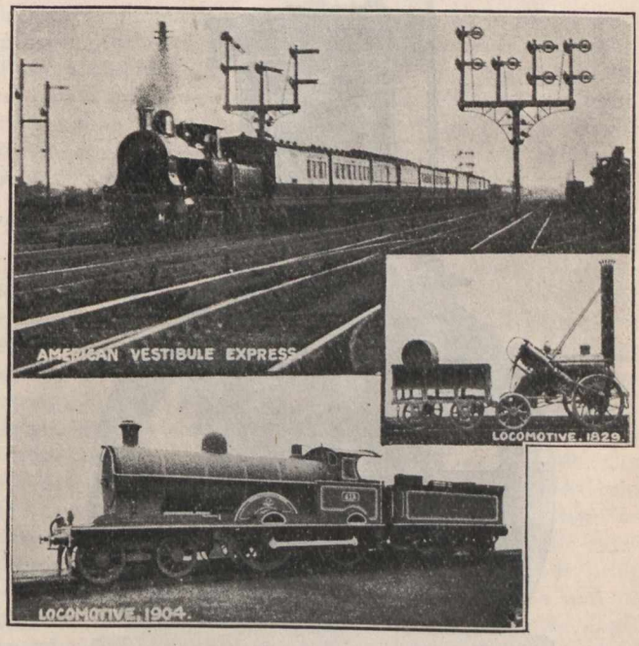
advantage of dividing the coaches into compartments of different sizes.

In frequency and cheapness of excursion rates the British railways are in advance of American roads and not only is this the case, but a party of friends who wish to visit a place of interest may engage a coach (car) at very low rates. For example, the L. and N. W. allow return tickets at a fare and a quarter if six or more first-class tickets, or ten or more second or third-class tickets, are bought by one party; or in case of a party with fifty first-class or one hundred second or third-class tickets at a single fare for the round trip. Still greater advantages are given to school children and Sunday school children, so that cheap excursions are available on much easier terms than in America.

The highest tribute that can be paid to British railways is in the value they place upon human life and the care the directors take to this end, not only in building and equipping roads, but in maintaining them. The first thing that strikes a Canadian when he sets out on a railway journey in England is the substantial character of every bridge and culvert and viaduct, all of which are of stone, iron, concrete or brick. The British railway construction engineer does not attempt to climb a mountain, but goes through or around it, or builds a viaduct across a valley instead of plunging into its depths, wisely estimating that the annual saving in fuel and wear and tear of engines will more than



pay interest on the extra cost. Apart from this, British engines outlast those of Canadian or American make, because they are constructed of more carefully selected material, and are better cared for while on the road. The majority of Canadian and United States engine drivers, where they are free to speak the truth, will tell you that their locomotives are being worked and racked to death and many a hideous wreck is due to the criminal policy of over-working the engines as well as the engineers. In Great Britain they do neither and the result is efficiency on the part of the train hands, and safety to passengers. In a recent year the London and North-Western Railway did not lose the life of a



single passenger on their whole system. When the reader understands that on this system there are twenty express trains per day up and down between Manchester and London and that in its suburban lines about London there are as many as 123 trains per day carrying millions of passengers in the year; while on the Grand Trunk Railway there were 134 people killed and 7 injured, and on the Canadian Pacific Railway 192 killed and 54 injured in the year ending March, 1906, he will realize the contrast between the two countries. The total casualties in railways in Canada in 1906 were 382 killed and 222 injured, and the record of wrecks in the United States is a still bloodier one. The

leading American roads are at last beginning to see that this enormous annual destruction of property apart from the criminal destruction of life and the evil reputation it gives their roads is a dear price to pay for the so-called economies in labor and safety devices. It should not take Canadian railway managers so long to perceive that the block and automatic stop devices and a few extra employees are a very cheap insurance against collisions, seeing that 17 deaths and 24 cases of injury with accompanying personal damages and loss of rolling stock were due to collisions, a class of accidents which would be completely eliminated from the casualty lists if such improvements were adopted.

THE LAZIER GAS ENGINE.

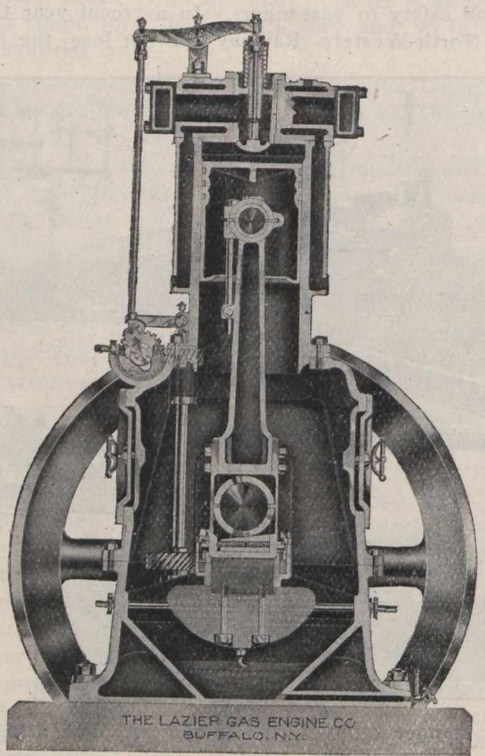
The evolution of appliances for the production of power from the primitive steam engine up to the apparatus of the present day includes the complete history of modern progress along industrial lines.

The steam engine accomplished wonderful results, but for many purposes the gas engine has outclassed it. With its aid automobiles are enabled to run at a speed which a few years ago was deemed unattainable ; submarine boats dive into the depths of the sea, and it has placed power within the reach of even the farmer.

The principle of the gas, or air-expansion engine, was from the first accepted as a new and most important discovery in power development, which would eventually supersede steam, and since that time the efforts of mechanical engineers have been directed to simplifying the gas engine.

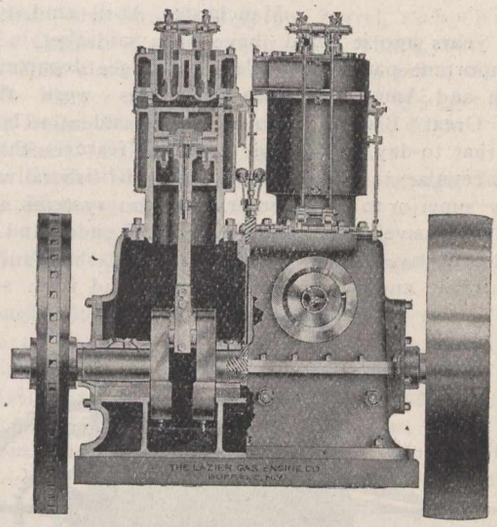
One of the latest types of engines being placed on the market is that manufactured by the Lazier Gas Engine Co., of Buffalo. Mr. Arthur A. Lazier is one of the pioneers in the gas engine business, and he has associated with him some of the best-known gas engine experts on the continent.

The Lazier engine is of very simple construction, which makes it much less liable to get out of order than engines



Sectional Side View.

that are more complicated, and, as most of the mechanism is exposed, the making of adjustments and repairs is considerably facilitated. Unlike other gas engines, the one illustrated has a double system of ignition, which can be run either separately or in combination, and it is so arranged that the time of firing the charge can be changed while the machine is in operation. The cams and cam-shaft run in oil, although they can be seen by the operator at all times. The system of operating this cam-shaft is also new, since there are only four spiral gears on the machine, which run in oil, making the operation almost noiseless. Arrangement has been made for taking up the lost motion of all working parts, the lack of this being an objectionable feature on many types of engine. The "splash" system



Sectional End View.

of lubrication is used, and the engines are provided with automatic self-starters.

These engines will operate on almost any kind of fuel—alcohol, kerosene, distillate, illuminating gas, or producer gas.

They are made in sizes ranging from 2 to 300 H.P., and the simplicity of their construction enables the manufacturers to market them at a much lower price than that asked for any reliable machine at present built.

AUSTRALIAN METHOD FOR REDUCING IRON ORE.

Claims for a new method for reducing iron ore to iron or steel have been received from Sydney, N. S. W. They are as follows:—

"Lesser cost of plant, which is estimated at one-fifth the cost of a blast furnace and converter of equal capacity.

"A saving in fuel; the consumption being 12.46 hundredweight as against 21 hundredweight of the old indirect process.

"Saving in fluxes; for every ton of pure metal produced under the old process 21 hundredweight of fluxes is required and under the new process only 2½ hundredweight.

"Saving in labor; under the new process the treatment of the ore from the feeding hopper to the ingot truck is absolutely automatic; the labor cost, therefore, is reduced to a minimum.

"In the saving of time, which is still more pronounced; under the old stystem, from entry at the blast furnace to the discharge by converters, time occupied is from twenty-four to thirty hours; by the new direct process pure iron can be made in from two to four hours. Summarized, the saving in plant is 80 per cent. and in cost of production of malleable steel or iron, 25 per cent."

For the purpose of demonstration, a plant has been erected at Melbourne.

Samples showing the treatment of the native ores have been submitted to United States Consul O. H. Baker at Sydney. Samples may be procured from him by parties who wish to investigate the process.

PRINCE EDWARD ISLAND TUNNEL.

A tunnel under Northumberland Strait, from Pictou shore to P.E. Island is estimated by Ottawa engineers to cost $15,046,000. M. J. Butler, C.E., deputy minister of railways, instead of a tunnel recommends a great causeway with two swinging bridges. This he thinks more feasible and less expensive than a tunnel, costing only $10,000,000.

ENGINEERING NEWS FROM GREAT BRITAIN.

(From Our Own Correspondent.)

London, March 30.

The launch of torpedo boat No. 9 (lately known as H.M.S. "Grasshopper") at the Cheswick yard of Messrs. J. I. Thornycroft & Co. is an event of considerable interest from the fact that it is the fifth of the new class of British turbine-driven torpedo boats constructed at this yard, and, in addition, marks the end of the long and notable list of torpedo craft which has been constructed by this firm at their Chiswick works, commencing with the "Lightning"—known in the service as torpedo boat No. 1—which was delivered in 1877. The "Lightning" was a boat of 85 feet in length, and capable of a speed of 18 knots, which was then considered most remarkable. Torpedo boat No. 9 is 168 feet long, with a beam of 17 feet 6 inches, and a draught, under fully loaded conditions, of 5 feet 11 inches. She is fitted with Parsons turbines and Thorneycroft boilers, using oil fuel, both turbine machinery and boilers being constructed by Messrs. Thorneycroft. The contract speed is 26 knots, but in the case of four earlier boats, which have already undergone trials, this speed has been exceeded by considerably over a knot. The armament consists of twelve quick-firing guns and three torpedo tubes.

The Canal System of Great Britain.

Considerable interest is just now being taken in the future of the canal system of the British Isles. At present, of course, the greater mileage of the waterways of that description here are in the hands of the railway companies, who have been charged with sacrificing the usefulness of the canals to the benefit of the railways. That is a question of economics, which hardly comes within the purview of these notes, but there is also a very serious engineering question involved which the ordinary trader hardly stops to consider when he is attacking the powers that be for cheaper freight rates. To be of signal service, horse traction must admittedly be abolished on our canals. Hence, the question arises as to the most economical form of mechanical propulsion. Popular fancy may fly to electricity, but the results to date do not justify great optimism. The Teltow Canal installation, according to experts, is over-capitalized, in that a too elaborate equipment has been adopted, and a reliable guide from such an installation is hardly likely to be forthcoming. Experiments have also been carried out in France and Belgium, but from the figures, the running costs seem to work out higher than horse traction. In view of the uncertainty in this direction attention has been drawn to the possibilities attaching to self-propelled boats, and the following particulars of a trip with a gas-driven barge will indicate the capacity of such plant for this purpose, and at the same time expose the limitations of our canal system. The boat referred to was 71 ft. 6 ins. long by 7 ft. 1 in. beam by 3 ft. 3 ins, draught. She was originally fitted with steam engines and boiler, and, under the old conditions, was carrying a useful load of 16 tons. This is the largest type of boat which can navigate the majority of our canals, but even this length was too great for some of the locks. By installing the suction gas plant a saving of about 4½ tons was effected in the weight of the machinery, whilst there was a gain of space of three feet in the length of the engine-room. The boat was thus enabled to carry a load of 20 tons instead of 16 on the same draught and at the same speed as formerly, and without increase of power. The experience gained with the trials of this boat go to prove that a very large capital expenditure will have to be incurred in increasing the cross section of practically all our canals if commercial use is to be made of them. The cost of carrying goods over a particular section of the canals traversed worked out to .34d. per ton mile. This includes fuel, wages, depreciation, interest on capital, insurance, and repairs. Objection has been taken to the use of producer gas on the ground that danger would arise in passing through tunnels, owing to the deleterious nature of the exhaust gases. As a matter of practical experience, no ill effects were felt on the trials above referred to. It is pointed out that the chemical composition of the exhaust from a gas engine is the same as the gas from the funnel of a steamboat, with the advantage that gas engine exhaust is free from smoke or sulphur. The conclusion arrived at is that with a reorganization of our canals, with through communication and through tolls, by the use of such barges as that described above the cost of transport of goods might be reduced to one-third or one-fourth the present rates.

The Patent Laws.

A bill has been introduced by the Government which should be welcomed by the engineering industry in common with all others, inasmuch as it removes several of the disabilities now attaching to our patent laws. One particular detail in which reform has been necessary is in respect of the large number of foreign patents taken out in Great Britain and factories erected abroad for their development. Under the new bill this will be remedied, for if after three years any patent taken out in Great Britain is not actually worked here, it will be open to anyone to object. The present practice—and this applies to both British and foreign patentees—is to deposit in the patent specification all manner of possible combinations, many of which have never been tried by the patentees themselves, in order to forestall the possibility of later patents. But the new bill says that samples of everything proposed in a patent specification must be deposited. Finally, the poor inventor is thought of in that the procedure is simplified, so that the cost of patenting an invention, or of setting up a defence to threatened actions for infringement, is reduced. Being a Government measure, and uncontroversial, there is every likelihood of it becoming law.

The definite expression of opinion from the Government that its support will not be given to the project of constructing a tunnel between Dover and Calais has virtually killed the proposition, for it would be futile for a set of private promoters to proceed in face of such opposition. From a national and political point of view the construction of such a tunnel would probably lead to more harm—indirect rather than direct—than good, but we have been deprived of an opportunity of studying an engineering problem of intense interest.

The Victoria Bridge Over the Zambesi.

The Victoria Falls Bridge in South Africa is one of those engineering undertakings in which the general public takes more than its wonted interest. Carried out under the supervision of British engineers, the following particulars, given to the Institution of Civil Engineers, will be interesting, for it is the first description of the bridge, in any detail, to be published. The choice of the site for the bridge was due in the first instance to the late Mr. Cecil Rhodes. The position fixed upon is about 700 yards below the cataract, and, the rock being very hard, the bridge was designed to fit the profile of the gorge with as little expenditure in excavation as possible. Several types of bridge were considered, but the nature of the situation and the purpose of the work made it obvious that a two-hinged, spandrel-braced arch was the one which most completely answered the requirements of the case. The bridge is designed to carry two lines of the usual South African gauge, 3 ft. 6 ins. In addition to the dead load, the forces which the bridge is calculated to sustain are (1) a train on each line of way, consisting of two engines, followed by heavy trucks, the weight of the whole train averaging 1.40 ton per lineal foot; (2) temperature stresses caused by a 60° F. variation above or below mean; (3) wind stresses due to a wind pressure of 30 pounds per square foot on the train and bridge, or 45 pounds per square foot on the bridge alone. The pressure is calculated on the entire area of both

arches, and stresses due to unequal distribution of such pressure are allowed for. The bridge consists of three spans, composed of braced girders of ordinary type, with horizontal upper and lower chords, 12 feet 6 inches deep, and divided into square panels. The girders are fixed 20 feet apart. The central span is 500 feet between centres of bearings, with a rise of 90 feet. The curvature of the arched rib is parabolic. The entire bridge, with the exception of the main bearings, weighs approximately 1,500 tons. Each half of the arch was designed to meet the other with a butt joint in the arch rib. The bridge was constructed by the Cleveland Bridge and Engineering Company, of Darlington, to the designs and specifications of Sir Douglas Fox & Partners and Sir Charles Metcalfe, Bart.

The Motor Vehicle Industry.

The commercial motor vehicle industry in Great Britain, as distinct from the motor car industry, has made such rapid strides during the past few years as to render it necessary to hold a special exhibition devoted to this branch. This embraced motor omnibuses, both petrol and steam, baggage waggons, travellers' vans, and so on. The application of petrol motors to agricultural purposes also was a feature. Special interest attached to the efforts that are being made to bring about a reliable and silent transmission gear from the engine to the road wheels; and it would appear that, although electricity as a motive power, pure and simple, for locomotive purposes of this kind is not likely to take the place of other forms, yet its use in an auxiliary sense in connection with these vehicles would seem to bring a solution to the difficulty that has for a long time hampered the heavy vehicle industry. There have been many attempts to produce an efficient petrol electric power transmission, and these have ranged themselves under three heads: (1) Where starting and acceleration has been electrical, but the final drive mechanical; (2) the employment of accumulators, which, through the medium of a dynameter, assists the engine at starting and on grades, and (3) those systems which drive entirely electrically all the time. At the exhibition above referred to there were four such systems, and the fact that all of them are of the third type indicates in which direction attention is being drawn. In the near future I shall take the opportunity of describing these, but in the meantime it may be mentioned that firms of electrical manufacturers are responsible for two of them, viz., the British Thomson-Houston Co. and Messrs. Greenwood & Batley, the former of Rugby, and the latter of Leeds. There were also many good things to be seen at the exhibition in the shape of steam and petrol cars, some of which will be referred to in the future.

Electric Power in London.

The proposals to supply electric power in bulk in London are just now in a state of suspended animation. Owing to the change at the recent election in the constitution of the London County Council, the bill of that body will in all likelihood be abandoned, but it is pretty certain that with the present House of Commons the bills by the two companies will not be allowed to proceed. It will thus be seen what a purely political question this severely engineering matter has become.

The Wireless Telegraph Convention in Berlin.

A Select Committee of the House of Commons is now sitting in London to consider the advisability of ratifying the convention arrived at in Berlin in the summer of 1906. There do not appear to be any reasonable grounds why we should not do so, although the colonies have a perfectly free hand, so far as adhering to the terms of the convention is concerned. The convention and service regulations which have been drawn up relate entirely to ship and shore communication, and to naval signalling, or to ship and ship communication. The latter, as a matter of fact, are not bound to communicate with each other, either by semaphore or flag signals, so that it would have been putting a regulation upon them which has never existed before. The principle of free intercommunication has been accepted by the British delegates, with the proviso that any particular stations may be exempted at the discretion of the Government. This is a useful provision in the case of experiments and so on, and one which the British delegates insisted upon. There is complete unanimity of opinion amongst the delegates that the terms of the convention should be ratified at the earliest possible moment, so as to allow plenty of time for the details to be drawn up for the convention, to be put into force by the stipulated time, July, 1908.

Electricity in Cotton Mills.

There have been considerable developments in the application of electricity to cotton mills in Lancashire during the past few years. A recent installation was the conversion of the Droylsden Mills, Fairfield, which is the first cotton spinning and weaving mill in Great Britain, to discard, at one stroke, mechanical transmission for the transmission of power by electricity. The mill contains 88,900 spindles and 900 looms, and power is applied to the various processes by means of 24 motors, aggregating over 1,000 B.P. Incidentally, the fact that a separate power-house has been installed, although the mill is within range of the power-house of the Lancashire Electric Power Co., indicates the slow progress being made by the electric power companies of Great Britain.

A PORTABLE CORE OVEN.

Many attempts have been made to design an economical and, at the same time, efficient portable core oven. Most cores are baked in heavy brick structures which take up an unduly large amount of space, and which cannot be moved or shifted as development in the department requires more space or a change in the general arrangement of the plant.

Several types of ovens have been put on the market, which are equipped with swinging doors. The objection to

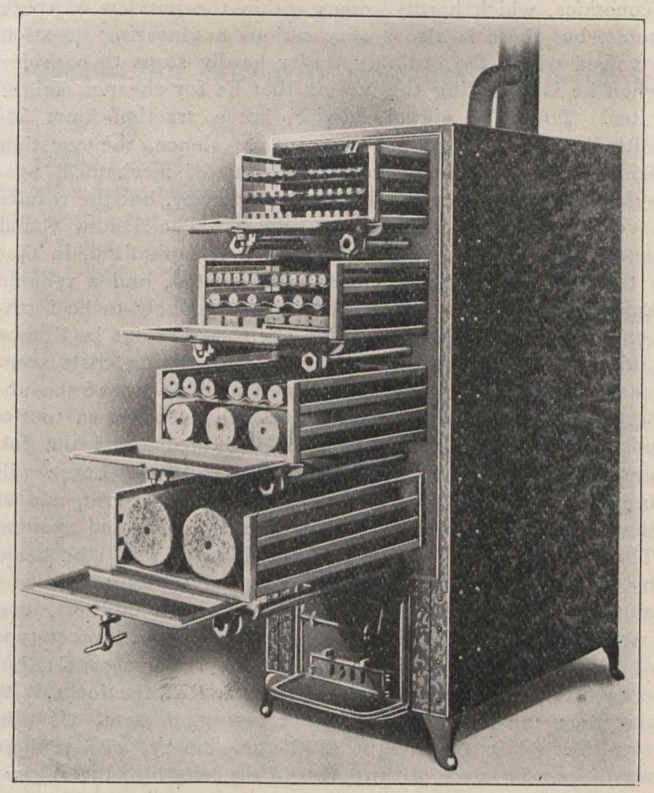


Fig. 1.

all ovens of this type is that there is a large amount of waste space, due to the difference between the area of the quadrant and the area of a square having sides equal to the radius of the quadrant. One objection to the quadrant or semi-circle type of oven is that it is not suitable for drying long cores such as are made on core machines, for the clearance which must be left along the curved edge of the shelf still further reduces the area that can be covered with core plates. The objection to all ovens of the stationary shelf type is that the core plates have to be put into and taken out of the oven through openings, which interfere with the

draft or heat conditions and thus retard the baking of the cores in the oven.

The accompanying illustrations show two views of a drawer oven, manufactured by the Falls Rivet and Machine Company, Cuyahoga Falls, Ohio, which is self-contained and economical. The one shown is equipped with four drawers, supported by rollers at the back and by pipe guides at the front. The drawers are removed from the oven by slipping a pair of handles into the pipes shown in the front, lifting them slightly and running them forward by means of the wheels on the inside at the back of the shelves, the action

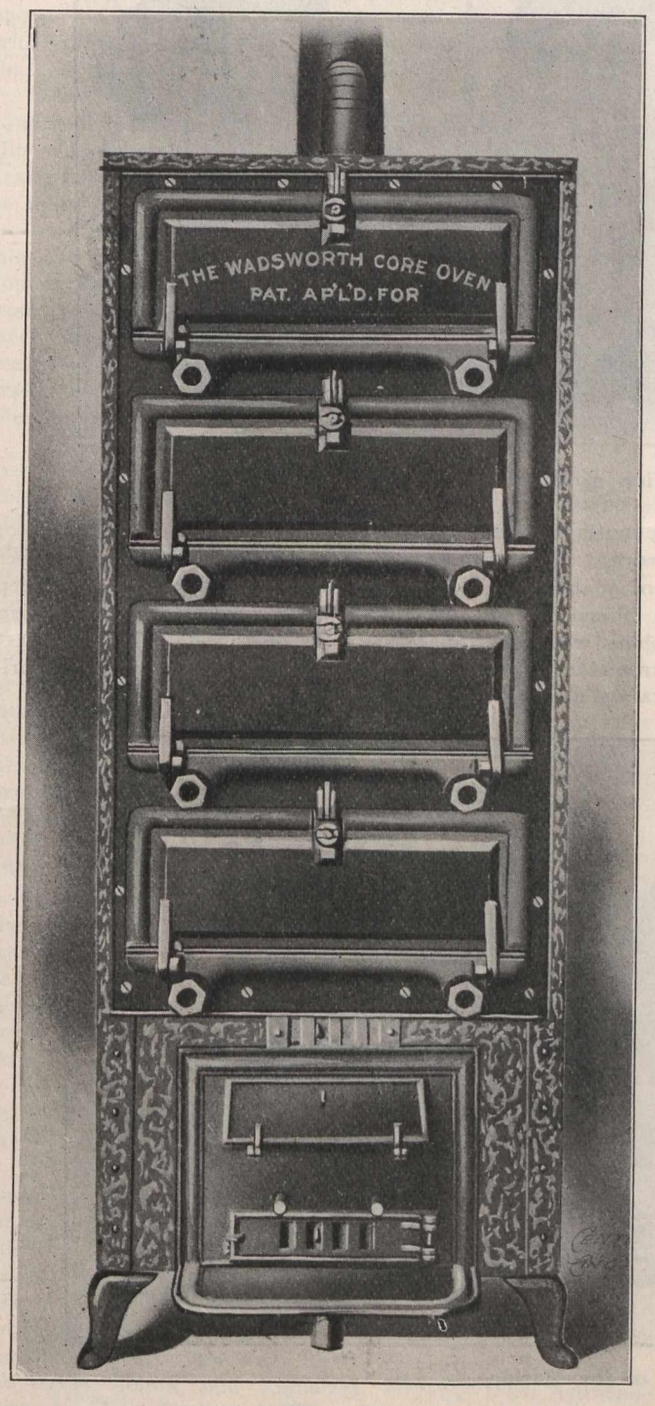


Fig. 2.

being much like that of a wheelbarrow. The shelves are self-sealing, in that when they are drawn forward a plate closes the opening, so that the baking of the cores on the other shelves goes on without interruption. In Fig. 1 the shelves are shown open and drawn to different distances, so as to illustrate the variety of cores which can be baked in the oven at one time. The large cores on the lower shelf are 7 inches in diameter.

This oven was run for an entire day with one bucketful of fine coke or breeze, swept up in the coke bin. The consumption of fuel in an oven of this kind would naturally be less than the other types, as the space is all utilized to the greatest possible extent, their being no ducts or passages in which radiation takes place.

The fact that the fronts of the doors drop down as shown enables the core plates to be taken out easily.

These ovens can be distributed about the core department, thus minimizing the distance the core-makers have to walk to put their cores in the oven, and a re-arrangement of the department can be effected very easily, as the portable oven is as easily moved as the core bench.

In an experimental run the temperature was found to be 450 degrees in practically all parts of the oven, and this temperature was easily maintained the entire day on the amount of coke already referred to.

One point to which special attention should be called is the provision for supplementary shelves dividing the main drawers into divisions. As shown in the illustration, the two highest drawers are divided into three shelves each, the next into two and the bottom one is arranged without any supplementary shelves. The facility with which these different divisions can be put in will enable the operator to dry any size of cores readily.

This device was designed by George H. Wadsworth, of Cuyahoga Falls, Ohio, who has applied for patent on the same.

CARRYING CAPACITY OF PIPES.

Editor, The Canadian Engineer:

Will you kindly let me know how many cubic feet of water per minute will run through a 16-inch diameter pipe with a fall of one per cent. and oblige.

Yours truly,

R. WILLIAMSON.

P. S.—Some years ago you published a table showing the capacities of pipes, but I cannot find it in my back numbers.

* * * * * *

The carrying capacity of a 16-inch diameter pipe, with a fall of one foot in 100 feet is 2,803 gallons per minute. The table you refer to appeared in the The Canadian Engineer of January 1896, and is as follows: It shows the number of gallons discharged per minute, for specified sizes and grades.

Size of Pipe.	One-inch Fall Per 100 Feet.	Two-inch Fall Per 100 Feet.	Three-inch Fall Per 100 Feet.	Six-inch Fall Per 100 Feet.	Nine-inch Fall Per 100 Feet.	One ft. Fall Per 100 Feet.	Two ft. Fall Per 100 Feet.	Three ft. Fall Per 100 Feet.
3-in. .	13	19	23	32	40	46	64	79
4-in. . .	27	38	47	66	81	93	131	163
6-in. . .	75	105	129	183	224	258	364	450
8-in. . .	153	216	265	375	460	529	750	923
9-in. . .	205	290	355	503	617	711	1006	1240
10-in. . .	267	378	463	655	803	926	1310	1613
12-in. . .	422	596	730	1033	1273	1468	2076	2554
15-in. . .	740	1021	1282	1818	2224	2464	3617	4467
18-in. . .	1168	1651	2022	2860	3508	4045	5704	7047
24-in. . .	2396	3387	4152	5871	7202	8303	11744	14466
30-in. . .	4187	5920	7252	10257	12580	14504	20516	25277

According to the report of the Commercial Agent for Australia and New Zealand, the mineral production of the latter in 1905 was £3,622,786, and for the former £24,922,232. The increase in the production of minerals is remarkable when it is remembered that gold, which constitutes a good deal more than half of the total production, has been mined for over fifty years, and, though it shows a diminution in some of the States, yet, taken as a whole last year, shows a greater yield than in any previous year, and is more than double that of ten years ago. Recent finds in Victoria indicate that these resources have not been exhausted in the older States, and the probability is of rich finds in Western Australia. The number of men employed in this mineral production was not given for last year, but the probability is that at least 140,000 were thus occupied. While the quantity of minerals produced is increasing, the returns per head employed is diminishing. Mining is becoming a settled industry, in which the great mass of workers are employees of the firms. More and more the industry requires capital for its development. The return per head is, however, greater than it was fifteen or twenty years ago.

MOTOR DRIVEN ROTARY SLOTTING-MACHINE.

The Union Pacific Railway has just been supplied with a double rotary slotting-machine, which was built specially for that road by the High Duty Saw & Tool Company, Eddystone, Pa. The machine is designed for use in slotting forged steel crank shafts, connecting rods and links, but it can also be used to cut off axles and miscellaneous straight stock by the removal of one of the saw blades. The machine operates two "Tindel" high duty, high speed steel inserted teeth milling saws. The milling blades are 36 inches diameter, and have sixty inserted cutters each of high speed steel. The slotter is directly connected to a Westinghouse direct-current 2 to 1 motor of 15 h.p. capacity. The motor is attached to the driving shaft of the machine, through the gear and spur-pinion, as shown in the back view of the illustration, fig. 2. This arrangement gives power feeds ranging from ⅜ in. to 1⅛ ins. per minute, both saws feeding simultaneously.

Following this company's system, no worm or worm gearing is used in the drive. All driving power is transmitted to the saw blade through straight and bevel gearing. Thus the enormous friction generated by worm gearing under heavy feeds is eliminated, and the frequent renewals of costly worm wheels obviated. The housing of the machine is massive. The saddle carrying the arbor is heavy, has large surface bearing on the table and is fitted to it with underlock cast solid. All wear on saddle or table is taken up with phosphor bronze tapered shoes. A removable table with screw adjustment for setting work to the line is a feature of the machine. On it are shown mounted special "V" stands and rest blocks with clamps and bolts designed especially for setting and firmly holding crank shaft work while being slotted. These fixtures are removable, so as to leave the table underneath clear for bulky work, or the mounting of other special fixtures for holding a variety of work. A liberal reservoir for a supply of drilling, or other compound and an automatic pump with flexible piping keep a liberal stream for cooling and lubricating each milling blade while the machine is in operation. Troughs cast around the bed of the machine collect and return the lubricating fluid to the reservoir and pump.

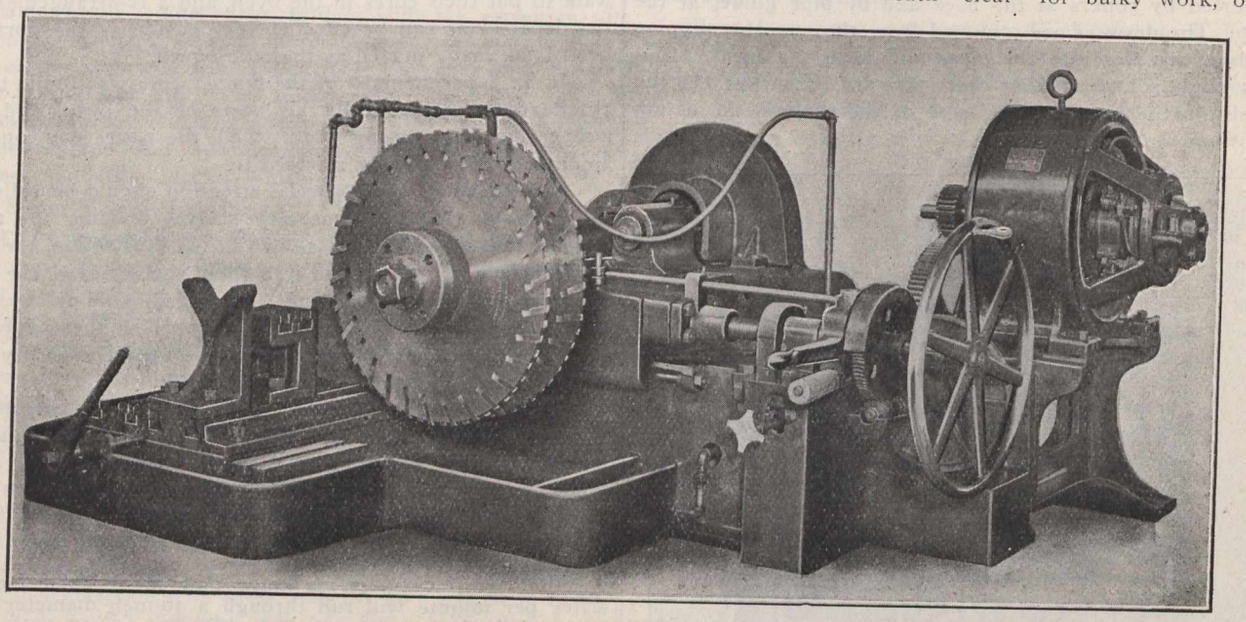


Fig. 1.—Front View of Machine.

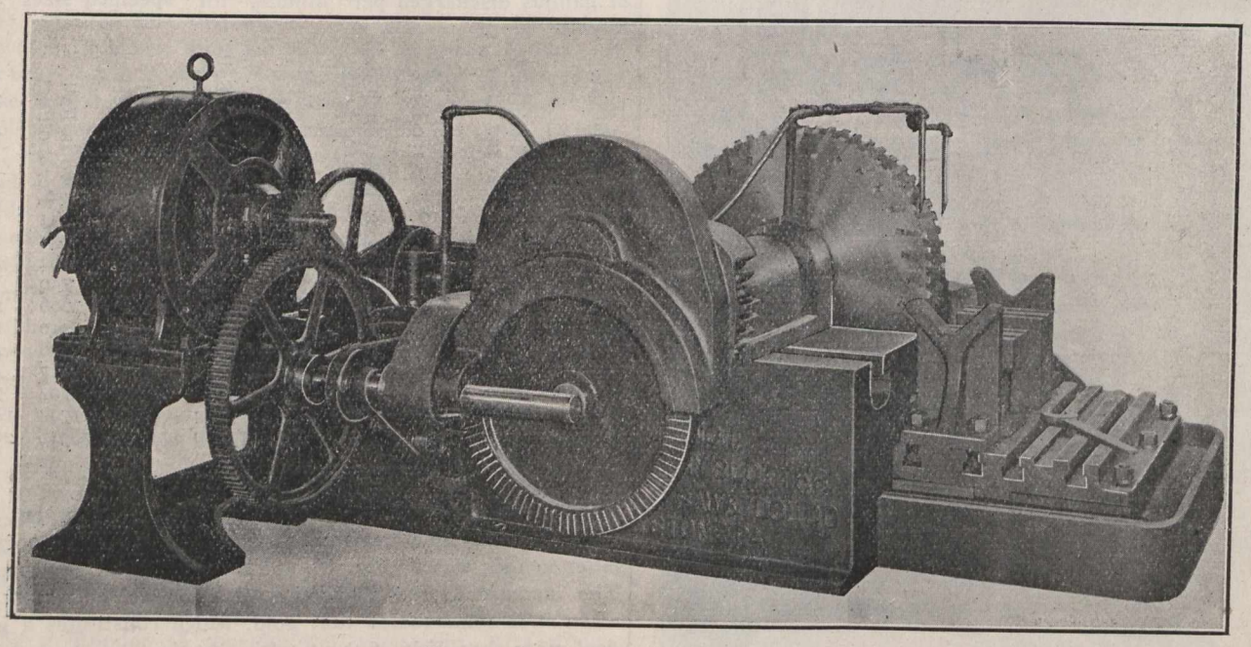


Fig. 2.—Back View of the Machine.

The machine has capacity to cut double slots spaced up to 10 inches wide and 11 inches deep. On steel up to .45 carbon the machine driven moderately cuts slots of these dimensions in fifteen minutes.

A project is on foot for the construction of a second Suez Canal, supported solely by British capital. It is said the project has passed the speculative stage, and has taken definite form. A concession will be granted in a few weeks. This will place the Bagdad Railway, which was intended to cut into British influence in Asia Minor, and be a menace to India, in a second place. The Germans consider the project a checkmate to their Asiatic ambitions.

BOOK REVIEWS.

Publications reviewed under this heading may be secured in Canada from the Smith Publishing Company, 62 Church Street, Toronto, who are the publishers in this country of the books published by The Norman W. Henley Publishing Company, of New York.

Henley's Twentieth Century Book of Recipes, Formulas, and Processes.—Edited by Gardener D. Hiscox, M.E., New York: The Norman W. Henley Publishing Company. 6½ x 9½, pp. 787. Cloth, $3.00.

A recipe book of any kind, provided it can be relied upon, is a valuable asset to those interested in the subject with which it deals, even if it only contains information on that one special line of work.

This volume may be considered of exceptional value, containing as it does some ten thousand recipes, covering almost every known subject. It is a book that meets the demands of everyone in every day life, and in its pages may be found information of value regarding the processes that are used in the manufacture of the countless articles in common use. It contains selected recipes and formulas of compounds that almost everyone must need at some time, and from its pages may be readily secured information that will meet the requirements at hand. The preparation of nearly every substance employed in art and manufacture is fully explained. Directions for mending almost everything that one can think of are given.

The housewife, painter, carpenter, metal-worker, farmer, soap and candle maker, the photographer, jeweller and watchmaker, the electroplater, tanner, mechanic, engineer and manufacturer will find valuable information in its pages; information that has been gathered from almost every corner of the globe, and translated from the many languages in which the recipes were first written.

There is practically no limit to the scope of the book, and many of its formulæ are novel to a degree. Through careful selection the information contained is the very latest obtainable, and on this account is adapted to present day requirements. The subjects have been arranged in alphabetical order, and numerous cross headings are given throughout, making it possible to find the desired data without loss of time.

As explained by the editor, the information has been selected from works and periodicals specially devoted to each subject, so that the book is practically one of expert advice on nearly every subject. The recipes, of course, have not all been tested, since this procedure would mean the expenditure of a sum of money altogether out of the question, and no doubt some will not be found as satisfactory as could be desired, but on the whole the work may be taken as a safe guide.

It is impossible here to list all the subjects on which the book contains information, but in order that a fair idea may be given a few of them are enumerated as follows:

Bleaching, Candles, Corn-Cures, Etching and Engraving, Glass Making, Ceramics, Paper, Ointments, Microscopy, Mirror-Making, Paints, Rubber, Explosives, Gilding, Galvanizing, Bronzing, Tinning, Silvering Acid Proofing, Adhesives, Plating, Enameling, Varnishes, Polishes, Cleaning Process, Soaps, Leather and its Preparation, Insecticides, Amalgams, Alloys, Solders, Photographic Formulæ, Shoe Dressings, Stove Blacking, Rust Preventives, Lubricants, Oils, Dyes, Colors, and Pigments, Dryers, Inks, Artificial Gems, Jewelers' Recipes, Watchmakers' Recipes, Household Formulae, Waterproofing, Fireproofing, Cements, Glues, Mucilages, etc., Fireworks, Stain and Spot Eradicators, Vinegars, Alcohol and its Uses, Essences and Extracts, Dentifrices, Cosmetics, Perfumes, Tanning, Metallurgical Formulæ, Casting, Hair Restorers, Depilatories, Condiments.

* * * *

The Commercial Organization of Engineering Factories.—By Henry Spencer. London: E. & F. N. Spon, Limited, 57 Haymarket. 5¾ x 8¾, pp. 220. (10s. 6d. net.)

Organization, or system, as it is commonly called to-day, plays no unimportant part in the operation of the modern industrial plant, whether it be large or small. The day has long since passed when the plodder, who carried the particulars of his business in his head, can be successful. Keen competition makes it necessary for any business, no matter what its magnitude may be, to be run as systematically as possible, if it is to win in the race for supremacy, or even if it is to have standing at all.

The work in hand is devoted exclusively to organization in engineering establishments, and large ones at that, but it is possible to extract from it principles applicable to enterprizes of much smaller dimensions. It may be considered a handbook to commercial engineering, and is an exposition of modern practice, with forms and precedents for the use of directors, secretaries, managers, accountants, cashiers, and all students of industrial economy.

Many principles which will help in a large measure to make a business successful are given. The application of these principles is set forth by an enunciation of the procedure that experience has proved to bring the desired results.

The call of late years for rapid production has led to specializing, and plants are designed that will give a maximum output at a minimum cost. With this maximum production a means of prompt distribution is called for, and to meet this demand the production engineer has arisen. It is the duty of the production engineer to see that orders received are promptly sent through their proper channels to be filled; that they are executed with the least possible delay, and that the finished product is shipped to the purchaser immediately upon completion. The manner of arriving at these results, which should receive the most careful attention at the hands of every management, is dealt with in the pages of this book.

In order to give the reader some idea of the comprehensiveness of what the work contains, the subjects of the various chapters may be enumerated as follows: Correspondence department, including filing, telephone calls, etc.; contracting department; receiving department; store-room; estimating department; advertising department; orders received; drawing office; costs department; plant, buildings, etc.; forwarding department; accountants' department; cashiers' department; selling agents and travellers; secretary's department. Ninety-five forms are given, which will be found either applicable to large or small establishments. These and the explanations regarding the use of same are most valuable.

* * * *

Crucibles: Their Care and Use. By Jno. A. Walker, Jersey City, N.J., Joseph Dixon Crucible Co.; 6 x 9, pp. 39.

This is the title of a comprehensive book on the subject of graphite crucibles, which are also known as plumbago or blacklead crucibles. It should be in the hands of everyone interested in the melting of the various metals. The author is Mr. John A. Walker, Vice-President, Treasurer, and General Manager of the Joseph Dixon Crucible Company, Jersey City, N.J.

Mr. Walker is thoroughly fitted by his long years of experience in crucible making to be an authority on the subject, as he certainly is.

The purpose of the book is to instruct users of crucibles as to their proper use, and the dangers of abuse of crucibles. It tells what graphite is, and why crucibles are made of it. It tells why crucibles must be made of flake graphite. It tells why some crucibles are dark and others light, and the importance of that fact.

It states that most crucibles are perfect when they reach the user, and that much of the trouble that comes is due to the fault of the user. It gives rules for annealing crucibles, and tells why all of them should be carefully followed. It gives the use of tongs for handling crucibles and their misuse by careless melters. The proper shape of tongs and how they should be handled is also set forth, and how the metal should be placed in the crucibles, and how the crucibles should be placed in the fire. The various fuels used in melting metals are fully described, and their effect on the crucibles given. It speaks of the importance of perfect combustion.

The book also carries much allied information, it gives the proportions of metal in commonly-used alloys. It tells the freezing, fusing and boiling points of various substances.

It gives the specific gravity of various metals and other commodities, and the comparative value of fuels, together with much other information of value in the foundry.

The double page center of the book carries a vivid and realistic foundry scene, and the illustrations throughout the book are the very best. The book in its entirety is a credit to its author.

* * * *

Questions and Answers from the Gas Engine, Cincinnati, Ohio. The Gas Engine Publishing Co., Blymyer Building; 5 x 7, pp. 275, $1.50.

During the last ten years the "Gas Engine" has published enquiries from its readers, asking for answers to same. The more interesting and useful of these enquiries and replies have been arranged according to subject and printed in book form.

The enquiries relate to the design, construction, operation and repair of gas and gasoline engines for stationary, marine and automobile use, and have been asked by some of the brightest aand most progressive readers of the United States. The answers were made by some of the best recognized authorities on the various subjects in America and Europe.

The result of the wide circulation that the questions were given in the gas engine, is that the information gathered is the best possible, since, as already mentioned, it has been secured from some of the best authorities on the questions dealt with. During the last decade much attention has been given to the gas engine by skilled mechanics and engineers generally, and on this account the questions published in the Gas Engine have been asked by men who are and have been making a specialty of the subject, and, therefore, many questions of vital importance have been asked.

A book of this type is more or less valuable, no matter what the subject may be, since it contains not the opinion of one specialist on the subject, but the opinions of many, and, therefore, no prejudice for any one design is contained in its columns.

The book has been divided into seven sections, in which the following subjects have been dealt with. Theory of design, mechanical design, marine design, automobile questions, producer gas questions, general questions, trouble enquiries. Wherever possible language of a technical character has been omitted, so that the non-technical as well as the technical man will be able to secure from its pages the information contained therein.

* * * *

Design of a Railway Bridge Pier.—By Charles Derleth, Jr., C.E., Associate Professor of Structural Engineering, University of California. New York: The Engineering News Publishing Co.; 7 x 10¼, pp. 24, 50 cents.

This is a reprint of a paper prepared by Professor Derleth at the request of the editors of the California Journal of Technology. The subject is dealt with in a very complete and efficient manner, and the work should prove very valuable to students in this line of engineering. The article gives the calculations for a first study of an intermediate pier to carry a metal superstructure for an inclined upper chord, double-track railway bridge, about 300 feet in span length. The pneumatic process is employed, the pier is assumed to rest on a rock, and the caisson proposed is of steel. An ideal case or fictitious foundation site has not been chosen, the site being for a pier of the Havre de Grace Bridge of the Baltimore and Ohio Railroad. The author deals with the construction of the pier from its very foundation, giving the general proportions and a complete specification of all material used, the weight that it has to support, and all data necessary for making the calculations. He gives the general stability of the pier as constructed and the forces acting upon it and superstructure. In fact the reader begins with the figures necessary for designing the pier, and is carried through the various operations of the work until the pier is finished. On the last page a bill of the approximate costs is given, which will be found very useful in estimating.

CATALOGUES AND CIRCULARS.

Coal Handling Machinery.—C. W. Hunt Company, West New Brighton, N. Y. Catalogue No. 072 furnishes information for engineers and architects, necessary for installing coal handling machinery for power stations, boiler rooms, coaling stations, gas companies, coal yards, shipping docks, and industrial establishments generally. It is well illustrated; 6½ x 9¼, pp. 64.

Concrete Machinery.—"What Others Say About Us." This is the title of a pamphlet containing copies of testamonial letters to the Ideal Concrete Machinery Co., London. These letters go to show that "Ideal" machines are amongst the best on the market to-day; 6 x 9, pp. 48.

Concrete Building Blocks.—The Ideal Concrete Machinery Co., London, Ont., publish a well-illustrated catalogue, containing much valuable information regarding concrete blocks. It gives formulæ for the mixing of materials to obtain the required results, such as the coloring of concrete, etc. Sixteen illustrations show some handsome buildings in which Ideal concrete blocks have been used. Size, 10 x 8, pp. 64.

Diamond Drills.—The Canadian Diamond Drill Co., New York, N.Y. Diamond drills of every capacity and for every purpose are described and illustrated in catalogue No. 26, published by the above-mentioned company. Size, 6 x 9¼, pp. 86.

Electrical Supplies.—The 144-page catalogue of the Manhattan Electrical Supply Co., is one of the most comprehensive of its kind published, setting forth electrical supplies for every purpose. It contains 750 illustrations.

Fans, Blowers, and Exhausters.—The Green Fuel Economizer Co., Matteawan, N.Y., in their latest catalogue, show fans, blowers, and exhausters for all purposes. The catalogue gives the types and sizes carried in stock, with descriptions of fans of special design. It also contains valuable engineering information, and tables, 6 x 9, pp. 96.

Fire Escapes.—Canada Foundry Company, Toronto, Ont. A pamphlet showing the detail of the standard fire escapes manufactured by this company, 3½ x 6¼, pp. 4.

Gas Engines.—The Hornsby-Stockport engine, for which the Colonial Engineering Co., of Montreal, are the Canadian representatives, is being advertised in a booklet, entitled, "Why pay ten times more for electric light than you can make it for yourself." 3½ x 5¼, pp. 8.

Generating Sets with Horizontal Engines.—The B. H. Sturtevant Company, Hyde Park, Mass. These generating sets, and engines are described in bulletin No. 143, 6½ x 9, pp. 8.

Hoisting Engines.—Lidgerwood hoisting engines, which are used for general contracting purposes, are set forth in bulletin No. 200, of the Allis-Chalmers-Bullock, Limited, Montreal. 8 x 10½, pp. 24.

Jacks.—The Norton ball-bearing jack as manufactured by A. O. Norton, Inc., of Boston, Mass., and Coaticook, Que., is fully described and illustrated in a 36-page catalogue. Norton jacks are made for every use to which a jack may be put. Size, 6 x 3½.

Metallurgical Machinery.—Catalogue No. 11, by Messrs. Mussens, Limited, Montreal, is a general catalogue of machinery and appliances for the treatment of ore. They are the sole Canadian agents for Fraser and Chalmers, of Erith, Kent, England. Size, 4¾ x 7, pp. 47.

Mogul Type Freight Locomotives.—A pamphlet recently issued by the American Locomotive Company is devoted to the Mogul Type, and illustrates and describes 25 different designs of locomotives built for various railroads. They range in weight from 49,000 to 187,000 pounds, with hauling capacity adapted to a variety of road and service conditions. The pamphlet as a whole constitutes a very complete record of the production of the company in this type of locomotive.

Polyphase Induction Motors.—In circular No. 4,004, of February, The Allis-Chalmers Co., Milwaukee, Wis., give a general description of type A N induction motor.

Pump Regulators.—The Mason Regulator Co., Boston, Mass. The 1907 catalogue of this company is illustrative and descriptive of automatic regulating devices for steam, electric, and power pumps, 6 x 9, pp. 55.

Paint.—Joseph Dixon Crucible Co., Jersey City, N.J. "Spring Painting" is the title of a very artistically gotten-up pamphlet, showing some particularly interesting views of buildings and bridges where Dixon's paints have been used. Size, 3½ x 6¼, pp. 12.

Rotary Snow Plow.—A pamphlet issued by the American Locomotive Company illustrates and describes the Rotary Snow Plow which they build. The pamphlet contains a brief account of the work done by the Rotary in fighting the snow on various railroads, with illustrations of the Rotary in operation. Also a description of the plow giving the particular features of the design, to-

gether with a set of rules for the guidance of those operating the Rotary, based on experience gained in handling the plow.

Rock Drills.—Prospectors and mining men generally will find the catalogue of the Canadian Rand Co., Montreal, Que., very interesting. It sets forth by illustration and description the "Calyx" diamondless core drill, which removes a core from the bore hole, thus showing the character of the earth's crust at the place of boring. Size, 6 x 8¾, pp. 54.

Rotary Converters.—Canadian Westinghouse Co., Limited, Hamilton. Circular No. 1,028 describes rotary converters, and gives views of several installations. Size, 7 x 10, pp. 24.

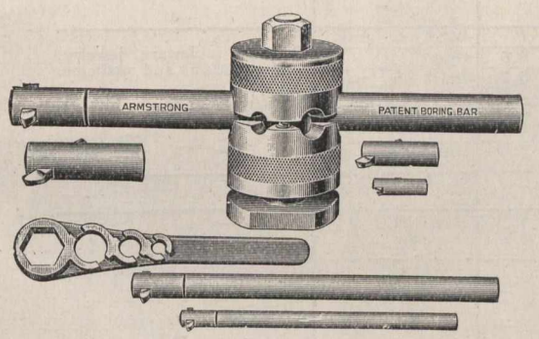
Split Friction Clutches.—Dodge Manufacturing Co., Toronto, Ont. In an illustrated pamphlet this company describes and gives prices of their split friction clutches and cut-off coupling: 3½ x 6¼, pp. 8.

Sprocket and Traction Wheels.—The Link-Belt Co., of Philadelphia, Pa., have just issued revised price lists, to take the place of pages 262-272 of their general catalogue No. 37.

Trussed Concrete.—A very artistic pamphlet showing the new automobile factory of the Geo. N. Pierce Co., of Buffalo, N.Y., in which the Kahn System of reinforced concrete is used, has been prepared by the Trussed Concrete Steel Co., of Detroit, Mich. The illustrations throughout are the finest. Anyone interested in concrete factory construction should secure a copy. 9½ x 12, pp. 24.

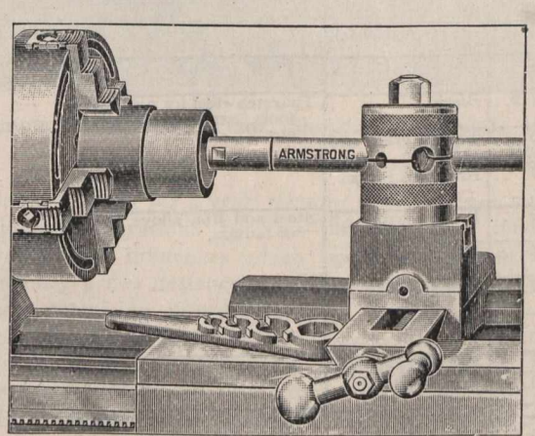
A THREE-BAR BORING TOOL.

A very useful device is shown in the accompanying illustrations. It is a three-bar boring tool, and, as indicated by its name, is a holder equipped with three bars of different sizes. From the illustrations machinists will at once appreciate the practical advantage of this lathe attachment. A slight turn of the nut at the top of the holder shown in Fig. 1 releases or fastens both bar and



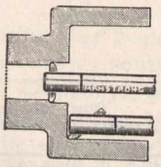
Three-Bar Boring Tool.

holder. It is possible to change the bars almost instantly, enabling the operator to use the stiffest bar possible for each job, and in this way speeds and feeds may be increased, and time saved.

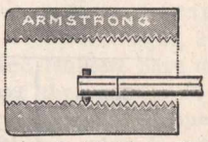


The Armstrong Three-Bar Boring Tool.

The holders are made in four sizes: 1-B with bars ½, ¾, and 1-⅛ inches diameter; 2-B 9-16, 15-16, and 1-5-16; 3-B ⅛, 1⅛, and 1-½; 4-B 15-16, 15-16, and 1 13-16. The bolt head and bottom part of holders are made of ample size to allow for fitting which is necessary on account of the great variation in height of centres above slide rest and sizes of slots.



Roughing out cored hole and Angle Cutter Boring and Facing.



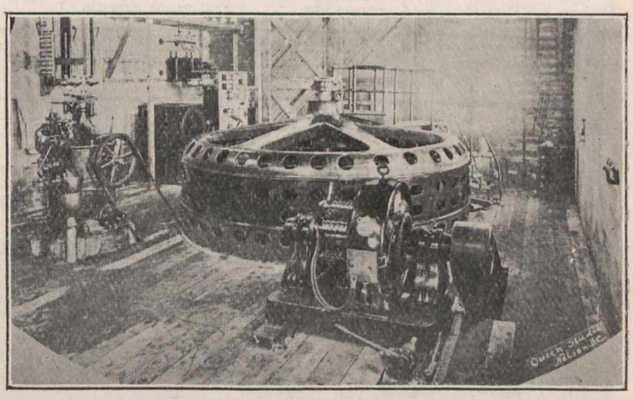
Showing Tool Cutting a Thread.

This tool, which will be found very useful in almost every machine shop, is manufactured by the Armstrong Brothers Tool Co., 104-124 N. Francisco Ave., Chicago, Ill. Each set is supplied with an Armstrong combination wrench

HYDRAULIC TURBINE AND GENERATOR AT NELSON, B.C.

A test run of an Allis-Chalmers hydraulic turbine generator unit was recently conducted at the city power plant of Nelson, B.C., in the presence of city officials, which resulted decidedly in favor of the apparatus. The turbine generator unit has a normal capacity of 750 k.w., but during the test run this output was increased to 1,340 k.w. for a period of over forty-five minutes continuous running without undue increase in temperature of bearings.

The usual tests were made as to the heating of the coils and bearings. According to the guarantees the armature



Generator driven by Hydraulic Turbine of 1,000 horse-power rated capacity at Nelson, B.C., developing 1,250 horse-power continuously.

and field coils did not rise in temperature above 35° centigrade.

The supply for light and power has been furnished up to the present time by the West Kootenay Power and Light Company, situated just across the Kootenay River from the new city power plant, out of which source both companies derive their power.

The hydraulic turbine, which is of standard design, was built at the Scranton, Pa., works of the Allis-Chalmers Company, and the generator, which is the vertical type, specially designed for direct connection to hydraulic turbines, was built at the electrical works of the Allis-Chalmers Company, Cincinnati, Ohio.

A NEW JOURNAL.

Under the title "Copper and Brass" a new 32 page monthly journal is being published by the Copper and Brass Publishing Company, of Detroit, Mich. The journal is devoted to the copper, brass, bronze, and aluminum industries. Mr. R. Marshall is the editor. The first number (March, 1907) contains an interesting and valuable article by H. M. Lane, Sources of Non-Ferrous Metals. Mr. Lane purposes writing a series of articles for "Copper and Brass," of which this is the first. Other articles contained in this number are: The Copper Situation, by Paule Leake; Moulding of Odd Castings, and Aluminum in Typewriters.

CHART OF ANALYSES OF MINERALS OF COMMERCIAL IMPORTANCE.

PART II.

Metal	Principal Ores	Composition Approximate Per Cent.	Hardness	Spec. Grav	Color	Uses
Lithium..... $1.50 pound	Lepidolite.....	Litha 5; silica 49; alumina 27; potash, flourine.....	3 ..	2.3..	Lilac and white..	
	Amblygonite....	Lithium phosphate.....	6 ..	3 ..	White, green, etc	
Magnesium.... 1¼c. pound	Epsomite.....	Magnesia 16; water 51; sulphur tri-oxide 32.....	2.5..	1.7..	White.....	
	Brucite.....	Magnesia 69; water 31.....	2.5..	2.4..	White and green	
	*Magnesite.....	Magnesia 47; carbon di-oxide 53.....	4 ..	3 ..	Various, light....	
	*Asbestos.....	Magnesia, silica, lime, etc....	5 ..	3 ..	Green and brown	
	*Meerschaum....	Magnesia 27; silica 60; water	2 ..	2 ..	Whitish.....	
Manganese.... Ore 20c. unit	*Pyrolusite.....	Manganese 63; oxygen 37...	2 ..	5 ..	Iron black.....	Iron manufacture, good demand at increasing prices for higher grade ores.
	*Rhodochrosite...	Manganese protoxide 62; carbonic acid 38.....	4 ..	3.5..	Rose red.....	
Mercury..... 53c. pound	*Cinnabar.....	Mercury 86; sulphur 14.....	2 ..	9 ..	Red.....	Milling by amalgamation.
	Native.....	(Liquid).....		13.5..	Tin white.....	
Molybdenum... $1.75 pound	*Molybdenite....	Molybdenum 59; sulphur 41	1.5..	4.5..	Lead gray.....	Steel manufacture for certain tools, wire, gun, etc.
	*Wulfenite.....	Molybdenum tri-oxide 34; lead protoxide 65.....	4.5..	6 ..	Iron black.....	
Nickel..... 50c. pound	Niccolite.....	Nickel 44; arsenic 56.....	5 ..	7.5..	Copper red.....	Nickel steel, coinage, plating, etc.
	Millerite.....	Nickel 44; sulphur 36.....	3 ..	5.6..	Brass yellow.....	
	Ullmannite.....	Nickel, antimony; sulphur..	5 ..	6.5..	Silver gray.....	
Niobium.....	*Columbite.....	Niobium pentoxide 79; iron, manganese, lead, copper, tantalum.....	5 ..	6 ..	Iron black.....	Manufacturing electric and incandescent lamps.
Platinum..... $20.50 oz.	Native.....	Usually alloyed with one or more following metals: Ruthenium, Iridium, Rodium, Palladium and Osmium.....				In chemical, electrical apparatus, jewelery, etc.
	Sperrylite.....	Platinum; arsenic.....	6 ..	10.6..	Tin white.....	
Potassium.....	*Nitre.....	Nitrogen; potash 47.....	2 ..	2 ..	White.....	Gunpowder, medicine, etc.
	Sylvite.....	Potassium 52; chlorine 47..	2 ..	2 ..	White.....	Medicine.
Selenium.....	Clausthalite. ...	Selenium 28; lead.....	2.5..	8 ..	Lead gray.....	
	Tiemannite.....	Selenium 29; mercury, etc...	2.5..	8.2..	Blackish.....	
Silver..... 65c. oz.	*Argentite.....	Silver 87; sulphur 13.....	2 ..	7 ..	Black and gray..	Coinage, tableware, jewelry, photography and medicine.
	Hessite.....	Silver 62; tellurium 37.....	2.5..	8.5..	Gray.....	
	Pyrargyrite(ruby)	Silver 60; antimony 16; sulphur 17.....	2 ..	5.7..	Black and red...	
	Stephanite.....	Silver 68; antimony 16; sulphur 16.....	2 ..	6 ..	Iron black.....	
	Cerargyrite.....	Silver 75; chlorine 25.....	2 ..	5.5..	Gray, green, etc..	
Sodium.....	*Halite (common salt).....	Sodium 39; chlorine 61.....	2 ..	2 ..	White.....	
Strontium.... 7c. pound	*Celestite.....	Strontia 56; sulphur.....	3 ..	4 ..	White and red...	
	*Strontianite.....	Strontia 70; carbon di-oxide.	4 ..	3.8..	Greenish.....	
Sulphur..... 2½c. pound	Native and combined in many ores, forming sulphides and sulphates.....					Manufacturing sulphuric acid etc.
Tellurium... .	Native and combined in few ores		2.5..	6.2..	Tin white.....	
Thallium.....	Crookestite.....	Thallium 19; copper, silver, selenium.....	2.5..	6.9..	Lead gray.....	
	Lorandite.....	Thallium 60; arsenic, sulphur	2.5..	5.5..	Carmine red.....	
Thorium..... $4.50 pound	*Thorite.	Thorium 48 to 72; silica.....	5	5 ..	Yellow and brown	Gas mantles.
Tin ..... 42c. pound	*Stannite	Tin 27; sulphur 30; copper, iron, etc.....	4	4.5..	Dark gray.....	Tin plating, bell metal, bronze
	*Cassiterite	Tin 78; oxygen 22.....	6 ..	6.5..	Brown and black	
Titanium.....	*Rutile.....	Titanium 61; oxygen 39....	6 ..	4.2..	Reddish.....	Artificial teeth, etc.
Tungsten.. ... 90c. pound	*Wolframite.....	Tungsten tri-oxide 76; iron, manganese.....	5.5..	7.2..	Black.....	Tungsten steel for high speed tools, armor plate alloys, etc.
	*Scheelite.....	Tungsten 64; calcium 14; oxygen 22.....	4.5..	6 ..	Yellow, green and various.....	
	*Hubnerite	Tungsten 60; manganese, oxygen	5 .	7 ..	Brown to black..	
Uranium .... $3.40 pound	Uraninite.. .. .	Uranium oxide 75; variable	5 ..	9 ..	Black (pitch blende).....	Steel and iron alloys, source of radium.
	Gummite.... ..	Uranium oxide 61; lead calcium; barium, etc.....	3 .	4 ..	Yellow and brown	
	Torbernite.....	Uranium oxide 60; copper phosphorous.....	2.5..	3.5..	Apple green.....	
	*Carnotite.....	Uranium oxide 65; vanadium potassium				
Vanadium. ..	*Vanadanite.....	Vanadium, lead, chloride....	3 ..	7 ..	Red and yellow..	
	*Descloizite. ...	Vanadium, lead, zinc.....	3.5..	6 ..	Brown and red...	
Zinc ..... 6c. pound	*Sphalerite..	Zinc 67; sulphur 33.....	3.5.	4 ..	Yellow and black	Galvanizing, electric batteries paint, alloys, medicine, metallurgy, etc.
	*Zincite...	Zinc 80; oxygen 20.	4 ..	5.6..	Yellow and red..	
	Goslarite....	Zinc oxide 28; sulphur, water, etc.....	2.5..	2 ..	White.....	
	*Willemite.....	Zinc oxide 73; silica 27.....	5 ..	4 ..	Various.....	
Zirconium $10.00 pound	*Zircon.....	Zirconium 67; silica.....	7.5..	4.7..	Various.	

WESTMOUNT'S GARBAGE DESTRUCTOR AND LIGHTING PLANT.

The Westmount municipal garbage-consuming and electric lighting and power plant, if not the first municipal undertaking of the kind in the Province of Quebec, is at least the most prominent.

This plant has a peculiar interest, not only for other municipalities, but for all who are concerned in efforts of this nature, for the reason that it is being operated in competition with a strong and well-managed hydraulic plant with headquarters in the city of Montreal, of which city, Westmount may be considered a part.

An interesting feature of the establishing of this plant is the manner in which the contract for its erection was given out.

Construction and Operation of Plant.

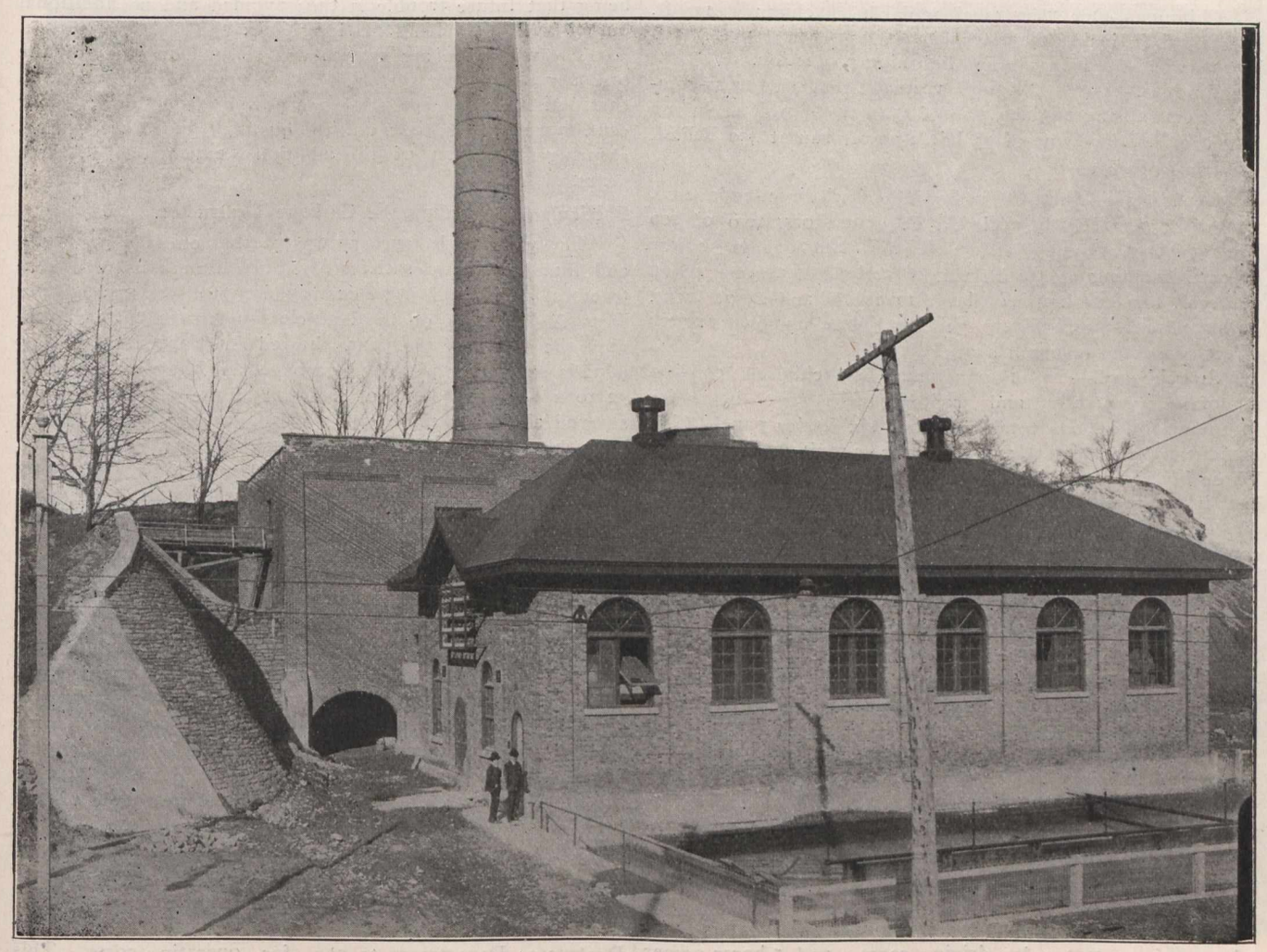
The contract was given to Messrs. Ross and Holgate, engineers, who, in accepting it, stipulated that after erecting the plant they were to appoint the employees, train them and operate the plant for a year, turning it over to the municipality in full operation. In this manner they insured themselves against influences which in municipal undertakings frequently prove destructive to the successful operation of the most promising enterprises.

Messrs. Ross and Holgate began the work of construction towards the end of September 1905, and owing to the favorable winter the work was carried on almost continuously. By April, 1906, the buildings were practically completed, being several months ahead of the time anticipated. A temporary engine and generator was installed so as to start the plant operating as speedily as possible. The first lamps were accordingly connected on April 20th, since which time the plant has been in successful operation.

The garbage destructor was started about April 16th, and was tested officially, and accepted on May 3rd, while the street lighting was begun on December 15th, at the expiration of the town's contract with the Montreal Light, Heat and Power Company. Messrs. Ross and Holgate have made a report to the town council regarding the results of the work to the end of 1906, and they will continue to operate the plant until the end of the present year, when it will be turned over to the town in full running order. By that time they will have demonstrated what the plant can do, and if its record is not sustained after the corporation has assumed control, the conclusion will be obvious.

Reasons for the Undertaking.

It was about three years ago that the topics which eventually led to the erection of this plant came up in Westmount. They were, how to dispose of the garbage of the town, and how to reduce the cost of lighting. The necessity of burning the garbage soon became evident, and it was but a step from this to the consideration of the utilization of the heat thus generated towards the production of electricity for the town.



Westmount Destructor Plant, Showing Destructor and Boiler Building in Rear, with Lighting Station and Cooling Pond in Front.

Inventory of Land, Buildings, and Plant.

After the reports from Messrs. Ross and Holgate, concerning the electrical end of the proposition, and from the town engineer, regarding the destruction of garbage, had been placed before the council and approved, a by-law was passed authorizing a bond issue of $225,000 to meet the estimated costs. The contract was given to Ross and Holgate, and work was proceeded with as already described. The report the contracting engineers recently made to the town regarding the plant is certainly as complete a document on a work of this nature as could well be made. The inventory on January 1st, 1907, shows that the plant and adjuncts then consisted of the following:—

About 171,000 square feet of land on Glen Road, near the C. P. R. and M. S. R. tracks. Two buildings. One building (40 x 90 ft.) containing the destructor, boiler room, and coal bin, the other (40 x 70 ft.) containing the engines, generators and other electrical equipment. The foundations of the buildings are of concrete, the walls of brick and concrete, and the roofs of steel construction, the destructor building being covered with felt and gravel, and the engine-house with slate.

Machinery Installed.

The detail of the machinery installed to date is as follows:—

Destructor.—One "Meldrum" 3-grate (75 ft. of grate surface), 50-ton continuous pattern, regenerative refuse destructor connected to a Babcock and Wilcox boiler; steam jets for forced blast.

Boilers.—Three B. and W. water tube, two drum, horizontal boilers, 2,197 square ft. heating surface each, rated at 200-boiler horse-power each. Two arranged for hand firing, with coal in one battery; third boiler connected to destructor and fired by gases from burning refuse.

Chimney.—One "Custodis" radial brick chimney, 150 ft. high by 6 ft. inside diameter, made of special perforated blocks, with cast iron cap and lightning protection.

Engines.—Three "Robb" vertical enclosed cross-compound condensing engines, two of 350 horse-power each, run at 360 R.P.M. and one of 75 horse-power run at 450 R.P.M.

Electric Apparatus.

Generators.—Three "Crocker-Wheeler" direct-connected, 2,300-volt, 3-phase, 60-cycle A. C. generators, two of 200 k.w. capacity, running at 360 R.P.M., and one of 50 k.w. capacity running at 450 R.P.M. Overload guarantee of 50 per cent. for four hours on large machines and 25 per cent. on small machines. Each generator has its own exciter direct-connected on main shaft.

Switchboard.—One 12-panel main switchboard, consisting of four generator and exciter panels (one blank for future machine), one totalling panel, six feeder panels (five equipped, one blank) and one arc circuit- control-panel. These boards are of blue Vermont marble, with black oxidized instruments, double sets bus bars, automatic switches, etc. (Canadian Westinghouse Company.) Four panels for control of magnetite arc lighting circuits complete, with blower and motors, transformers, reactances, etc. (Canadian General Electric Company.) One tie panel for control of spare arc circuit, and one lighting panel. (Hill Electric Switch Company.)

Arc Apparatus.—Four complete sets of controlling apparatus, each for a 50-light magnetite equipment, and consisting of switchboard panel transformer reactances, blower and motor, rectifier tubes, etc. Three of these are active and one is spare. (Canadian General Electric Company.)

Auxiliaries.—Two Knowles boiler pumps and two condensers; one Wainwright feed-water heater; two automatic smoke preventors on boilers; two automatic Williams pump governors; one each Spencer damper regulator; Wright trap on main steam line; pump for condensing water; and 3-horse-power motor for driving same, and 5-horse-power motor for driving coal hoist; continuous bucket elevator and conveyor for distributing coal, and 3 Williams feed-water regulators on boilers.

Cooling Pond.—One cooling pond for condensing water (150 x 30 ft.), with an average depth of 5 ft., completely lined with tarred lumber.

Outside Line Construction.—About 975 poles, average length 35 to 40 ft., spaced about 100 to 110 ft., making a total length of about 20 miles. About 150 C. G. E. magnetite arc lamps are spread over 20 miles of streets; arranged in three circuits on No. 6 B. and S. wire. There are also 6 or 7 multiple arc lamps rented to different customers, and eight hundred Westinghouse single-phase integrating wattmeters for houses.

Only Magnetite Arc Lighting System in Canada.

The report speaks of the very considerable cost of the site for the plant. Messrs. Ross and Holgate state that while the location was a costly one from a standpoint of construction, it is an ideal one for purposes of operation, and the additional outlay was considered justifiable in view of the certainty of a tremendous reduction in operation costs. With this same object in view the engineers considered it advisable to install the very best apparatus procurable.

Particulars regarding the construction of the plant, the difficulties they met with and the changes they found it advisable to make, are entered in the report. The changes were only made when it was apparent that they would be for the ultimate advantage of the plant, even though they might involve an additional capital outlay. For instance, the original estimate was for two boilers, it was found advisable to install three. In the original estimate, two simple engines were calculated upon; three compound condensing engines with condensers and cooling pond have been installed. The capital cost was thus increased, but the saving in coal is estimated at about $5,000 per year.

The amount of wiring done is largely in excess of present requirements and of estimates, and is sufficient to supply twice the present population, the explanation for this being that future trouble is thus avoided and no additional outlay will be needed for a long time.

The magnetite arc system was selected in place of the ordinary alternating system. This involved an increased cost, but the result is a saving in power of one-third; 50 per cent. more light is given and the quality is much better, thus assuring the return of the additional expenditure in three years.

Particulars Regarding the Garbage Destructor.

The garbage-destructor was tested on May 3rd, 1906, and found perfectly satisfactory. Meldrum Bros., the contractors, guaranteed it to destroy fifty tons of garbage per day. A test made on the lane clean-up in the spring, probably the worst of the year, showed an evaporation of 1.36 pounds steam per pound of garbage, and the destruction of 52 tons per day. Up to the end of the year it has destroyed about six million pounds of garbage, necessitating only the replacement of certain brick linings. Since that time it has been in almost continual operation, destroying with absolutely no smell or smoke, whatever has been brought, varying in quantity from 5 to 50 tons per day, and averaging 13 to 14 tons.

The clinker obtained from the destructor is hard and vitreous, is very good for road purposes, and can also be used for making cement walks.

The horse-power generated by the destructor has not been determined from day to day, owing to conditions which will shortly disappear. It is safe to say, however, that it will give 125 to 150 boiler horse-power while in operation, that is, for 24 hours per day during the winter, and as long as the garbage holds out during the rest of the year, the winter giving the most garbage. During the day time the whole of the load, amounting to 150 horse-power, is carried by the garbage. At night coal is used for the coal-fired boilers to take the heavy loads of the evening lighting. This runs up to 300 horse-power, and will increase as customers are added.

The heat value of the garbage is credited back to the Destructor Department to pay for operating costs. This means that the lighting station derives no direct monetary benefit from the installation of the destructor. The heat value of the garbage is charged to the lighting station at its equivalent coal value, and so the operating costs of the electric plant are figured out the same as though coal were used entirely. No coal whatever is used in the destructor, except on Sundays when it is not operating, coal then being used at times to keep up banked fires.

Results of Test.

The results of a test on May 3rd were as follows:—

Weight of garbage destroyed, 38,090 pounds.

Hours of operation, 8 hours 32 minutes.

Pounds of water evaporated, 1.36 from and at 212° F. per pound of coal.

Temperature of furnace, 1994 (average).

Temperature of stack, 334 (average).

As already stated, when it was found that the buildings would be in readiness several months earlier than expected,

a temporary plant was installed in order to take advantage of the spring contracts for electric light. The plant remained in use about two months, and its cost was borne by the contractors, who were late in supplying the necessary machinery. It was non-condensing, with unclothed pipes and boilers and under only a light load. After the first permanent generator and engine unit had been installed about June 1st, and the pipes were covered, the cooling pond put into operation, and the whole plant operated condensing there was a large decrease in fuel consumption.

Its efficiency, the engineers claim, will be greatly increased, as time goes on, principally because the rapidly increasing loads tend to reduce the cost of fuel per horse-power delivered.

Unexpected Demand is Met.

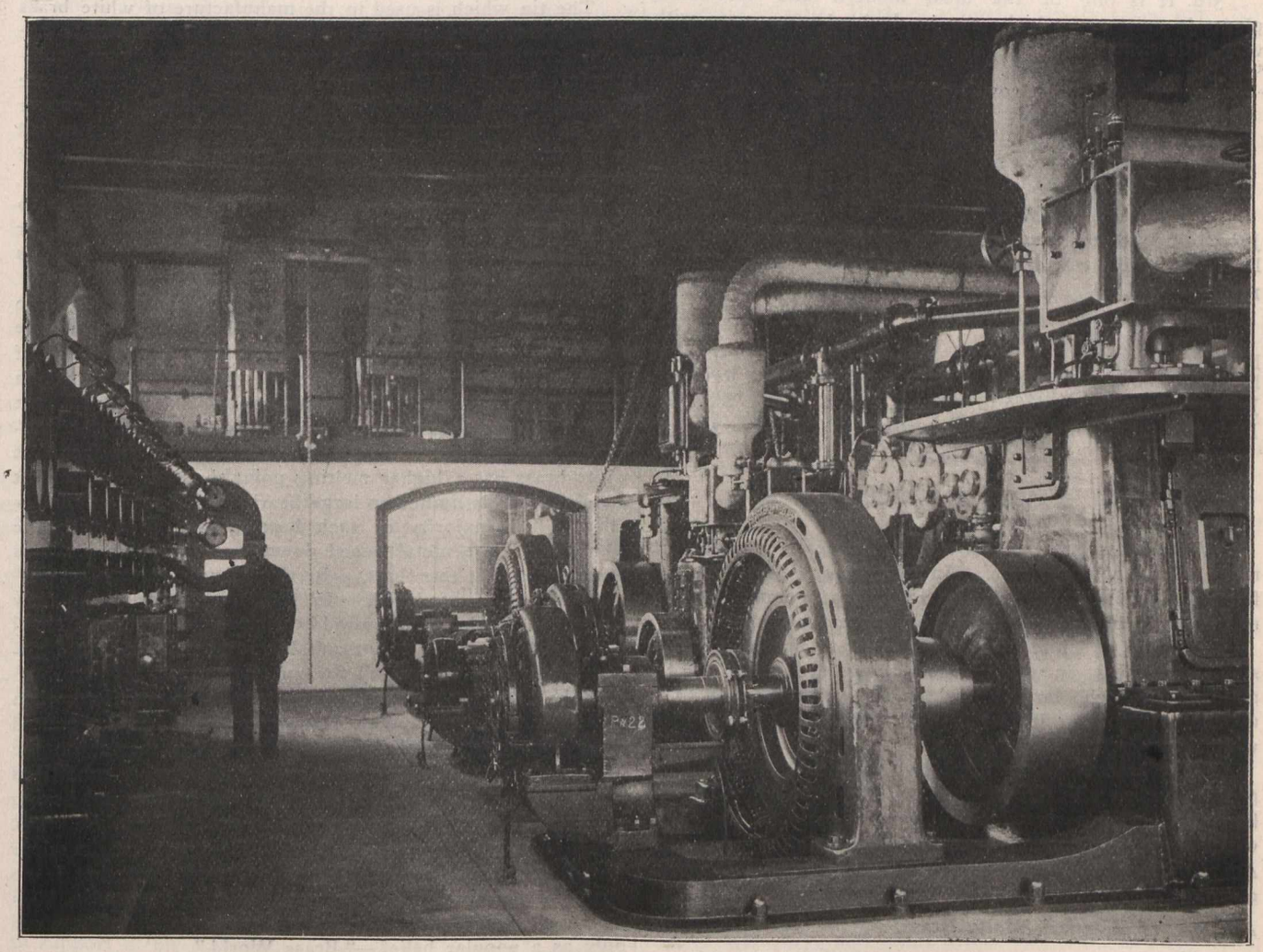
The smallest of the three present units was installed in view of the belief that little or no motor load would be obtained in Westmount, and the intention was to operate the small generator during periods of light load. However, the extension into Notre Dame de Grace offered an opportunity to obtain a motor load of about 125 horse-power, to be operated almost entirely on garbage, giving returns of $5,000 to $6,000 per year, but the results from a technical standpoint have been bad. The small engine, installed for day operation, cannot handle the unexpected demand, and the cooling pond, instead of having 12 hours out of the 24 to cool, is in continuous operation. The returns will, however, practically pay for all the coal the plant has to contract for, and hence the advantage of the new contract.

The loads obtained at present run up to between 250 and 300 kilowatts at night, necessitating the employment of one large and the small engine, and as new customers are being constantly added it is not thought that there will be much falling off on this maximum load during the spring. Accordingly it may be necessary to shortly install a fourth unit to meet the demands of the winter of 1907 and 1908, and this unit should be of such a size as will double the present plant.

General Management of Plant.

The entire management having been placed in the hands of the contracting engineers, they proceeded to engage a staff of competent men. Mr. Davidson, chief engineer of the plant, was appointed to oversee the installation of the machinery, and was afterwards put in charge of the power-house. Later, the general superintendent, Mr. Thompson, was engaged and he selected his own staff.

A system of book-keeping was inaugurated, showing details of all receipts and expenditures, and test apparatus and other auxiliary machinery was installed to assist in ascertaining the exact results of the plant. The instruments, etc., included a five-ton scale for weighing coal, a coal hoist for distributing the coal into bins to minimize handling, appliance for testing coal and oils and for weighing and measuring fuel and water. Even in the construction of the plant certain portions were carried on by contract and certain by day labor in order to ensure the greatest efficiency and saving.



Westmount Destructor Plant, Interior of Lighting Station.

The results of operation show that within six months the department has been placed on a paying basis, even with the reduction of 33 per cent. on the rates previously paid for private lighting.

The contracts now total about 750. (February 15th, 1906.) Apart from light supplied to private customers a number of small motors throughout the town, aggregating 45 horse-power, are being driven, in addition to a contract for the operation of a waterworks pump of about 125 horse-power, throughout the day.

Financial Results.

The capital expenditure to the first of this year was $212,000, exclusive of land, but including $2,000 for a line to convey power to a pump outside the municipality. During

the construction period the expenditure for operation was $12,629, and the revenue from sale of light $12,243.

In December the revenue amounted to $3,468, and in January over $3,800, and it is estimated that during 1907 it will total about $53,850, while fixed charges and operation cost will not much exceed $50,179. The plant is consequently on a paying basis, better lighting is being given at a considerably decreased cost, and when it is decided to double the capacity of the plant the additional cost will amount to only $70,000, for engine, generator and house transformers and meters.

Summary of Results.

1st. The total operating expenses and revenue for the construction period of six months have balanced.

2nd. From the beginning of this year the plant is on a paying basis, covering costs, interest 4 per cent., sinking fund 1 per cent., and depreciation varying from 10 per cent. on meters and lamps to 2 per cent. on buildings, and is expected to show in addition a very fair profit at the end of the year.

3rd. It is one of the most modern and interesting plants in existence, which can be doubled in capacity with very little expenditure.

Growth of the Service.

Month Ending	Signed Contracts.	Customers Connected.	Meters Installed.	Total Lamps Connected.	Total Arc Lamps.	Power Load.
July 4 . .	398	312	314	7,131	1	16.1
Dec. 31 . .	708	634	594	15,198	155	159.2

1906.

Growth of Revenue.

Month Ending.	Inc. Lighting and Meter Renewal.	Power.	Arc Lighting.	Sundries.	Total Revenue.
July 31 .	$ 504.55	$129.50	.....	$11.60	$ 645.65
Dec. 31 .	2,421.30	515.53	$456.25	75.07	3,468.45

WHITE BRASS.

White brass, as it is known in commerce, is a Babbitt metal which contains zinc. In toughness, color, and antifrictional qualities it closely resembles genuine Babbitt metal, but it has the advantage of greater cheapness.

The uses of white brass are limited to marine work or similar appliances in which large bearings are used. As the majority of such large bearings, however, are found in marine construction, it may be said that the principal use of white brass is in this class of work.

White brass has been used for a long time, and its composition varies with different makers. The best white brasses, however, are those in which tin predominates, as the alloys which contain an excess of zinc are too brittle for many uses. An analysis of a common brand of white brass is herewith given.

Analysis of Parsons' White Brass.

Tin	65.12	per cent.
Zinc	31.71	"
Copper	2.87	"
Iron	0.13	"
Antimony	none.	
Lead	0.17	"

The lead and iron present in this analysis are impurities from the zinc, and were not intentionally introduced. The mixture consists of tin, zinc, and copper. The increase of the copper hardens the mixture. The increase of the zinc likewise hardens it, but at the same time the melting point is increased, and the melted metal does not run freely.

To make such a mixture of white brass take the following:

Straits tin	10 lb.
Common spelter	5 "
Copper	6 oz.

The copper is melted in a crucible in the usual manner, and then the zinc is added. When this has been thoroughly melted and stirred to incorporate the copper with the zinc, the tin is added, and the whole is again stirred. The mixture is then poured into ingots. Care must be exercised to avoid overheating the mixture.

The drossy nature of white brass renders the making of ingots of good appearance a troublesome matter. It is customary to pour it into large ingots to avoid splashing. The metal is poured at the lowest possible temperature at which it will run. Some makers cast the metal in a mould closed on all sides, and containing a series of ingots. The mould is placed on end, like a mould for casting brass billets for rolling. In this manner the dross floats to the top, and ingots of better appearance are produced. With care, however, an ingot of good appearance may be made in the usual ingot molds. Aluminium is frequently introduced into the mixture in the amount of about 1 oz. to 100 lb. of mixture to purify it, but when good metals are used it is not considered necessary.

Straits tin	10 lb.
Common spelter	4 lb. 13 oz.
Yellow brass	9 oz.

The tin which is used in the manufacture of white brass should be of good quality. Any of the Straits brands are good for the purpose. The zinc should be a good commercial brand. If, however, the very best results are desired, Bertha or Horsehead should be used. The copper may be either ingot or wire, as the amount which is added is so small that it is unnecessary to use Lake copper. If scrap brass is used for making the mixture instead of copper, it should be free from lead. As it is rather difficult to obtain scrap brass free from lead, and the amount of copper that is used is so small, the use of metallic copper itself is preferable to scrap brass.

As far as anti-frictional qualities are concerned, white brass is fully the equal of genuine Babbitt metal. The one great fault of white brass, however, is the large amount of dross which forms when the metal is poured. That which forms when the metal is melted may be skimmed off, but when the metal is poured more forms and runs into the casting. For this reason, and also on account of the fact that white brass has a higher melting point than genuine Babbitt metal, its use is limited to large bearings that may be readily filled. The majority of such bearings are filled with the white brass, the metal pened down, and then the whole is bored out to fit the shaft. In this manner a very serviceable bearing is produced. In fact, it is really the only manner in which a really good bearing may be made of small brass. This metal is not suitable for small or thin bearings, and is not used at all for such a purpose.

The drossy nature of white brass is so manifest when it is used that now and then one may see a bearing poured in in which the metal is spread almost like mortar on the bearing surface. Even under such unfavourable conditions a good bearing is produced provided the pening and boring are carried out. Marine engineers seem to like white brass, and it is extensively used by them. They say that the odour which is given off from it when a bearing runs hot is so characteristic that a hot box may easily be detected. This statement, however, lacks complete verification, and is given only as a popular belief.—"Brass World."

THE BELL TELEPHONE COMPANY'S ANNUAL REPORT.

At the recent annual meeting the report for 1906 showed that 16,950 subscribers had been added to the company's list during the year; 95,145 instruments are now rented. The company owns and operates 571 exchanges and 1,160 agencies. The Long Distance System was increased by 6,318 miles of wire during last year, making a total of long distance lines of 43,400 miles of wire, with 9,391 miles of poles. During the year $1,038,000 of five per cent. bonds were sold. The premium on which $51,900 being carried to contingent account. Ten thousand shares of New York stock were offered to shareholders at 25 per cent. premium, bringing the paid-up capital to $9,980,800.

The receipts for the year from long distance and private lines were $1,098,114.08.

MINERAL RESOURCES OF NEW ZEALAND.*

The exploitation of a mineral deposit is a commercial undertaking carried on with a view to profit. Its promoters contemplate the expenditure of a sum of money in the expectation of gaining a larger sum by the sale of the mineral won and put into marketable condition by their operations. It is not a work of scientific research; and, although its operations may result in the enrichment of the world at large by the incidental acquisition of much valuable and previously unsuspected knowledge, it is essentially a business proposition.

Thus the development of the mineral resources of this country must proceed along commercial lines or not at all. The location of as-yet-undiscovered deposits is not the only point worthy of consideration, although it necessarily bulks largely in an essay on the present subject; for, while the people of New Zealand can do but little to increase the value in the markets of the world of the minerals contained in their country, yet members of all classes can assist in the direction of decreasing production-costs.

Considering the matter from a purely utilitarian standpoint, the most important item for the shareholder is dividend. This may be defined as that amount—expressed as a percentage of share capital—which is returned to shareholders. Evidently, then, if the share capital of the company could be kept at a lower figure, the same sum as net profits would appear as a higher dividend, and would thus encourage investors to extend or repeat such profitable undertakings. Again, with share capital and gross profits unaltered, a higher dividend could be secured by decreasing operating expenses.

Some of the most important items that figure on the debit side of the profit and loss account are legal and similar expenses, depreciation of plant, cost of power, materials and stores expended, loss of metal in residues and otherwise, cost of conveyance of product to market, wages, rent, taxes, etc.

Now, it may be quite possible to diminish the total while increasing the last two items.

The employee wishes to maintain a high standard of comfort, which demands high wages, considerable purchasing-power of same, continuity of employment, and health. The public at large desire to receive a fair proportion of the profits in return for supplying the raw material which renders the operations possible. But, at the same time, the State has important duties to discharge, not the least of which are to keep religiously the national honour, and to prevent as far as possible individual ignorance or mental shortsightedness from injuring any of her citizens.

Thus it is quite legitimate and even essential for the essayist to deal with as many of the points touched upon above as his space will allow.

Many of the following suggestions have been made previously. They have invariably been dismissed as impracticable. The writer has therefore usually given figures in support of his contentions, and where this was impossible has debated the point at considerable length.

The essay will be divided into three parts, dealing respectively with the minerals contained in—I. Lodes: Value of output to end of 1905, £18,000,000; II. Stratified deposits: Value of output to end of 1905 £12,000,000; III. Drifts: Value of output to end of 1905, £62,000,000.

PART I.—LODES.

Copper.

It would be difficult to specify a district in New Zealand in which cupriferous minerals have not been located, yet the production of ores of this metal has up to date been trifling. Small quantities of copper-ore have been taken at various times from the following:

(1.) Champion Mine, Waimea County, and adjoining leases, Roding River, Nelson: On these properties there is a heavy lode of copper-pyrites and some copper has been found native. A reduction-works was erected, but the capital of the company was soon exhausted, and the mine closed down. A company (Maoriland Copper-mining Company) has recently been formed in Christchurch to exploit leases in this district.

(2.) Johnstone's United Mine, Aniseed Valley, Nelson: copper lode in serpentine rock. No work proceeding.

(3.) Dun Mountain, Nelson: Various ores of copper in serpentine. Not now worked.

(4.) D'Urville Island, Nelson: Various ores of copper in serpentine. Not now worked.

(5.) Kawau Island, Auckland: Copper-pyrites. Not now worked.

(6.) Great Barrier Island: Fissure lode of copper-pyrites in slate has produced over 2,000 tons, but it is not now worked.

(7.) Croixelles Harbour: Small quantity taken out. Not now worked.

Other places at which cupriferous minerals have been detected are: Waitahuna, Tuapeka County, Otago (lode 4 ft. thick); Moke Creek, Lake County, Otago; Routeburn, Lake County, Otago; Flagpole Hill, Selwyn County, Otago; Ismuth Sound, Preservation Inlet, Otago (auriferous); George Sound, Milford Sound, Dusky Sound, Otago; Jackson's Bay; Paringa River, Westland; Arahura Gorge, Westland (olivine and schist, bearing copper up to 10 per cent.).

Hackett's stratum, Aniseed Valley, Nelson (serpentine carrying native copper 5 per cent., evenly disseminated): Windtrap Gully, Maitai, Nelson; Bedstead Gully, Aorere, Nelson; Maharahara, Woodville, Hawke's Bay (chalcocite, etc., auriferous); Patua Range, Taranaki; Te Aroha, Auckland (in auriferous quartz); Hen and Chickens, Whangarei, Auckland (deposit of cupriferous diorite of great thickness but variable richness).

There are also many other deposits which have been prospected in a rough and ready fashion, but little is known of the real merits of any of them.

Value of a Copper-Deposit.

A report to a capitalist who may be contemplating the exploitation of a cupriferous lode must answer the following questions:

(1.) What percentage of copper is carried in the ore? Is the mineral auriferous or argentiferous, if only to a slight degree?

(2.) What is the probable extent of the deposit, and does it present any unusual difficulties as regards mining operations?

(3.) Taking into consideration the following factors: (a) Quantity and price of fuel available; (b) quantity of fuel required per ton of ore; (c) quantity of suitable fluxes in neighbourhood; (d) price of labour and cost of power; (e) cost of machinery and plant delivered on claims; (f) quantity and value of gold and silver concentrates or ores which can be purchased locally at a profit—is treatment on the ground commercially possible?

(4.) If shipping for treatment elsewhere is inevitable, what will be the cost of delivering the ore or concentrates at the smelting-works?

In the case of unusual ore-value being shown, it might pay the operator or the State to spend considerable sums on constructive works in order that the last two questions might be met. Thus, as the country becomes opened up by roads and railways, its copper-deposits will gradually increase in value until their exploitation—or, at least, their systematic investigation—becomes commercially practicable. The demand for copper is increasing more rapidly than the supply, and its price is rising in accordance therewith.

The location, valuation, and exploitation of the copper deposits of the colony will be considered with those of auriferous lodes in subsequent pages.

The value of copper-ore produced to date is £18,228.

* Prize Essay in New Zealand Mines Record.

Manganese.

This occurs in New Zealand mostly as oxides or carbonate. Some silicate has also been encountered. It has two principal uses in the arts: (1.) In the manufacture of chlorine for bleaching-powder. The introduction of the Weldon process, in which much of the oxidized manganese is recovered and returned to be used over again in the earlier stages, has lessened the demand. (2.) In the manufacture of iron and steel. Here the manganese as oxide serves a double purpose, assisting in the elimination of phosphorus, and at the same time enhancing certain valuable properties in the metal produced. It is in the latter connection that it is most valued in modern practice. Steel containing manganese—within certain limits—is very much harder than ordinary steel of the same degree of carburisation.

The most important occurrences are at the Island of Waiheke, Auckland Harbour; Bay of Islands, Auckland; Kawau Island, Whangarei, etc., Auckland; Kawarau and Clutha, Otago.

The value of manganese-ore produced to date is £61,791.

Lead.

A few tons of lead-ore has been shipped, mostly from Te Aroha, Auckland. A large number of lead minerals are known to occur in various parts of the colony. At Collingwood, Nelson, a few tons of silver-lead ore has been mined.

Chromium.

The chief deposit at present known is at Dun Mountain, Nelson.It is found, in fact, all through the mineral belt across the north end of the Middle Island.

Chromium is required for the manufacture of special steels for armour-plate and other purposes.

The value of chromium-ore produced to date is £38,002.

Antimony.

With reference to this metal, it is difficult to say in what part of the country it is not found. No discoveries of possible commercial significance have been made in Canterbury, Hawke's Bay, or Taranaki; but elsewhere antimony lodes are as plentiful as leaves in Vallombrosa. The deposits which may on present evidence be considered of most importance are situated in the west coast of the Middle Island and in Central Otago.

The two important factors in fixing the value of the deposit are its richness in antimony and facilities for shipping. Practically all the smelting of antimony is done in Germany. The ore must contain 50 per cent. of antimony to be saleable, and prospectors are often misled by the metal being finely disseminated through its matrix.

The value of antimony-ore produced to date is £52,598.

Tungsten.

Scheelite is found in veins in schists all over Central Otago. Some 30,000 pounds' worth has been mined, crushed, concentrated, and shipped.

Much interest is being taken in this mineral at the present time by local investors.

Nickel.

This is the only other metal which on present showing holds out much prospect to the mining operator, and even with this there is little reason for extravagant hope. Some ore from the Collingwood district appears to warrant further inquiry, and attention might be directed with advantage to the Mahurangi district.

Other Metals.

Zinc has been discovered in the Thames and Collingwood districts, but usually as an undesirable constituent in ores worked for other metal.

Molybdenum as sulphide has been reported from Dusky Sound, Otago, and from the West Coast between Greymouth and Westport. Lead molybdate is said to have been found at Dun Mountain, Nelson.

Arsenic as arsenical pyrite is widely distributed. No discoveries of commercial importance have been recorded.

Cobalt has only been discovered in traces.

Mica.

This mineral is known to exist in rocks on the west coast of the Middle Island, perhaps the best deposit being at Milford Sound. So far as published records show, it has never been mined.

Reef Gold and Silver.

In October, 1852, a reward of £500 was offered by the authorities of the Auckland Province for the discovery of a payable goldfield, and within a week this was claimed by Mr. Charles Ring, a settler, who had recently arrived from California. The find consisted of auriferous quartz and some minute particles of gold-dust from the Kapanga Creek, Coromandel Harbour, Cape Colville Peninsula. A rush took place, but died out within six months, only 1,200 pounds' worth being won. The largest nugget was valued at £10.* Yet from these small beginnings sprang the gold-mining industry of New Zealand, an industry which has added to the world's store gold to the value of no less than £69,124,539,† and silver to the value of nearly £900,000. Of this total of over seventy million pounds sterling, £18,000,000 has been won from quartz reefs.

In 1905 the product amounted to £1,356,995. There were 3,558 men employed in the industry, and plant to the value of £1,945,430 was in use, consisting of 112 crushing-machines, 2,075 head of stamps, and 230 berdans.

The returns for 1905 show an increase in product but a decrease in number of men employed as compared with 1904. Seven fatal accidents occurred during the year.

The Geology of Gold in New Zealand.

Gold is found in association with silver and other minerals in New Zealand under very different conditions. H. A. Gordon says,‡ "Gold is found in the alluvium derived from and in metamorphic schists in Otago, Westland, Nelson, and Marlborough; in slates of Silurian age in the north-west district of Nelson; from slightly metamorphosed or unaltered Devonian and Carboniferous rocks in Southland, Otago, Westland, Nelson, Wellington, and Auckland; from rocks of volcanic origin near Dunedin (Otago) and over the goldfields of Cape Colville Peninsula. Gold in small quantities has also been obtained from serpentine in the Dun Mountain Range, Nelson; in haematite from Maharahara, Hawke's Bay; Collingwood, Nelson; Whangarei and Bay of Islands, Auckland. It occurs also in antimony-ore (stibnite) at Reefton and Langdon's in the Grey Valley, Nelson. Native silver has been obtained from schistose rocks in Bruce, Lake, and Vincent Counties, Otago; from Carboniferous rocks in Kawau Island; in the volcanic rocks in the Golden Crown Mine, Thames; Waihi Mine, Waihi; Talisman Mine, Karangahake; and at Opitonui, Auckland. Ruby ore (sulpho-arsenide of silver) occurs at Puhipuhi, in Carboniferous rocks; in the Great Barrier Island, at Thames, Waihi, and Karangahake (Auckland) in volcanic rocks; and as an important constituent of tetrahedrite silver occurs at Richmond Hill, Collingwood, Nelson, in gneissic schist; and as a telluride at the Thames, Auckland; with galena, as silver-bearing lead-ore, at Mount Rangitoto, Westland, in mica-schist and gneissic granite; in the Owen and Wangapeka Valleys, Nelson, in Silurian slates."

In other words, gold is found in stratified and igneous rocks of all ages. The matrix is usually quartz, and may be so highly mineralised as to be nearly black or pure milk-white,†† except for the specks of gold showing in it.

The sources from which the gold in our alluvial deposits has been derived can be indicated in a few unimportant instances.††† The work of the Geological Survey may eventually—if pushed to an end—result in the location of the mother-lodes if still in situ, but the reefs when found may prove to be too poor to pay for working. Again, the gold may be derived not from definite and easily recognizable

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* Hochstetter, "New Zealand," pp. 94 et seq.

† Up to end of October, 1906; other minerals are only brought up to the 31st December, 1905. Auriferous concentrates to the value of some thousands of pounds sterling per annum are included under "Mixed Minerals" in departmental reports.

‡ "Mining and Engineering," 1906, pp. 12 et seq. q.v.

††Some stone in Victoria Range, Inanghua County, Nelson, is like this.

†††McKay: "Gold-deposits of New Zealand."

lodes, but by the disintegration of vast masses of rock throughout which it has been disseminated. It has been definitely decided that the andesitic rocks of the Thames, for example, contain gold scattered through their mass, and it may have been from such that the rich auriferous gravels have been derived. He would be a rash man indeed who would dare to state positively on geological evidence alone that a particular stretch of country must, or could not possibly, contain payable gold reefs.

Methods of Working.

The majority of the deposits of auriferous quartz known to exist in New Zealand are at present neglected for reasons which will be subsequently considered.

The exploitation of a gold reef consists of :

(1.) Its discovery : This is mostly effected by the finding of its outcrop by a prospector. In some cases the presence of the lode vertically beneath a particular claim has been inferred from its strike and dip in an adjoining lease. In some cases the reef has been found as the result of many hundreds of feet of diamond-boring conducted in directions governed by the personal equation. The most usual practice, however, is to sink a winze on stone right down from the outcrop.

(2.) Its development : This consists of sinking shafts, rising, driving levels, etc., with the idea of blocking out the ore. When a sufficient quantity of ore is in sight—i.e., exposed on all four sides—it is, in good practice, thoroughly sampled, and if sufficiently good is stoped out and taken to the battery. Most of the exploratory work is done on contract, a price being given by competing parties of miners for each foot run of the work. Stoping also in certain mines is paid for on a tonnage basis, but otherwise mining in New Zealand is conducted on day-wages. During the drilling and blasting much fine dust is produced, which is liable to enter the lungs of the men engaged, and, setting up irritation there, to cause silicosis, or miner's phthisis.‡ At the Waihi Mine a jet of water is used in the hole during machine drilling, which to some extent reduces the quantity of dust thrown into suspension.

(3.) Its reduction : The stone is crushed to the desired size, and treated by various physical and chemical processes. A mere enumeration of the different machines in use would be of little value, but generally it may be said that New Zealand practice is quite up to that of other countries. The fact that mills in the colony show a low crushing-rate per head of stamps may be attributed to the unusual hardness of the quartz encountered ; and this has also been the reason, probably, of the failure here of forms of ball mills and other machines which have done good work elsewhere. That the old-fashioned gravitation stamp-mill has been retained so generally by no means proves the ultra-conservatism of the New Zealand millman, for most of the inventions with prima facie claims to consideration[1]—and many without—have had a fair and exhaustive trial.

It is difficult to compare the operating-expenses of the mines of one country, or even of one district, with another ; but it is safe to assume that the Keep-it-Dark Gold-mining Company (Reefton), with a total cost of 16s. 9d. per ton crushed,[2] is as cheaply conducted as any mine of similar size and dealing with a similar ore in the world.

Quartz-Mines from Investor's Viewpoint.

The figures which follow are taken from the annual reports of the Mines Department. They deal with the history of mining companies then operating up to the end of 1905 : Paid-up capital, £1,576,829 ; value of product, £6,291,917 ; total expenditure, £4,395,366.[3] The record, however, is incomplete, in that several companies have been omitted. Some of these have been successful ;[4] others, again, have been less fortunate ; some have even closed down altogether.

No published return has been found by the writer which gives the figures under the above headings for companies which had gone out of business before the beginning of 1905. It is probably true that statistics could be prepared giving the nominal share capital of all the mining companies which have operated in New Zealand, and the amount which they have returned to shareholders ; but such a comparison, even if possible without disproportionate labour, might only serve to place the industry in unmerited disfavour before the eyes of capitalists, for the total share capital of these companies would be very much in excess of the amount of money actually subscribed.

Shares (fully paid) to the amount of £600,000 might by some be added to paid-up capital in above ; but in many cases the scrip was presented as reward for services which under the scheme proposed in later pages would never have been performed, and which in some cases never were performed. In this country, as in all others in which mining operations have been carried on along limited-liability lines, many properties have been floated only to die after a comparatively small sum had been expended.

It is also true that one company—the Waihi Gold-mining Company—has paid a very large proportion of the dividends; but neither this nor any of the above facts affects the point which it is desired to establish—namely, that investors as a body have no right to complain of New Zealand as a mining field. It cannot be said of this country that its reef-gold, for example, has cost more than £4 4s. 11½d. per ounce.

Lode Minerals.

The mining of lode minerals other than gold and silver would not make such a good showing,[5] but it must be remembered that in no case has the attack been pushed home by a sufficiently large and well-directed and attacking force.

It yet remains a lamentable fact that capital is not attracted as it should be. This is easily explained as regards local investors, all available capital being absorbed by house property, extensions of existing businesses, etc., or by the more attractive—to small people—gold dredging companies. The considerations influencing the minds of foreign capitalists are discussed in subsequent pages. It is the belief of the writer that if his suggestions are adopted the mining of lode minerals in New Zealand will gradually attain to the dimensions which its merits warrant.

It is assumed throughout this essay that the mining of the future will be done by limited liability companies. When an insurance company takes a risk on a property of great value they invariably reinsure portions with a number of other companies. In like manner a marine underwriter assumes only a small portion of a marine policy of insurance. Unless quartz-mining is followed in a mere gambling spirit, it is advisable for investors to spread their interests similarly over several properties, and limited liability companies are thus indicated.

To be Continued.

According to the report of the Department of Trade and Commerce for 1905-6, the trade of Canada showed an increase over the previous year of more than $80,000,000, the increase in imports being $27,450,000 and the increase in exports $53,270,000. The duties collected amounted to $48,737,941 as against $42,905,990 in 1904-5. The total trade of Canada was $550,872,645 compared with $470,151,289 in the previous fiscal year. The trade of Canada with other portions of the British Empire amounted to $227,778,608, an increase of about $40,000,00. Trade with France increased from $8,712,977 in 1904-5 to $9,818,138 in 1905-6, and with Germany from $7,788,793 to $8,912,648 in the same period. Trade with the United States amounted to $278,532,663 compared with $243,444,961 in the previous year, and with Japan $2,157,031 compared with $2,425,712 in 1904-5 The sum of $2,440,771 was paid in bounties during the year. The bounty on pig iron amounted to $687,632, on puddled iron bars, $5,875 ; on steel, $941,000 ; on manufactures of steel, $369,832 ; on lead, $90,196 ; on binder twine, $15,079, and on crude petroleum, $291,157. During the year 229,062 vessels, including those employed on inland waters, arrived at and departed from Canadian ports. Of these, 188,993 were British and Canadian. The total tonnage of all vessels was 81,056,234.

‡Some consider, however, that the disease is due to the action of a special micro-organism. Whether this is so or not, it remains a fact that the quartz-dust is a primary cause.

[1] The Morison-Bremner high-speed stamp is a notable exception.

[2] Report of Department of Mines.

[3] Including paid-up capital.

[4] E.g., Progress Mines of New Zealand (Limited), which in seven years has paid 18s. in the pound on a share capital of £275,000.

[5] Above figures merely relate to gold and silver.

MODERN AMERICAN AND EUROPEAN HIGH-POWER GAS ENGINES

By Frank C. Perkins.

On the continent of Europe the iron and steel works are more largely equipped with high-power gas engines than those of England or America, but the engineers in the latter country are investigating this subject closely and are now beginning to utilize high-power gas engines extensively on account of the great advantage gained by using the waste blast furnace gases as well as on account of the wonderful economy due to the extremely high thermal efficiency of these engines. Prominent American engineers have found it to their advantage to make use of the costly experimental work of European engineers, a number of celebrated American manufacturing firms arranging to utilize European designs for high-power gas engines driving electrical generators as well as blowing engines.

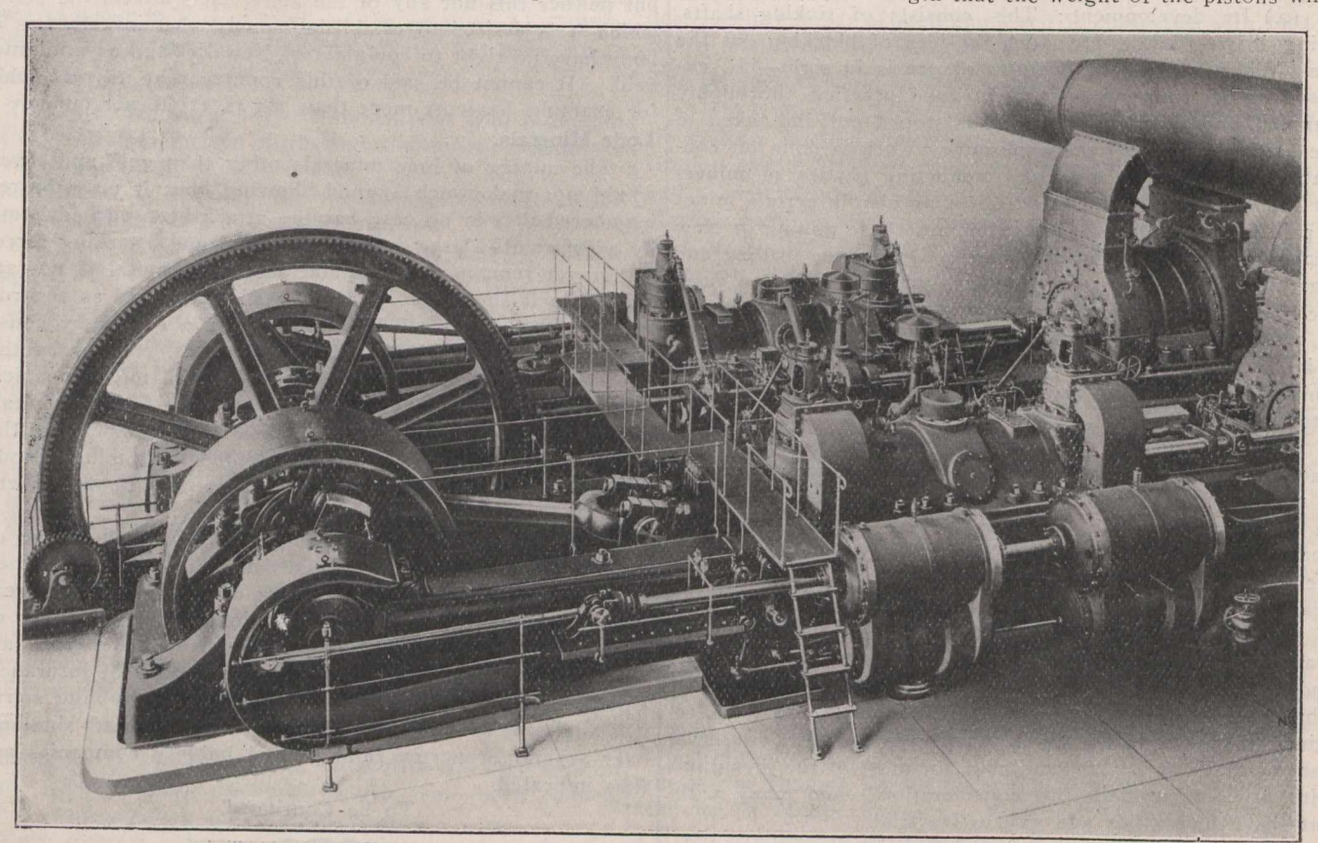
At the Micheville steel works in France the electrical power-house is provided with two gas engines of the single cylinder, double-acting four-cycle type, each having a capacity of 1,100 horse-power. These gas engines operate at a speed of 100 R.P.M., and are directly coupled to continuous current dynamos, which supply current for operating electrically-driven machine tools and labor-saving devices, as well as various other machinery about the iron and steel plant. The engines were installed in January 1904 for the Soc. Anonyme des Acieries de Micheville by the Vereinigte Maschinenfabrik Augsburg und Maschinenbau Gesellschaft Nürnberg, A. G. These Nürnberg engines are constructed by the Allis-Chalmers Company, Chicago, Illinois.

An enormous Nürnberg gas engine, having a capacity of 3,200 horse-power, has recently been installed at the Rheinische Stahlwerke at Meiderich, near Ruhrort, operating at a speed of from 40 to 80 R.P.M., driving a blowing engine with a capacity of 1,400 cubic meters of air at a normal pressure of 1 atmosphere and a maximum pressure of 1.4 atmospheres.

For driving a rolling mill at the Burbacher Hutte at Burbach, near Saarbrücken, a 1,500 horse-power tandem double-acting 4-cycle gas engine of the Nürnberg type has been installed for working on waste blast furnace gases, and has been giving excellent service since June 1904. This engine operates at a speed of 90 R.P.M., and is doing service such as heretofore only high-power steam engines have been applied. A 500 horse-power single-acting 4-cycle engine has been utilized for some time at the rolling mills of Frederick Krupp at Essen.

In August 1904 two 1,800 horse-power double-acting gas engines were installed at Gelsenkirchen for the Aktien-Gesellschaft Schalker Gruben-u. Hütten-Verein. These engines operate at 94 R.P.M., and are directly coupled to direct current and alternating current dynamos, the total output being 3,600 horse-power. A very large blowing engine has also just been installed at the Rhein Stahlwerke at Meiderich, near Ruhrort, having a capacity of 3,200 horse-power at 80 R.P.M. as mentioned above, while a similar engine has also been in operation for a month or more at Volklingen at the power-house of the Rochling'sche Eisen und Stahlwerke.

The Nürnberg gas engines have pistons which are provided with cast iron spring rings, and are mounted upon piston rods of such strength that the weight of the pistons will be fully supported by them. Each piston rod is carried at both ends upon a cross head so that no pressure is exerted by it against the cylinder walls other than the slight pressure due to the expansion of the spring rings. The stuffing boxes for the piston rods are provided with a special type of floating metallic packing. The guides for the cross heads, as well as the frame and main pieces, are of such construction that they will not in any way interfere with the ready dismantling or removing of any of the working portions of the machine. The crank is of the double-arm type, and the main bearings of a special construction, giving ample support to the shaft and yet allowing automatic adjustment in line.



Two Cylinder, Double-acting Koerting Gas Engine, Operating Horizontal Blowing Engines.

Each end of each cylinder is provided with two distinct igniting points, insuring perfect ignition and combustion of the gases, and at the same time constituting a safeguard against a miss fire, even though one of the igniters should fail to act.

In iron and steel plants where a larger amount of power is required than it is possible to develop by burning the entire waste gases from the blast furnace plants under boilers, it is found necessary to use coal for developing the

extra power. Otherwise a part or all of the waste gases may be used directly in high-power gas engines. The prominent American engineers manufacturing the Nürnberg gas engine in the United States state that in a blast furnace, gas is generated to an amount exceeding 160,000 cubic feet per ton of pig iron produced having a heat value of 85 B.T.U. per cubic foot. About 70,000 cubic feet of this gas is utilized in heating the blast, and about 90,000 cubic feet of gas remains available for power generation.

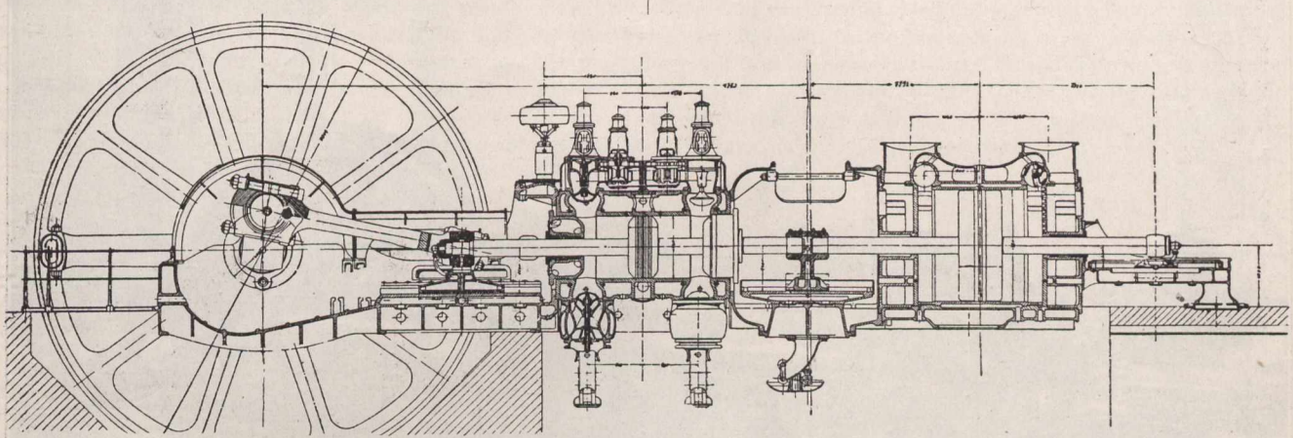
The power required to operate the blast furnace plant, that is, the power consumed by the blowing engines, pumps, mechanical charging apparatus, etc., amounts to about 10 B.H.P. per ton of pig iron produced per 24 hours, or 240 B.H.P. hours per ton of pig iron. Taking as a basis of comparison a blast furnace plant having a capacity of 1,200 tons of pig iron per 24 hours, the following figures will be obtained:

Gas produced per hour, 8,000,000 cubic feet equivalent to 680,000,000 B.T.U. Gas required per hour to heat the blast 3,500,000 cubic feet equivalent to 300,000,000 B.T.U. Gas per hour available for power, 4,500,000 cubic feet, equivalent to 380,000,000 B.T.U.

If burned under boilers to generate steam for compound condensing engines this volume of gas would be sufficient to develop 13,000 horse-power. If utilized directly in gas engines this volume would be sufficient to develop 3,500 Brake horse-power.

Power required to operate the plant is 12,000 Brake horse-power, therefore, if all the available gas be burned under boilers to generate steam for compound condensing engines it would be little more than sufficient to operate the blast furnace plant; while if used directly in gas engines it would not only operate the blast furnace plant, but develop an excess of about 18,000 B.H.P. available for 24 hours, that is 432,000 B.H.P. for other purposes; which latter power, if required and developed in compound condensing steam engines using coal under the boilers, would consume about 860,000 pounds of coal; or in such a plant, the use of steam would be equivalent to an excess in coal consumption of 300,000,000 pounds per annum.

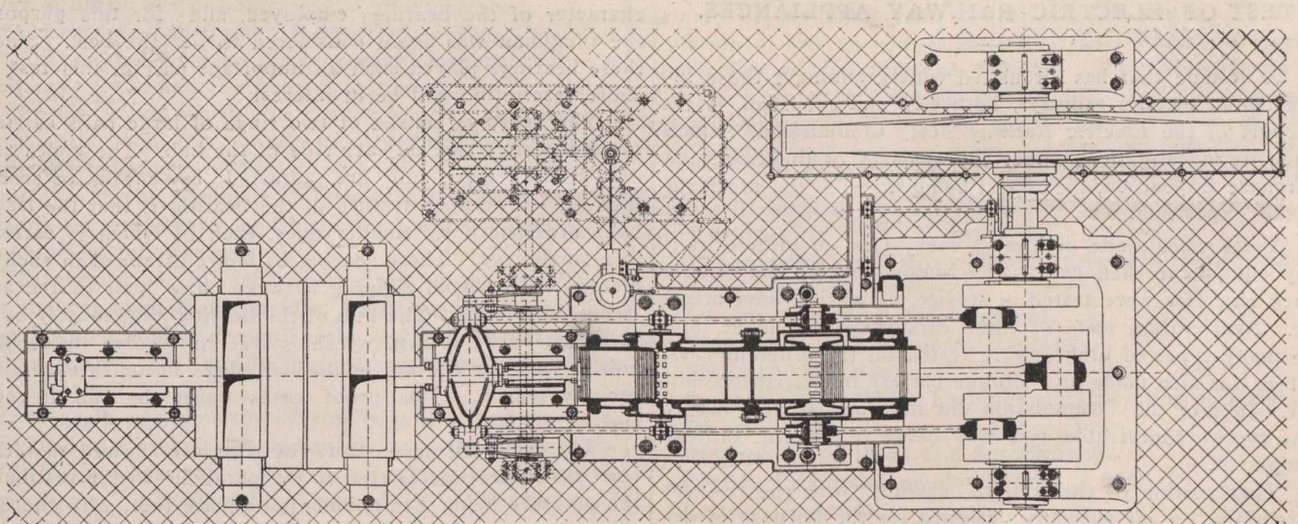
The German high-power gas engine is being extensively introduced in Europe as well as in America for operating blowing engines as well as electrical generators in the large power plants of iron and steel works. These gas engines in utilizing the waste blast furnace gases and coke oven gases



Nurnberg Double-acting Blowing Gas Engine for Iron and Steel Plants.

are most economical in operation and are replacing in many cases the large steam engines heretofore used almost exclusively.

Owing to the more prominent German gas engines of the single-acting and double-acting types of two-cycle and four-cycle designs constructed for large powers, should be mentioned the Oechelhauser of the Deutsche Kraft Gas-Gesellschaft, of Berlin, constructed by A. Borsig in Tegel, and in Dessau and Aschersleber by the Berlin-Anhaltische Maschinenbau-Actien Gesellschaft, and the Aschersleben Maschinenbau-Actien Gesellschaft, the latter firm having installed a 1,000 horse-power twin-cylinder engine of this type directly coupled to an alternating current generator in the power-house of the Ilseder Hutte in Gross-Illsede, near Pein, as well as a 1,000 horse-power twin Oechelhauser engine for operating the rolling mill of the Deutsch-Luxemburgische Bergwerks-u. Hutten-Actien Gesellschaft in Differdingen, together with a 1,500 horse-power twin-blowing engine at Laar, near Ruhrort, at the power plant of the Phoenix Actien Gesellschaft fur Bergbau und Hutten Betrieb.



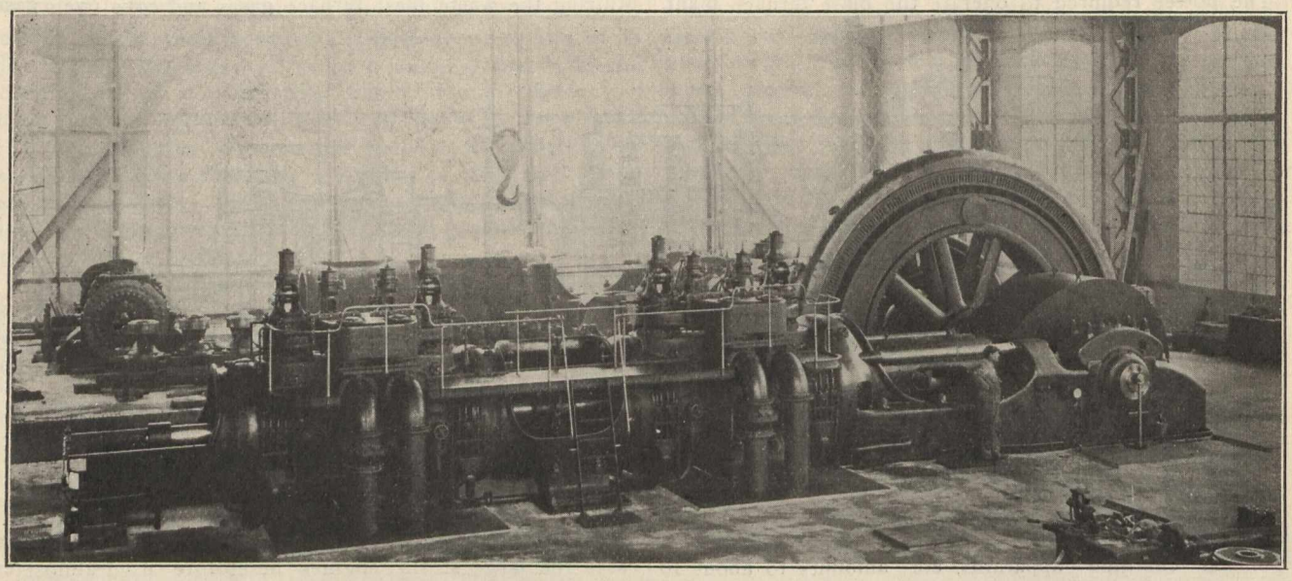
Five Hundred Horse-power Oeschelhoeuser Blowing Gas Engine, Constructed by the Aschersleheuer Maschinenbau Aketien Gesellschaft.

The double-acting two-cycle engines are well represented by the Koerting types, installed largely in German steel plants, as well as in the largest gas engine steel plant power-house in the world at Buffalo at the Lackawanna

Steel Works, where 16 2,000 horse-power blowing gas engines are being erected, and 8 1,000 horse-power gas engines for driving electrical generators of both alternating and direct current type by the De la Vergne Machine Company, of New York, who are constructing these engines of 40,000 horse-power output at their works, after the designs of the German engineers.

The double-acting and single-acting four-cycle German gas engines for blast furnace gases of prominence include the Nürnberg and Augsbery types, as well as those of the Gas-Motoren Fabrik Deutz. The latter German engineers have installed two 1,000 horse-power four-cycle engines and two 600 horse-power machines driving alternating current generators of the three-phase type machines at Düdelingen at the power-house of the Eiden Hutten-Actien-Verein. The alternators were constructed at Baden, Switzerland, by Brown, Boveri and Company, and operate at 132.6 and 140 R.P.M. supplying 164 amperes and 106 amperes at 3,000 volts pressure, the larger alternators having a capacity of 492 kilowatts and the smaller machines an output of 318 kilowatts.

Double-acting Deutz blast furnace gas engines operating blowing engines have recently been installed at the power-house of the Burbacher Hutte, having a capacity of 1,400 horse-power, and at the mining power plant at Hoerde I.W. at the Hoerder Bergwerks und Hutten Verein of 200 and 2,000 horse-power capacity for operating mining ventilators and three-phase alternating current electric generators respectively. The double-acting gas engine is now receiving special attention for this class of service.



Showing One of Two Units, 1800 Horse-power Double-acting Nurnberg Engine at Gilsenkirchen, Operated by the Aktien-Gesellschaft Schalker Gruben-u. Hutten-Verein, and Installed by the Vereinigte Maschinenfabrik Augsburg und Maschinenbaugesellschaft Nurnberg, A.-G. Work, Nurnberg.

TEST OF ELECTRIC RAILWAY APPLIANCES.

A volume that has circulated widely amongst those interested in electric railways, both city and suburban, is the "Report of the Electric Railway Test Commission," which made its investigations under the auspices of the Louisiana Purchase Exposition, the report being made to the president of the Exposition.

Tests were made of almost every type of electric railway equipment then existing. Single truck and double truck city cars were tested in service, as was an inter-urban car. Acceleration tests of these cars were also made, and the many types of brakes were tested on the different cars. A test was also made of a storage battery industrial locomotive. In fact the commission did its work so thoroughly that every conceivable test was made of electric railway equipment.

That section of the report dealing with the test car "Louisiana," a car specially designed for the purpose of determining the effect of the air pressure upon the front, sides, and rear of a car when running at various speeds up to 70 miles per hour. The construction of this car was given every attention, and nothing was left undone that would make it as nearly perfect as possible. The methods of support for the car body were given careful consideration. Various knife-edge supports and ball and roller bearings were considered, and it was finally decided that the double ball bearings manufactured by the Chapman Ball Bearing Company were the most practical for the purpose. The use of this bearing combined a number of important features for safety and convenience, but it is possible that if time had permitted, a spring hinge would have been devised.

The axles were also carried by the Chapman bearing. The success of the experiments depended largely upon the character of the bearings employed, and for this purpose the Chapman was again considered to be the best. Since these bearings played such an important part in this test, a short description will be of interest.

The bearings consist of two rings of large balls carried between cones, one on each side of the hub. The cones are of hard tool steel, and are adjusted by means of screw threads. A peculiar feature of the bearing is that the large balls are spaced by smaller ones, each of which is carried in a small cage. These spacing balls are arranged in such a manner as to avoid slipping between any pair of the adjacent large balls. The hub of the bearing slips loosely over the shaft to be driven, which is free to revolve inside the hub in case the friction in the ball rings becomes excessive for any reason. Dust-proof cases cover the hub at each end.

The air resistance tests of this car showed that the least resistance was offered to the parabolic-wedge vestibule, the pressure being 2.10 pounds per square foot, with the car running at 60 miles per hour. The other types of vestibules met with resistances as shown: Parabola, 2.50 pounds per square foot; standard, 4.53, and flat, 8.20.

Altogether the report of the commission is a most exhaustive one, and the members are to be commended on the admirable way in which the tests were conducted.

MERCHANT MARINE CONSTRUCTION.

The shipbuilding business in Japan according to current reports, has been showing unprecedented activity of late. The Mitsui Bishi and Kawasaki yards are full with orders. Owing to the increase of wages and the advance in the price of imported materials necessary for shipbuilding, however, it is said to have been found cheaper to order a steamer from England than to build in Japan, unless a shipbuilding bounty is granted.

WHAT IS AN ENGINEER-CONSTRUCTOR?*

By George A. Damon, M. W. S. E.†

One prominent element of modern industrial life is **bigness.** We have large business corporations, combined railway systems, extensive manufacturing concerns and comprehensive enterprises in all lines of commercial activity.

Another dominant element is **efficiency,** which may be taken as the key word of modern business life and engineering practice. The constant aim is not cheapness in construction or equipment, but effectiveness, the greatest return for the outlay.

These two elements chiefly have brought about a condition in which we have the necessity for a technical organization ready to produce large results in an effective way. Between the desire for bigness and efficiency and its fulfillment, is the field of operation for the creative and constructive abilities of the Engineer-Constructor.

An Engineer-Constructor is an organization, and not an individual. It makes possible the most effective combination of technical theory with practical experience, and provides for the use of "team work" in connection with the designing and building of properties. Its aim is to attain the greatest economy in effort, time and money,—its province is to "do" things in the most effective way.

In its broadest development such an organization need not be confined to any one class of enterprise. Here is something to be built which requires for its completion a combination of conception, technical knowledge, construction experience, and executive ability. Whatever it is, the Engineer-Constructor should be prepared to carry the proposition through from beginning to end without technical assistance from outside the organization. To be most effective, such an organization should have at its command the technical knowledge and experience of the past; the ability to analyze situations, and discover the truth from conflicting testimony; the imagination to conceive unprecedented results and courage to overcome obstacles; the ambition to improve existing systems, and the honesty to spend money without favor or graft; and finally loyalty to itself and to its client, which will protect in every way the interests of all concerned.

An Engineer-Constructor, therefore, is nothing less than an ideal employee who has the best possible preparation, the widest experience and the natural aptitude to do in a large way the big things which the development of this country is constantly requiring. Such an organization substitutes for the isolated efforts of one or more individuals an effective combination of the aggregate abilities of a number of experts and adds the enthusiasm and inspiration which comes from the contact of fellow-workers.

The expression that "the team plays as one man" suggests the comparison of our ideal Engineer-Constructor organization to a modern football team, and, as this idea grows upon us, we can find considerable instruction and inspiration in the analogy.

If this talk was upon the development of a team for football instead of a technical organization, we would very probably divide our dissertation into such headings as "Individual Requirements," "Training," "Team Play," "Formations," "Generalship."

Our football vocabulary would contain such words as "Purpose," "Perseverance," "Quickness," "Accuracy," "Mental bravery," "Discretion," "Obedience," "Aggressiveness," "Confidence," "Self-control," "Judgment," "Tenacity," "Versatility," "Discipline," "Loyalty," and "Enthusiasm."

A discussion on the principles of developing a team would contain the phrases,—"Fundamentals of the game," "Every man should master details," "Get into the game," "Start together and play together," "Whole heart in every play," "Perfection of team play," "Unified purpose," "Combined efforts," "Theory wins games only when put into practice," "Play hard," and "Hurry up."

All the things that might be said in regard to getting together, and developing a winning football team could be applied equally well to the building up of an organization to do the work of an Engineer-Constructor. To carry the illustration further, let us line up the candidates for this new kind of team,—the more material to select from the better,—we will always have use for substitutes.

We need a,—

Civil Engineer,
Electrical Engineer,
Mechanical Engineer,
Structural Engineer,
Sanitary Engineer,
Chemical Engineer,
Gas Engineer,
Fire Protection Engineer,
Hydraulic Engineer,
Mining Engineer,
Architect,
Industrial Expert,
Statistician
Purchasing Agent,
Construction Superintendent,
Operating Engineer,
Accountant.

An Engineer-Constructor is an organization in which a number of these candidates are fitted together as a mechanic would build a machine, and the efficiency of such an organization for the purpose for which it is created depends upon, first,—the perfection of its individual parts; second,—upon the skill with which these parts have been brought together; and, third,—upon the absence of any unnecessary friction during operation.

Such an organization should not be the maker or manufacturer of any equipment, nor be connected with the exploitation of any system of apparatus, nor interested in the introduction of any patented devices. In its highest stage of development it will not be connected except in a technical way with the financial interests which control the enterprise.

Carrying our analogy even farther, let us look at some of the plays with which the candidates will become familiar in some of the big games which they must be prepared to play.

The carrying out of every big enterprise will entail nearly all of the following duties:—

Investigations and Reconnaisance,
Preparation of Preliminary Reports,
Estimates of Costs,
Estimates of Probable Earnings and Operating Expenses,
Surveys,
Preparation of Plans and Specifications,
Getting Proposals and Purchasing,
Letting Contracts,
Field Engineering,
Construction and Erection.
Inspection,
Preparation of Progress Reports,
Record of Costs,
Tests,
Operation,
Final Reports and Statistics,
Accounting.

It is important to gain as much ground as possible on every play. In playing an entire game from start to finish, different men will have the ball in nearly every play, but the precision of the team work should be so perfected that every man will be in every play. To assist is fully as important as actually carrying the ball. Look over the various situa-

*Paper presented before the Electrical Section of the Western Society of Engineers, November 16th, 1906.

†Managing Engineer of the Arnold Company, Chicago, Ill.

tions which this Engineer-Constructor team which we are developing is sure to face,—is there any detail which the candidate for responsibility can afford to ignore? Is it not better to have an organization of trained men prepared to help each other do these various things, rather than depend upon unsupported individual effort?

Granted that such an organization of technically trained men can be brought together, what are some of the things which they may be called upon to do? A few of the things requiring such ability and experience in design and construction which first occur to us are as follows:—

Complete Steam Railroads,
Complete Electric Railways,
Electrification of Steam Roads,
Hydro-Electric Plants,
Transmission Systems,
Power Plants,
Gas Works,
Electric Lighting Systems,
Industrial Establishments,
Buildings for all Purposes,
Public Service Works.

In so far as an organization is prepared to effectively carry out any of these enterprises just that far will it reach its highest development.

To show the possibilities of such an organization, let us pick out a team for the building of some large proposition. Let us take for instance, the design and construction of a steam railroad locomotive repair shop, involving the expenditure of from two to three million dollars.

In deciding on our men, we will make a study of the qualifications of each one, and at the same time we must have a clear conception of the work each one must be familiar with in order that there be no weak spots in our line, or break in the organization. The selection of men with their chief duties will be as follows:—

Industrial Expert:—
Designing Layout of Shops.
Planning Method of Handling Work.
Arrangement of Tool and Transportation Equipment.

Electrical Engineer:—
Providing Power and Lighting Equipment.
Laying Out Transmission Systems.
Planning Telephone and Signal Systems.

Mechanical Engineer:—
Design of Power Plant.
Plan of Heating and Ventilating.
Laying Our Air, Gas and Steam Systems.

Structural Engineer:—
Building Foundations.
Designing Steel Structures.
In Charge of Reinforced Concrete Construction.

Architect:—
Designing Building Superstructure.
Choice of Fixtures.
Laying Out Landscape Work.

Civil Engineer:—
Directing Grading.
Testing of Soil.
Construction of Track.

Sanitary Engineer:—
Design of Sewage System.
Construction of Water Works.
Choice of Plumbing.

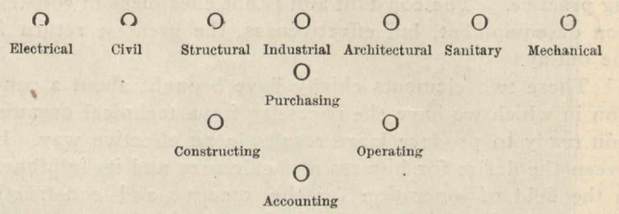
Purchasing Agent:—
Selecting Markets for Material.
Checking Bills of Material.
Arranging for Delivery of Material.

Constructing Superintendent:—
Organization of Construction Force.
Consideration of Time Element in Construction.
Settling Labor Difficulties Arising in Connection with Construction Work.

Operating Engineer:—
Consideration of Economies in Operation.
Securing Reliability in Operation.
Insuring Effectiveness in Operation.

Accounting Department:—
Keeping Pay Rolls.
Making Record of Costs.
Preparing Progress Reports.

The line-up of the team may be shown by Fig. 1. Here are eleven men,—each one selected for his particular ability to solve the problems suited to his individual training and experience. Each man has won his position as the result of a gradual growth which has demonstrated his reliability and resourcefulness. Many of these men have played this game before, and together, and are always eager for a proposition which will tax their strength and skill.



Line Up of The Engineer-Constructor Team For The Building of a Railroad Repair Shop. Fig. 1.

Let us watch the play. First will come a number of preliminary studies, showing the proposed sizes, designs and relative arrangements of the buildings. There will next be forthcoming a carefully prepared report, showing the advantage of the finally selected arrangement, and the suggested construction of each of the buildings, together with a description of the equipment required. An important part of this preliminary report is an approximate estimate of cost, based upon a careful consideration of all the items involved in the construction.

With the general layout and the preliminary report and estimate approved, the next move is to prepare the plans and specifications. To indicate the scope of this work, the following classification is shown, the numbers being the key which is placed in each drawing, specification, data sheet, report, or letter which may be originated as the work progresses.

The entire range of work undertaken by the company, and all incidental construction connected therewith, is grouped under the following general heads and assigned the range of numbers indicated:—

Divisions of Classification.

Division.	General Subject.
—000—	Organization and Engineering.
—100—	Buildings and Building Material.
—200—	Hydraulic Construction and Equipment.
—300—	Bridges and Tunnels.
—400—	Tracks and Roadway.
—500—	Electric Transmission Lines.
—600—	General Equipment.
—700—	Power Plant Equipment.
—800—	Tools and Instruments.
—900—	Transportation Equipment.

Each division above is subdivided so as to cover all possible classes of construction that may arise. Thus, for instance, in the 100 to 200 series it is possible to have one hundred subdivisions each representing a different class of work. Each of these may, of course, again be divided to any extent desired by using decimals. Each piece of work undertaken is given a contract number which is prefixed to the general classification number and thus the identification of any letters, drawings, or data sheets is made easy and certain. As an illustration, suppose the number 109 is assigned to roofing. This number would be used in roofing specifications and contracts in all work done. Its particular application to roofing done under contract 74 would be indicated by the number 74,109. As a further subdivision 109.1 might stand for slate roofing and 109.2 for composition roofing. The number 74109.1 on a drawing would then indicate its relation to slate roofing for contract 74. To locate the building upon which the roofing is placed a letter is

placed after the number—a letter in all cases locating the work while the number indicates its character.

As an illustration of the above, we may note the following, taken from a classification in use at the present time:

Parts of the Work.

A—Yard.
B—Power House.
C—Store House.
D—Oil House.
E—Office Building.
F—Locomotive Shop.
G—Forge Shop.
H—Iron Foundry.
I—Pattern Shop.
J—Frog Shop.
K—Car Machine Shop.
L—Truck Shop.

74101—Preparation of Site.
74102—Excavation and Fill.
74103—Piling.
74104—Foundations.
74105—Superstructure Masonry.
74106—Structural Steel and Iron Work.
74107—Carpenter Work.
74108—Mill Work.
74109—Roofing.
74110—Sheet Metal Work.
74111—Plastering.
74112—Painting and Glazing.

The plans should preferably be drawn upon one size of paper and every drawing should be numbered to correspond to the classification. A border and a standard title printed by a draughting room outfit gives a finished appearance to each drawing.

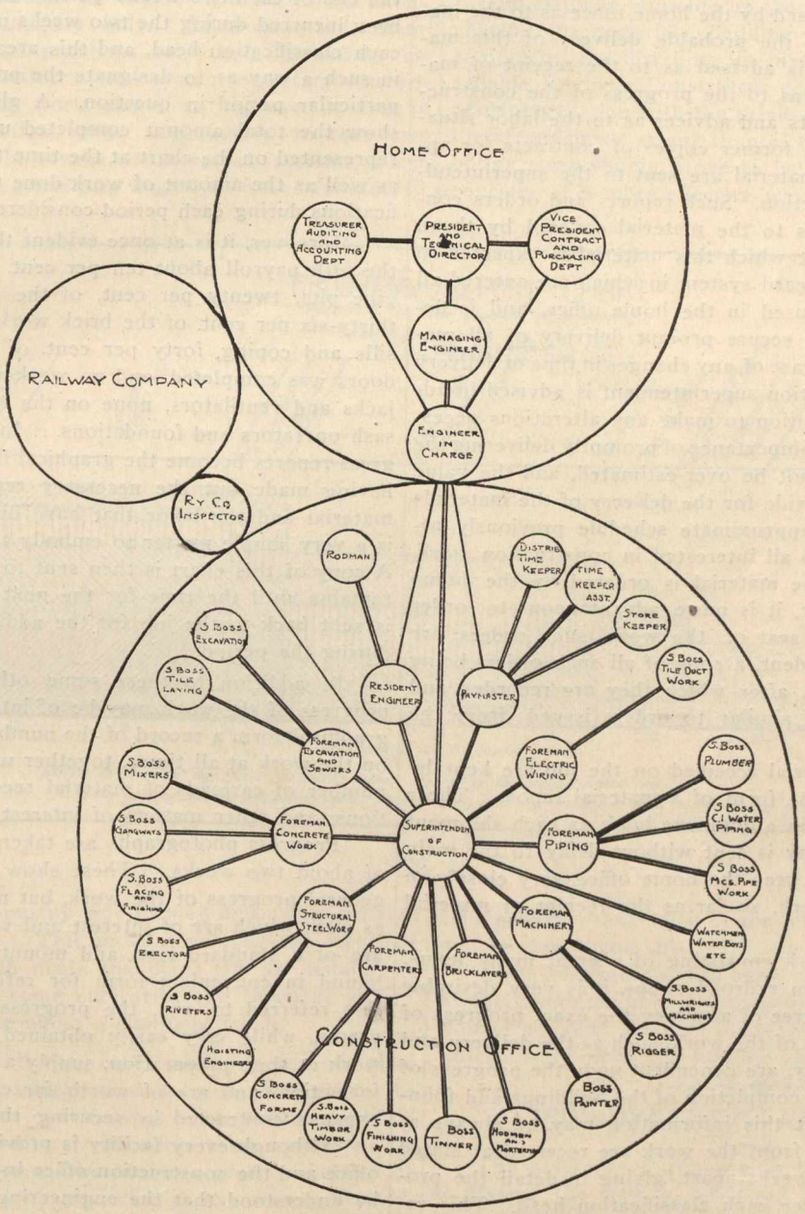


Diagram of Construction Organization.
Fig. 2.

M—Coach and Paint Shop.
N—Freight Car Shop.
O—Planing Mill.
P—Dry Lumber Shed.
Q—Dry Kiln.
R—Scrap Platforms, Sheds, etc.
S—Turntables.
T—Yard Crane.
U—Pipe Tunnel.

Detail Classification.

The detail is given for only one division, which is sufficient for illustration.

74100—Building Structures.

Specifications can now be printed very quickly, and when at least twenty copies are required they can be produced in this way as cheaply as by carbon copies, or the better method of blue-printing from a typewritten record.

In the office the same system of classification is used for data and estimates and all bills of material. There is also published in blue print form a literature bulletin which contains references to articles in all the current technical papers, which may be of interest to the officers and engineers of the company, these references being classified according to the same system. A well-equipped library containing bound volumes of most of the technical journals, proceedings of the engineering societies, government and special reports of all

kinds, makes this system effective in results and efficient in its operation.

In purchasing, the Engineer-Constructor should find some advantage over an occasional buyer. He is in the market constantly, is favorably known by the manufacturers of standard equipment, and buys apparatus delivered f.o.b. cars, doing all erection work as far as possible with his own experts, and calling on the factory for assistance only when necessary.

There should be the greatest unity between the engineering, the purchasing and the construction department. The plan of organization to secure the results is shown by the diagram, Fig. 2. It is always better to have the construction superintendent in the office while preliminary decisions are being made and bills of matetrial are being prepared.

Throughout the entire progress of the work, systems are in use to keep all concerned informed as to each move. The construction office is advised by the home office as to the material ordered and as to the probable delivery of this material. The home office is advised as to the receipt of material on the job as well as to the progress of the construction work, and any reports and advices as to the labor situation. To accomplish the former copies of contracts for apparatus and orders for material are sent to the superintendent in charge of construction. Such reports and orders contain exact information as to the material covered by them, as well as to the time at which this material is expected to arrive on the work. A card system in which are entered all orders and contracts is used in the home office, and is designed to follow up and secure prompt delivery of all material and apparatus. In case of any changes in time of delivery of material, the construction superintendent is advised in advance, and is thus in position to make any alterations necessary in his program. The importance of promptly delivering the material on the job cannot be over-estimated, and the value of a system that will provide for the delivery of the materials in accordance with an approximate schedule previously arranged for will appeal to all interested in construction work.

Practically all of the material is ordered by the home office. In case, however, it is more advantageous to order small quantities at the seat of the work, such orders are issued by the superintendent, a copy of all such orders being sent to the home office, after which they are recorded and handled in all respects similar to orders issued from the office.

Records of all material received on the job are kept by the superintendent in the form of a material report. These reports are written out in a duplicate book as each shipment is received, and one copy is sent without delay to the main office. This serves to keep the home office very closely in touch with the field work, so far as the receipt of material is concerned.

In construction work consisting of a great many items, such as will be found in railroad shops, it is very desirable to know with a fair degree of accuracy the exact progress of the work. Certain lines of the work, such as the delivery and installation of machinery, are dependent upon the progress of other work, such as the completion of the buildings and foundations. In order that this information may be always at hand, progress reports from the work are received at stated intervals, usually two weeks apart, giving in detail the progress of the work under each classification head. This information is kept in form for convenient reference, and is useful in a variety of ways. Not only do these reports keep the engineering force in touch with the progress of the work, making it possible to more efficiently insure the work coming in proper sequence, but they also provide the information necessary to make decisions as to changes in detail, in case such are found necessary after the work has been begun. These progress reports, together with a record of moneys expended for material and labor at any date, give timely information as to the actual cost of the work as compared to the estimated cost. As such reports are made on the work under each classification heading, any variation of the cost from the estimate is at once detected. This is of importance to the constructor who proposes to complete a certain improvement within a definite estimated cost, and to the client's official who may be charged with the responsibility of protecting a definite appropriation.

Wherever it is possible, curves or diagrams are used to represent the condition of affairs of which record is to be kept. A chart showing the progress of the work on building construction is easily made, and shows very clearly at a glance the exact condition of the work at any time. Such a chart is shown in Fig. 3, which indicates the progress of the work on one of the buildings at the time of completion of the fifth payroll. On this chart the base represents the total estimated cost, and is divided into the various classifications covering the cost of this particular building. In this case these classifications cover excavation and fill (about 2-3 per cent. of the total cost), concrete footings and piers (about 6 2-3 per cent. of the total cost), while the other divisions, such as engine pits, underground heating ducts, concrete superstructure, and so on make up the total cost of the building. At the end of each two-weeks' period, the total expense that has been incurred during the two weeks previous is plotted under each classification head, and this area on the chart indicated in such a way as to designate the progress made during the particular period in question. A glance at the chart will show the total amount completed under each classification represented on the chart at the time the last entry was made, as well as the amount of work done under the various classifications during each period considered.

Moreover, it is at once evident that, during the period of the fifth payroll about ten per cent. of the work on the engine pits, twenty per cent. of the concrete superstructure, thirty-six per cent. of the brick work, fifteen per cent. of the sills and coping, forty per cent. of the windows and small doors was completed, and no work was done on the smoke-jacks and ventilators, none on the roofing, and none on the sash operators and foundations. In other words, these progress reports become the graphical history of the job. After having made out the necessary reports covering both the material and the labor that have been used on the work, it is a very simple matter to embody these results in the chart A copy of this chart is then sent to the main office where it remains until the time for the next report, at which time it is sent back to the job for the additions that have occurred during the period.

In addition to these some other curves, showing the progress of the work may be of interest. These contain in graphical form a record of the number of workmen employed on the work at all times, together with information as to the number of carloads of material received, the weather conditions, and other matters of interest.

Progress photographs are taken of the work at intervals of about two weeks. These show at a glance not only the general progress of the work, but many construction details, as well, which are of interest and value. These photographs are of a standard size, and mounted on cloth, so as to be bound in convenient form for reference. All the reports just referred to, viz., the progress reports, charts and diagrams, while very easily obtained, and requiring but little work in their preparation, supply a great deal of valuable information, and are of worth far exceeding the trouble and expense contracted in securing them.

Although every facility is provided for keeping the main office and the construction office in close touch, it should not be understood that the engineering is done at arm's length, and that all plans and specifications are devised and completed by an engineering force in the office to be sent down to the construction superintendent on the job for his execution. A competent engineer is in charge of all construction work, and spends a certain amount of time in the field, thus putting him in close touch with the situation, and enabling him to more efficiently direct the detailed engineering work that is done in the main office.

It would be a big mistake to think that such an organization as we are outlining could be got together and perfected in its work in a short time. A winning team is not made in a week, a month, or even a year. It takes time to find the men, to break in raw material, to perfect the plays, to develop a system, and to create a loyalty both inside and outside the team. In the case of our Engineer-Constructor

parallel it will probably take years, and it is evidently for this reason that this very inviting field is occupied by so few organizations which are really prepared to do the work justice. Our football players have learned the benefits of concentrated co-operative efforts when applied to their sport much sooner and better than have technical teachers and graduates recognized the same truths as applied to our life work, and yet the advancement of technical progress is certainly more important than the perfection of the game of football. The technical student of to-day is to be congratulated upon having before him such a splendid opportunity in a field which has not been worked harder than that occupied by the Engineer-Constructor.

It will be instructive to study the development of at least one company which is now prepared to play at this new game of Engineer-Constructor.

Ten years ago the president of this company was a consulting electrical engineer,—an expert on electrical questions, and in a consulting capacity only. Then came the natural addition of mechanical problems,—still in a consulting capacity. The introduction of the system of rotary converters for electric railway work, and of an improved system of power plant construction, made it necessary to take two contracts in which the results of these two systems, which were advised by the consulting engineer, were guaranteed. Thus a contracting company was formed and a construction department organized. This move developed the fact that the same brains which made the plans for an installation could be mixed with some enterprise and business ability, and thus actually bring about a complete result.

This worked so well that other contracts for complete electric systems were sought and secured,—sometimes as engineers, sometimes as constructors, occasionally as both. Civil, structural, architectural, industrial, and hydro-electric departments were added as the business grew. Systems of carrying on the work were perfected as experience dictated, and weak parts were made stronger. To-day this company has on its payrolls a technical force of over eighty men, and often employs on its construction enterprises thousands of skilled mechanics, experienced foremen, and unskilled laborers.

Most of the work of this company is done on the basis of "cost plus a percentage," that is, the work is done at actual cost, and then the Engineer-Constructor gets a percentage fee for his services. By such an arrangement the client or purchaser is relieved of the necessity of organizing a technical force of his own, or of employing a number of individual specialists. If the actual construction work is turned over to the Engineer-Constructor, then the client is relieved of the inconvenience of obtaining proposals and awarding contracts to a large number of separate contractors, with the attendant delays, conflicts and "extras," which even the closest supervision will hardly avoid.

The difference between the "cost plus a **percentage**" and the "cost plus a **fixed sum**" plans is not generally understood. If an Engineer-Constructor is thoroughly trained in drawing plans, has sufficient actual experience to make a reliable estimate, is absolutely honest in all things, and has complete control of a competent construction organization, then the "cost plus a **percentage**" arrangement is the better; but if the work is planned by an engineer and architect, and the actual building work is turned over to a separate construction organization, thus maintaining the old relationship of engineer and contractor, then the "cost plus a **fixed sum**" plan, no doubt, has advantages. The **"percentage"** plans express a shade more of confidence between the client and the builder than the **"fixed sum"** basis.

If the duties of making a preliminary report, preparing a careful estimate, drawing up the plans and specifications, purchasing the materials, building the structures, erecting the equipment, and installing the machinery is turned over to one reliable Engineer-Constructor organization on a "cost plus a **percentage"** plan with the privilege to the client of cancelling the arrangement at any time, if the progress, quality, or cost of the work should prove to be unsatisfactory, it is hard to conceive of a more effective way of getting results, and it is very probable that much of the important work of the future will be done upon this basis.

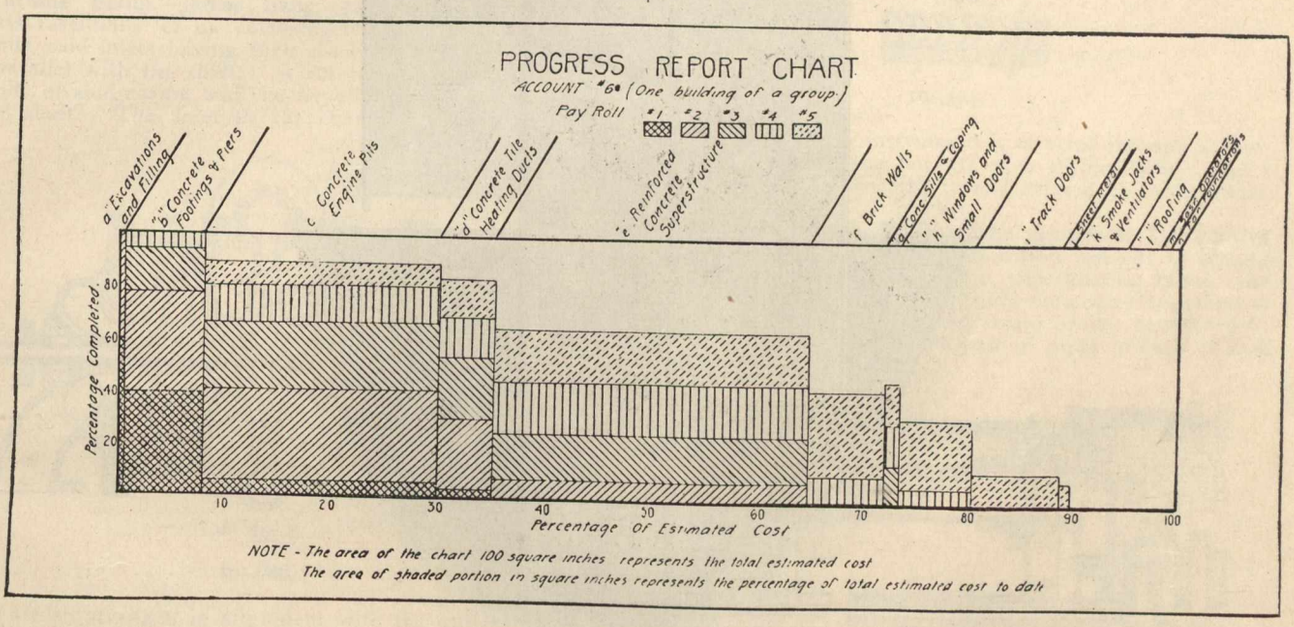


Fig. 3.

Such a business as has been outlined can only be built up by the demonstration of unquestioned ability, and the possession of not only absolute honesty, but also of those qualities which insure what has become known as the "square deal."

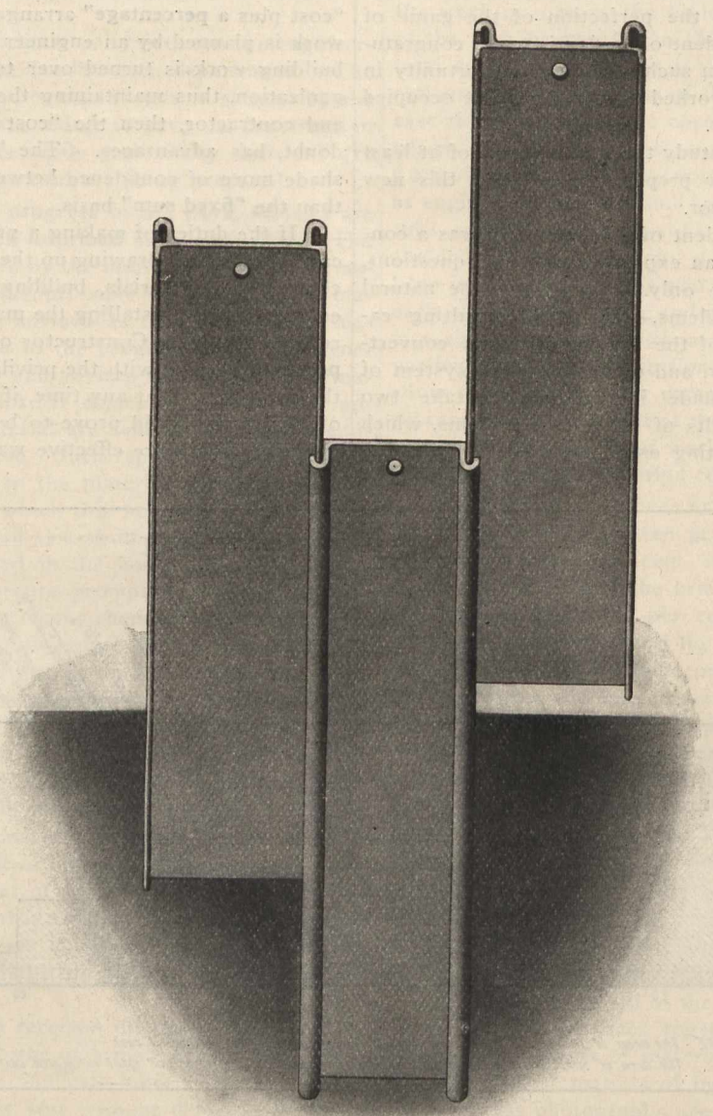
IRON ORE IN THE UNITED STATES.

The reserves of iron ore in the Lake Superior district, at present the leading American producer, are estimated at from 1,500,000,000 to 2,000,000,000 tons, of which the United States Steel Corporation is commonly supposed to control over three-fourths. This supply is being drawn to meet a constantly increasing annual demand, and it is conceded that before 1915 the district will probably be called upon to ship over 50,000,000 tons of ore a year. At such a rate the Lake Superior ores can hardly be expected to last beyond the year 1950. But there are enormous reserves in the South; these are estimated at a total, for the red and brown ores of the four States—Alabama, Georgia, Tennessee and Virginia—of over 3,000,000,000 tons. If to this are added ores occurring at deeper levels in the States named, the red and brown ores of Maryland, West Virginia, and Kentucky, and the magnetic ores of the other Southern States, it is assumed that the total American ore reserve will amount to very nearly 10,000,000,000 tons.

STEEL PILING.

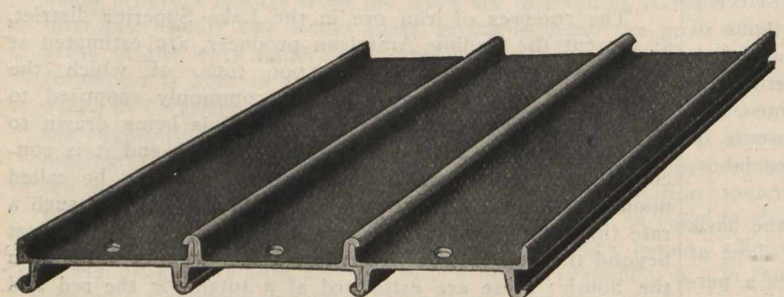
The steel piling herewith illustrated is manufactured by the Vanderkloot Steel Piling Company, and the illustrations acompanying this article are reproduced through the courtesy of that company.

Figure 1 shows a section of the piling which has now been successfully rolled, and which is being placed on the market. From the illustrations the Vanderkloot system will be thoroughly understood. This piling is rolled integral; there are no rivets or accessory parts. The double locking and double ribbed single steel piling section comes from the special rolls complete and ready to drive. The double flanges give the completed wall great strength, and the double locking insures to it great rigidity. This double locking feature is found in no other piling, and solves one of the great difficulties experienced in sheet pile driving. It gives a straight rigid wall, and as each pile is driven it is held accurately in place. The weight of the piling is 35 lbs. to the square foot for ⅜ inch webb, and 40 lbs. for ½ inch webb, giving a saving of about 20 per cent. in tonnage over piling made from stock material. It is quicksand proof and practically water-tight. In the section the metal is distributed where needed, and in this way the greatest strength is given without any unnecessary weight.

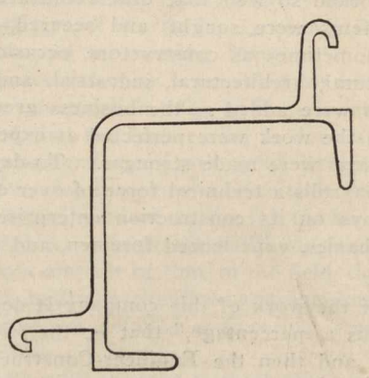


Vanderkloot Piling Partially Locked.

Eminent engineers say that the Vanderkloot Piling is an ideal one, and that it covers every defect developed during the time steel piling has been in use.



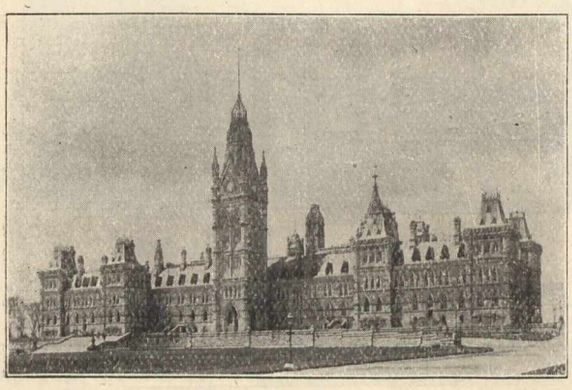
Vanderkloot Piling Locked.



Bent for Corner Turning.

Innisfail is having an 8-roomed brick school built by the Brandon Construction Company. Architect, Horwood of Winnipeg; cost, $26,000.

INTERNATIONAL PATENT RECORD

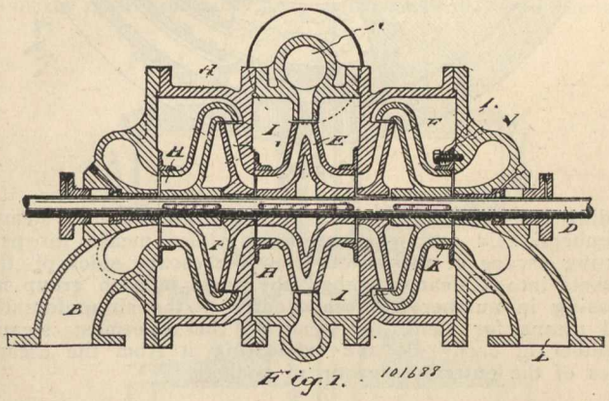


Dominion Houses of Parliament.

CANADIAN PATENTS.

Specially compiled by Messrs. Fetherstonhaugh, Dennison and Blackmore Patent Attorneys Star Bldg., 18 King St. W., Toronto; Montreal and Ottawa.

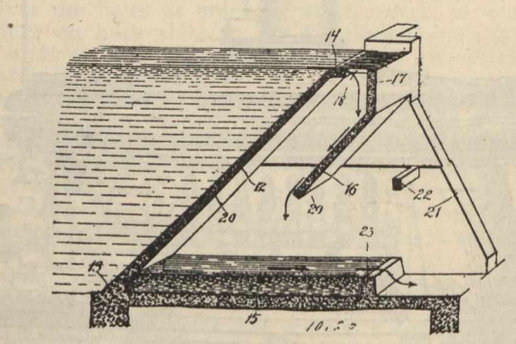
Turbine Pump.—James Lang.—101,688.—The invention consists essentially of an enclosing casing having inlets at the ends, said inlets having their discharge openings preferably parallel with the shaft. A rotor shaft is journalled in the ends of said casing and the impeller wheels are secured to said shaft. The inlet to the channels in the impeller



101,688.

wheels are so arranged in alignment with the outlets of the main inlets and extend radially outward, and are directly inward at the outer ends. Inwardly extending radial channels convey the fluid from the discharge end of the channels of the impeller wheels to a central impeller having double inlets extending radially outward and merging at the outer extremity where they discharge to the discharge chamber in the casing.

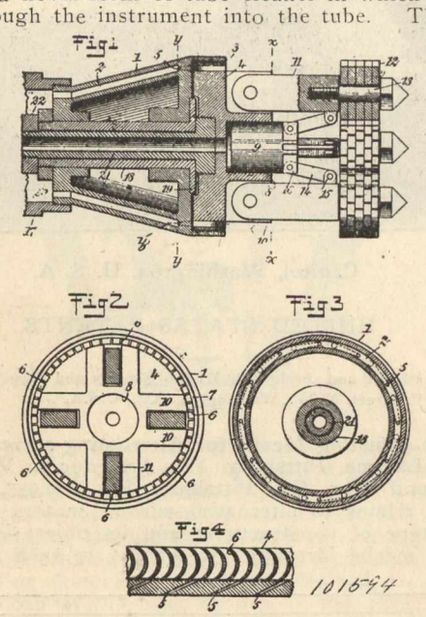
Dam.—W. L. Church.—101,258.—The above invention consists of a dam having a front, buttress and a deck at the top thereof, said deck having an opening through the top and



101,258.

a grating covering the same. The heel wall extends downwardly and inwardly below said opening in said deck so that the water flowing through will strike said inward incline and be directed backward and fall on a wear resisting bed from where it flows on down stream.

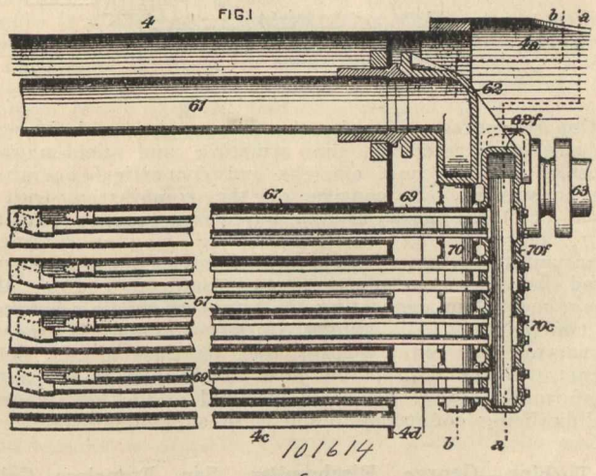
Tube Cleaner.—Thomas Andrews.—101,594.—The above invention is a novel form of tube cleaner in which steam is injected through the instrument into the tube. The steam



101,594.

in passage through the instrument is directed through a number of ports against the buckets of a turbine wheel and a rotor scraping tool is secured to and rotated by said turbine.

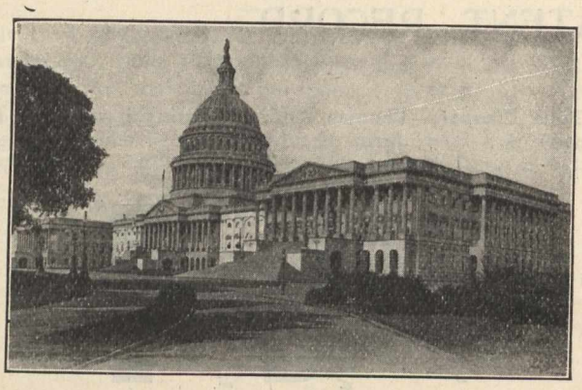
Superheater Steam Boiler.—The American Locomotive Company.—101,614.—The above invention consists in setting pairs of superheater pipes in the superheating tubes, the members of each of said parts being connected together at the rear end, a vertical saturated steam header connected to the forward end of one of each pair of pipes in each of said



101,614.

tubes, a superheated steam header separate from said saturated steam header connected to the forward end of the other pairs of superheater pipes. A T-head connection having a communicating passage from the supply compartment in communication with the saturated steam header to the delivery compartment from the superheaded steam header and a wall partially interposed between said chambers.

At the annual meeting of the stockholders of the Joseph Dixon Crucible Company the old board, consisting of Edward F. C. Young, John A. Walker, Edward L. Young, William Murray, George T. Smith, Joseph D. Bedle and George E. Long, was unanimously re-elected. The board of directors re-elected the former officers, namely, E. F. C. Young, president; John A. Walker, vice-president and treasurer; George E. Long, secretary. Judge Joseph D. Bedle was also re-elected as counsel. The stockholders present expressed themselves as thoroughly satisfied with the management of the company by its officers. Of the total number, 7,345 shares, there were represented 6,460 shares.

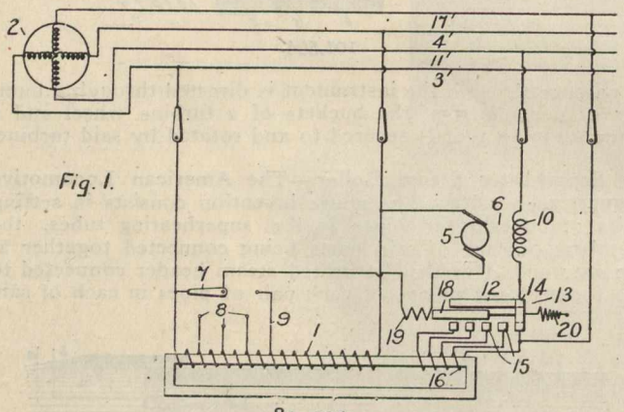


Capitol, Washington, U. S. A.

UNITED STATES PATENTS.

Specially selected and abridged by Messrs Siggers and Siggers, Patent Attorneys, 918 F. Street, N. W., Washington, D.C., U.S.A.

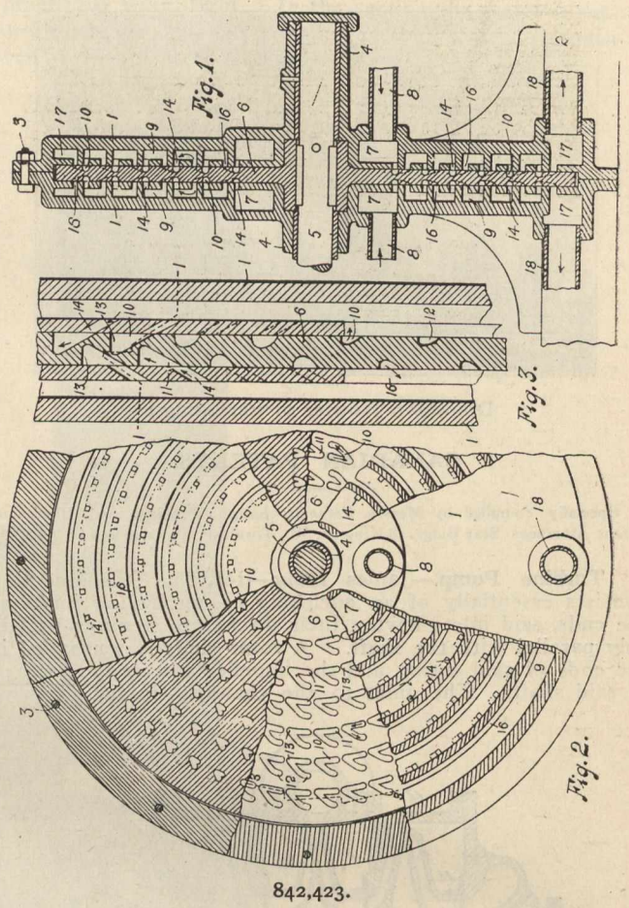
Phase-adjusting Means for Alternating-current Motors.—Benj. C. Lamme, Pittsburg, Pa., Assignor to Westinghouse Electric and Mfg. Co., Pittsburg, Pa.—839,935, 1907.—This invention relates to alternating-current motors of the commutator type of construction; and its object is to provide improved means for supplying energy to such motors from



839,935.

multiphase sources, whereby the proper phase relations of the currents traversing the armature and field-magnet windings for the most efficient and economical operation may be secured. It consists of the combination with a source of three-phase alternating-current energy and an electric motor having armature and field-magnet windings, of an autotransformer-winding having its terminals connected between two of the supply-conductors from the source, means for connecting the armature-winding between any two points in said autotransformer-winding, and means for varying the connection of one terminal of the field-magnet winding with points near the middle of the autotransformer-winding, the other terminal of the field-magnet winding being connected to the third supply-conductor.

Turbine.—George Rischmuller, San Francisco, Cal.—842,423. 1907.—This invention relates to improvements in turbines, the object of this invention being, first, to provide a turbine which can be constructed at a comparatively small cost, requiring very little machining or fitting of parts; second, to provide one which will be as small and compact as possible for a given development of power, and for this purpose to so construct it that at no time shall there be any dead steam contained in any of the recesses of the turbines not actually doing work in propelling the turbine; third, to provide one in which the recesses for admitting the steam shall vary but slightly in size, and shall be distributed as evenly as possible over the surfaces of the moving member, and yet at the same time allow for the expansion of the steam in passing from one series of recesses to another; fourth, to provide one in which the pressure on both sides of the movable member shall be evenly balanced, thereby avoiding any vibration or undue friction; fifth, to provide a construction in which the steam shall enter and leave the recesses in the most effective manner for imparting its momentum to the movable member. It consists of a shaft, a disk secured on said shaft, and rotating between said sections, and having on each side a concentric series of annular groups of pockets, each pocket having an impact inner side, each pocket opening its whole length into the side of the runner, the inner side being concentric to the runner and the outer side oblique thereto, and an escape outer side, the adjacent casing-section having a corresponding concentric series of annular steam-chambers, a concentric series of annular groups of ducts registering with the inner sides of pockets of the respective groups, and

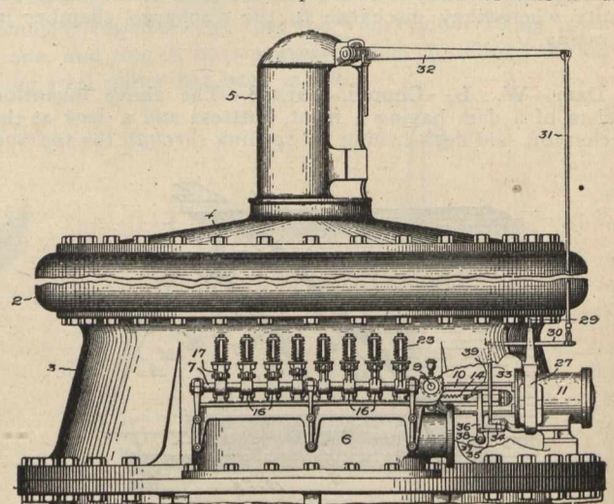


842,423.

leading from the outermost portions of the annular steam-chambers, said casing-section having also means for permitting escape of the steam from the escape sides of the pockets into a steam-chamber, the ducts in each group increasing in number from the centre to the circumference, and means for admitting steam to the innermost steam-chamber at each side and exhausting it from the escape sides of the outermost group of pockets.

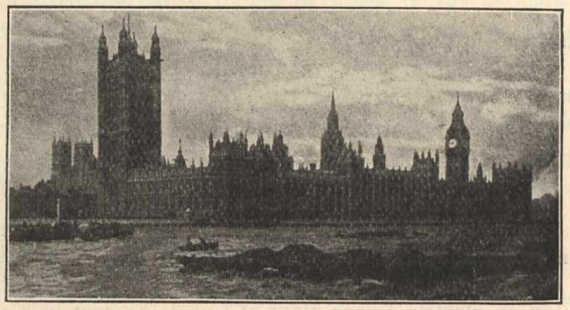
Governing Mechanism for Turbines—Oscar Junggren, Schenectady, N.Y.—848,106.—1907.—This invention relates to mechanism for governing the speed of steam-turbines; and its object is to modify existing structures with a view to securing greater compactness and readiness of access and also to lessen the weight.

A further object is to correct a tendency to "hunt," which has been observed in prior structures of this kind.



848,106.

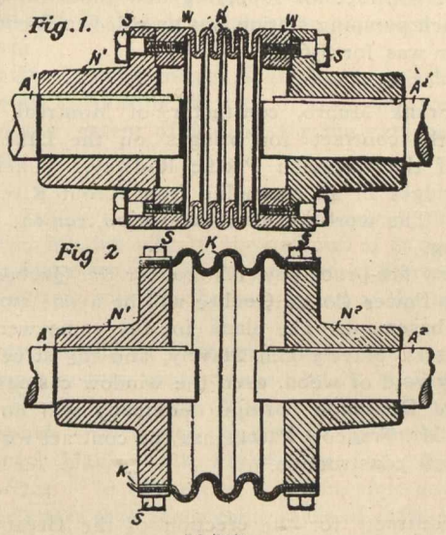
It consists of mechanically-operated nozzle-valves, of a liquid-pressure motor for operating them, means for causing said motor to operate by an intermittent motion instead of continuously, comprising a valve offering a predetermined resistance to movement, and an air-chamber.



British Houses of Parliament.

GREAT BRITAIN.

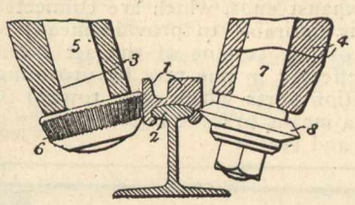
Shaft-Couplings.—Aktiengesellschaft Brown, Boveri, and Campagnie, Baden, Switzerland.—12,707.—1906.—This invention relates to improvements in flexible couplings for co-axial shafts. In such couplings it is necessary, and known, to provide a tubular flexible member or members in the coupling, so as to allow for inaccuracies in alignment, whipping, and the like. The object of this invention is to provide an improved form of tubular flexible connecting member in such couplings, which connecting member shall combine strength with elasticity. The invention consists in a coupling comprising as an essential a flexible tubular connecting member in the form of a hollow or tubular element of corrugated, grooved, or like surface, the corrugated or like hollow or tubular member being built up of parts, or arranged in one piece. According to the form shown in Fig. 1, A^1, A^2 are the ends of the shafts to be coupled up, and N^1, N^2 the coupling flanges keyed to the shafts. The hollow coupling consists of a preferably cylindrical body K. In the con-



12,707.

struction shown in Fig. 1 it consists of a steel cylinder having a corrugated or undulated shape produced by turning grooves from the material alternately from its interior and exterior. The corrugations may either have rounded-off edges, as shown in Fig. 1, or square edges. There is an annular enlargement W on both the faces of the cylinder which receives the bolts or studs S, which serve to connect the cylinder on both sides to the coupling flanges N^1 and N^2. Fig. 2 shows a modification in which the cylindrical body K is formed from corrugated steel sheet. The sheet for this purpose may be rolled in several layers on a cylinder, and fastened at both sides to the coupling flanges N^1 and N^2 by means of studs S, which in this case pass rapidly into the flange. In order to avoid any friction between the individual layers of the metal sheet, the layers may be kept separated from each other by the insertion of an intermediate layer at the points where it is fastened to the flanges at the ends.

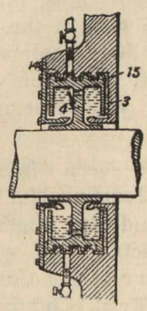
Compound Tramway Rails.—E. Rhodes and the Romapac Tramway Company, Limited, Leeds.—3,270.—1906.—This invention has reference to the appliance for fixing the wearing portions of compound tramway rails on to their base portions described in Specification No. 9,175, of 1902, and also to the appliance for cutting off the wearing portions of compound tramway rails described in the Specification of Patent No. 9,176, of 1902; the object of the present invention being to combine the two arrangements in one machine, or, in other words, so to arrange the machine hitherto employed for fixing or rolling on the upper portions of compound tramway rails that the same machine may be readily transformed and employed for cutting off the upper portions of compound tramway rails, and vice versa. To this end an appliance of similar construction to that described in Specification of Patent No. 9,175, of 1902, is employed. The said appliance consists of a carrying frame mounted on a guide-roller adapted to run in contact with the upper surface of the top portion of the rail, said frame being provided with two oppositely situated arms which are pivoted at their upper ends, each of which pivoted arms is provided with bearings carrying a shaft, while to the lower end of each shaft is attached a roller, which is serrated or roughened on its periphery, the upper ends of the shafts carrying the serrated rollers being provided with suitable gear-wheels, which are driven by in-



3,270.

termediate gearing from the driving-shaft of an engine or motor, while the pivoted arms themselves are connected together by means of toggle-levers attached to a central nut which is actuated by means of a screw. On the engine being put in motion, the serrated rollers are caused to revolve against the depending flanges of the top rail, whereby the said depending flanges are bent inwards and pressed firmly round the head of the base portion of the rail. In order to adapt this machine for cutting-off as well as for rolling-on, the shafts carrying the serrated pressure-rollers are so mounted that they may be removed from their carrying frame at will, while, in combination with the said frame, a shaft carrying a serrated guide-roller is mounted on one side, and on the opposite side of the said frame a second shaft carrying a steel disc-cutter in lieu of the two shafts with their serrated rollers. In this way the appliance hitherto employed for rolling-on is rendered equally applicable for cutting-off, the transforming of the machine by simply removing the two shafts carrying the pressure rollers employed for rolling-on and inserting the two shafts carrying the guide-roller and the disc-cutter employed for cutting-off and vice versa, being easily and quickly performed. The figure is a sectional elevation of a compound tramway-rail and the lower portion of the rolling-on machine arranged as a cutting-off appliance, in which the rail consists of a wearing portion and a base portion 2, while 3, 4 represent the bottom portions of the two oppositely-situated arms of the carrying frame of the rolling-on machine. The pivoted arm 3 is provided with a shaft 5 carrying a serrated guide-roller 6, while the pivoted arm 4 is provided with a shaft 7 carrying a steel disc-cutter 8, in lieu of the two shafts and the serrated pressure-rollers of the rolling-on machine.

Packing.—J. Wilkinson, Providence, U.S.A.—25,492.—1906.—This invention relates to liquid packing means for the shafts of rotary motors, such as turbines. The invention consists in a shaft-packing having no mechanical contacts or close clearances between stationary and rotating parts, a liquid being used to seal the joint. In the design illustrated, an element 4, rotatable with the shaft, is disposed within an annular chamber 3, supplied with a body of sealing liquid, and exposed at opposite ends to the different pressures be-



25,492.

tween which the packing takes effect. The rotating element rotates in close proximity to the inner circumferential wall of the chamber 3, leaving a slight radial clearance between said parts for the flow in an axial direction of the circulating body of liquid in the chamber, this flow being induced by the difference in pressures acting upon the liquid, and maintained by the pumping action of the rotating element, the volume flowing being regulated by the cross-sectional area of the circulation openings in the element, or by the

cross-sectional area of the clearance between moving and stationary parts. Thus, broadly speaking, the rotating element, through its pumping action, produces an axial circulation of the liquid in the nature of a local action, the axially-circulating body of the sealing liquid flowing through the clearance between the moving and stationary parts, and acting to seal the joint. The greater the difference in pressure, the more rapid will be the circulation. To retard the flow of the liquid between the periphery of the element in the chamber, and keep the volume of circulating liquid necessary to pack or prime the joint small, either part is provided with baffle-plates, or both parts are provided with angular projections 14, 15, forming an interleafed gland or tortuous passage, both of which constructions will act to retard the flow of the liquid, and thus reduce the volume of sealing fluid needed. Where several turbines are provided with the packing at their exhaust ends, which are connected to the same condenser, it is desirable to provide means for sealing the packing joint of any turbine of the set when not running. This may be effected in one way by providing check-valves for the circulation ports which open toward the atmosphere, and providing a means to force liquid into the tortuous gland, so as to flush and seal it.

Ontario.

The E. Long Mfg. Co., Orillia, have placed an order for a Duplex Pump, with the Smart-Turner Machine Company, Limited.

The plant of the Georgian Bay Engineering Works was destroyed by fire recently, and will be rebuilt as soon as possible.

The Grand Trunk Pacific announce that they have given a contract to J. S. Metcalfe for the construction of a two-million-bushel elevator at Tiffin, near Midland.

Fire destroyed pulp mill No. 1 of the Sault Ste. Marie Pulp and Paper Company, on April 24th. The loss is estimated at $200,000, with insurance of $100,000. Mr. Geo. Milligan, superintendent of the company states that in his opinion a new plant will be installed as soon as possible.

Quebec.

The Mechanics Supply Company are putting a line of first-class tools on the market. They are worth investigating.

New Brunswick.

The Massey-Harris Company have purchased land, and will erect a $15,000 warehouse at Moncton, and will make that place their distributing headquarters, which at present are in St. John.

Nova Scotia.

The Anthony Lumber Company, of South Maitland, is now erecting a very large saw mill, with a brick power-house. The mill and machinery will cost in the vicinity of $75,000.

Manitoba.

Humboldt is to have a cement industry for the manufacture of cement blocks, troughs, bricks, chimneys, waterproof cellars, beton work, etc. If the enterprise proves successful they will install a fully equipped plant and manufacture all kinds of cement pipes for waterworks, sewerage, etc. F. I. Hauser, and J. Armbrust are interested.

Alberta.

A new company has been formed at Medicine Hat, under the name of the Medicine Hat Coal and Brick Company. The coal mines and clay deposits near the city will be developed, and an electric line will be run out to the property. The R. R. Stoner Land Company and S. J. Hewson of the Menonamee Brick Company, of Minnesota, are interested.

SOCIETY MEETINGS.

American Waterworks Association will hold its annual convention at Toronto, Ont., from June 17th to 22nd. J. M. Diven, 14 George Street, Charleston, S. C., is the secretary.

CONTRACTS AWARDED.

Ontario.

J. S. Fielding, C.E., 15 Toronto Street, Toronto, has awarded the contract for erection of factory for the Carriage Mountings Company, at Niagara Falls, to A. Switzer, Toronto.

Jesse Stringer, of Carrville, has been awarded contract for the concrete work on the dam and power-house which is about to be constructed at Streetsville, at a cost of $20,000. John S. Fielding, 15 Toronto Street, Toronto, Engineer.

H. D. Symmes, of Niagara Falls has the contract for installing an electric power plant at Cobalt, to cost half a million dollars. The plant will supply the power to operate the mines of the district and work will be begun at once.

The Forter-Miller Engineering Company, Pittsburg, has been awarded a contract to reline the two blast furnaces of the Algoma Steel Company, Sault Ste. Marie. These furnaces each have a capacity of 200 tons. The contract for the fire brick has been given to the Harbison-Walker Refractories Company, of Pittsburg.

Contracts for three steel bridges, one over the Vermillion River, and two over the Wilson River, have been awarded by the rural municipality of Dauphin, to the Algoma Steel Bridge Company, of Sault Ste. Marie. The work on the bridges will be commenced as soon as the material arrives.

The Fire and Water Committee, of Hamilton, have awarded contracts as follows for fire-fighting apparatus:—Steam fire engine, H. C. Cameron, agent for Waterous engines, $5,500; combination waggon, Canadian Fire Engine Company, London, $1,450; hook and ladder truck, Seagrave Company, Walkerville, $3,500. These are all to have rubber tires. The contract for supplying new tubes for the boilers at the Beach pumping station was awarded to Richard Quinn. His tender was for $560.

Quebec.

Mr. Frank Munro, contractor, of Montreal, has been awarded the contract for bridges on the Lake Superior division of the Canadian Pacific Railway. There will be twenty bridges in all extending from Trout River to Fort William. The work includes excavation, cement work, and pile driving.

The new fire-proof power house for the Quebec Railway, Light and Power Co. at Quebec will be a one storey structure with basement. The plans for the same were prepared by Messrs. Stavely and Stavely, and the structure is to be entirely void of wood, even the window casings being of steel. The Dominion Bridge Company will do the steel work and Mr. Francois Parent has the contract for the stone and concrete construction.

Manitoba.

The contract for the erection of the Great Northern depot at Brandon has been given to the Brandon Construction Company, the contract price being $30,000. The structure will be one storey in height, on stone foundation, with cut stone trimmings. The walls will be of brick with enamelled brick inside. The floors will be tile and the platform vitrified paving brick.

MINING.

Ontario.

A concentrating plant will probably be installed on the Nipissing property this year.

Reports on the Larder Lake and Montreal River mining districts will be made by the Provincial geological staff, following through explorations and investigations to be conducted during the summer.

A despatch from Augusta, Maine, says:—The authorized capital stock of the Nipissing Mines Company has been reduced one-half to $6,000,000. There was no opposition. The $6,000,000 of stock thus retired never had been issued.

The Ontario Government has been asked for financial aid in the construction of a road from Boston, a point on the Toronto and Northern Ontario Railway, to Larder City. A good road is needed, it is claimed, to bring in supplies and

machinery, etc., and the deputation represented to the Government that assistance should be given in the building of such a thoroughfare. The Government decided to make a grant for the purpose, it was announced. The road will cost between $4,000 and $5,000.

Nova Scotia.

The Cape Breton Mining and Prospecting Company have decided to develop their big copper proposition at Scottsville, Inverness County. The sinking of a shaft will be undertaken, and for this purpose machinery will be installed.

Saskatchewan.

It is said that some of the finest iron deposits in the world are situated about 250 miles north of Prince Albert. A company is being organized to mine the ore, and a branch railway will be run to the properties.

British Columbia.

It is stated that the British Columbia Copper Company, operating at Greenwood, will shortly install a cyanide plant with a capacity of 500 tons a day at the Napoleon mine, near the Kettle River, in the Pierre Lake district, Washington. The plant with the other improvements that are to be made this summer will cost between $150,000 and $200,000. The Napoleon group, which consists of several claims, is two miles from Boyd's station on the Great Northern Railway.

MUNICIPAL.

Ontario.

The Village Council of Hintonburg have decided to extend the water-works system at cost of $10,000.

The ratepayers of Port Elgin have passed a by-law to raise $10,000 to complete and extend the new water-works.

The Railway Board has approved the Hamilton by-law for the issues of $62,000 debentures for extension of water-works system.

The Railway and Municipal Board has been asked to approve a by-law permitting the city of Hamilton to issue debentures to the extent of $62,000 for the extension of its water-works.

Manitoba.

Mayor Ashdown, of Winnipeg, announces that bonds will be issued by that city to the amount of $5,000,000. Of this amount $3,000,000 will be used for works started in 1906; high water system, and for the completion of the incinerator plant.

The City Council of Winnipeg, Man., has approved of the following amounts, recommended by H. N. Ruttan, City Engineer:—Block pavements, $53,072; macadam pavements, $53,382; asphalt pavements, $1,407,865; granolithic stone walks, $93,055; plank walk, $22,263; grading, $4,075; and sewers, $151,724. In connection with the civic power plant the engineer states that 35,000 cubic yards of earth and 65,000 cubic yards of rock will be moved, and 45,000 cubic yards of concrete work done this season.

REFUSE DESTRUCTORS FOR CANADA.

Messrs. Heenan and Froude, Limited, of Manchester and Worcester, have recently received two orders for their patent back feed refuse destructor for Canada, one for the city of Vancouver, and one for the city of Victoria, B. C. These two plants are similar in every respect and each consists of cells, combustion chamber, water-tube boiler regenerator, and fan and engine for forced draught.

In the case of Vancouver the steam generated will be for operating the clinker utilization machinery, and the authorities of Victoria are considering the putting down of an electric light plant in connection with theirs. Both these orders were placed after the strictest investigation by the city engineers and under the keenest competition from both American and British firms. These two destructors, together with that for the borough of Richmond, City of New York, make three contracts placed with the above firm this year for the United States and Canada is an evidence of the high state of efficiency to which British destructors of this type have been brought.

Mr. R. A. Taunton, of Winnipeg, is the Canadian agent.

Ontario.

Bids will be received until May 8th, for the erection of an addition to the main building of the Ontario Agricultural College at Guelph. J. O. Reaume, Minister of Public Works, Department of Public Works.

Quebec.

Bids will be received until May 10th for the purchasing of debentures of the village of Shawville, Quebec, for installing a waterworks and sewerage system, aggregating $25,000, redeemable in forty years, and bearing interest at the rate of five per cent., payable half-yearly. W. W. Ireland, Secretary-Treasurer.

New Brunswick.

Tenders will be received up to and including Friday, May 10th, 1907, for the work in connection with the double-tracking of the existing main line between Moncton and Painsec Junction, of the Intercolonial Railway. D. Pottinger, general-manager, Moncton.

Manitoba.

The date for receiving bids for supplying Brandon with about 85 tons 6 and 8-in. c-i. pipe and specials has been extended from May 6th, as announced in last week's paper, to May 17th. Bids are asked by G. R. Coldwell, Chairman Water-Works Commission. W. H. Shillinglaw is City Engineer.

At Gladstone, tenders are asked for a municipal building. The structure will combine the functions of municipal offices, jail, courthouse, and fire hall, with caretakers' apartments. Dimensions, 38 x 57 feet, stone foundations, brick walls, cost $15,000.

Saskatchewan.

Bids are asked until May 10th, by O. C. Lourie, Secretary-Treasurer of the town of Battleford, for installing an electric lighting system. Galt & Smith, 23 Jordan Street, Toronto, are Consulting Engineers.

Tenders will be received by the town of Battleford until May 10th, for the following works:—All labor and materials necessary for constructing the waterworks force main, distribution system and intake. All labor and materials necessary for constructing a sewer system. The supply and erection of a sixty thousand gallon elevator tank. The supply and erection of a waterworks pump. The supply and erection of one return tubular boiler. The supply and installation of an electric lighting system. The supplying at Battleford of cast iron work for manholes and catch basins. Galt & Smith, Consulting Engineers.

Bids will be received by the city of Regina until May 14th for the following:—Construction—(1) All labor and materials for constructing two compensating basins, 1,000,000 and 500,000 gallons capacity respectively; (2) trenching for and laying 36,500 feet C. I. pipe, and 54,000 feet sewer pipe. Materials—One 1,500 gallon pump, 1,500 feet 10-inch C. I. pipe, 3,000 feet 8-inch C. I. pipe, 32,000 feet 6-inch C. I. pipe, 2,600 feet 9-inch sewer pipe, 32,000 feet 12-inch sewer pipe, 9,400 feet 15-inch sewer pipe, 4,700 feet 18-inch sewer pipe, 6,200 feet 20-inch sewer pipe, 40,000 feet 6-inch sewer pipe, 600 corporation cocks, 600 curb cocks, 600 service boxes, 50 tons lead service pipe, 17 tons pig lead, 50 gate valves, 50 hydrants. Angus Smith is city engineer.

TELEGRAPH AND TELEPHONE.

Ontario.

The Ontario Railway and Municipal Board was notified on April 24th, that the Township of Rochester, North Essex, is considering the installation of a system of telephones.

Nova Scotia.

A telephone company is being organized to run a line from New Glasgow to Pictou Landing, Chance Harbor, and Little Harbor. J. F. Morrow is selling shares.

Manitoba.

The municipal council of South Norfolk has decided to at once construct a rural telephone system. Address Adam Forbes, Rathwell.

At a meeting of the Virden town council it was decided to take steps toward the installation of a telephone system. Address A. G. MacDougall.

At a meeting of the Brandon City Council called for the purpose of hearing Hon. J. H. Howden, Minister of Telephones, with regard to constructing a municipal telephone system in Brandon, it was decided to at once make arrangements for the erection of a fully modern system. Address S. E. Clements.

Saskatchewan.

The Bell Telephone Company will build a line from Regina to Prince Albert this summer. The two cities are 248 miles apart.

Alberta.

The Provincial Government has taken over the telephone system at Fort Saskatchewan.

F. J. Cumming, of Claresholm, has entered upon his duties as superintendent of the municipal system in Edmonton.

The first government-built telephone service in Canada is now completed, and will be in operation in a few days. It runs from Banff to Calgary.

The MacLeod Telephone Company, MacLeod, is making arrangements to get their plant into shape to connect with the long distance system being built by the government.

The Medicine Hat council is preparing a by-law for the purpose of raising sufficient money by the sale of debentures for the instalation of a civic telephone system, the Bell Company having refused to sell its plant.

The government has a gang of men at work constructing a telephone line between Coleman and MacLeod. Later the line will be extended east to Lethbridge, Taber, and Medicine Hat. Amongst the other lines to be built in the province are; from Edmonton to Lloydminster, and from Stettler to MacLeod.

Ontario.

The Toronto-Ottawa Railway line, in projection by Mackenzie & Mann, will be delayed in the commencement of the construction work by the railway troubles in the West, and although the whole line has been surveyed and plans are all ready for approval, the probability is they will not be presented until the appointment of a new Minister of Railways.

The construction of the Sandwich, Windsor, and Amherstburg radial railway has been completed, and the company have applied to the Railway Board under the provisions of the Railway Act, for the privilege to open traffic on the road.

The Grand Valley Railway is to be re-organized with United States capital, with extensions to Port Dover and London. The obstacles to reaching Port Dover have been removed, it is said, by the personal influence of the Minister of Public Works. The road will be rebuilt and will carry coal from Erie.

The cost of the improvements to be made in the Galt, Hespeler, and Preston Railway, will be about $100,000. The road is being double-tracked, new car barns built, a 750 horse-power engine installed; and four coaches and two new freight motors will be added to the rolling stock.

The C.P.R. is likely to take over the charter of the Owen Sound and Meaford Railway, which had intended to construct its line this summer. The line has a $96,000 federal subsidy. The C.P.R. want to construct through to a junction of the Victoria Harbor line near Peterboro. This would give the railway two new ports.

Between January 1st and April 21st the Temiskaming and Northern Ontario Railway carried 64,000 more passengers than for the same period last year, and the passenger receipts increased by $39,000. During the week ending April 21st, 10,871 passengers were carried by the road, while only 6,860 travelled over the line in the same week in 1906. In the freight department 30,000 tons more were carried up to April 21st this year than during the same time last year. This means an increase in the revenue of $32,000. During the week ending April 21st, 6,980 tons of freight were carried, or 1,490 tons more than for the same week in 1906. So far the total increase in revenue exceeds $70,000.

The Grand Trunk Railway Company is making considerable additions to its rolling stock, some five thousand freight cars of different kinds being now delivered. These cars are of the most modern type, as is snown by the immense capacity of the steel coal cars, which have a carrying power of 100,000 pounds each. The cars are being delivered at the rate of thirty a day, and are being rushed into active work as fast as they arrive. The order now in course of delivery consists of: 1,000 steel coal cars, each of 100,000 pounds capacity: 1,250 box cars, 1,500 flat cars, 250 furniture cars, 300 single deck stock cars, 200 double deck stock cars, 400 refrigerator cars, all of 60,000 pounds capacity each, and 300 ballast cars, of 100,000 pounds capacity each.

New Brunswick.

J. J. Lyons, the engineer to take charge of the construction of the Quebec-Grand Falls section of the Grand Trunk Pacific, is in St. John. He states that work will commence this week. At present there is about two feet of snow in the district where operations are to be begun. Edmundston is to be the headquarters for this section, and the work will commence there. When operations start about eight hundred men will be put to work, and in a few weeks the number will be increased to 1,500. The work will take about two years to complete.

The Westinghouse Construction Company will build the Grand Trunk Pacific line between Moncton and Chipman. Mr. Tucker, of that company, will be in charge of the work.

Nova Scotia.

The new railway wharf at Souris, which will cost $50,000, and is to be built by Mr. E. A. Walberg, the well-known contractor, it is to be constructed of reinforced concrete, no piles being used. This is the first wharf of its kind to be built in Canada, and when finished, it will be one of the best, presenting all the massive appearance of one of the great docks of Liverpool.

British Columbia.

The British Columbia Electric Railway Company is planning for extensive additions to their property in New Westminster, and over a hundred thousand dollars will be spent on new buildings.

NEW INCORPORATIONS.

Dominion.—Metcalf Engineering, Montreal, $25,000. V. J. Hughes, H. Rolph, A. Wainwright, O. Cousineau, C. F. Larkin, Montreal.

The Oposatica & Chibogomo Development Co., Montreal, $100,000. G. A. Robinson, M. J. Flanagan, S. R. Tarr, J. E. Coulin, Montreal; H. E. Walker, Westmount, Que.

The Lacoste Ship-Brake Co., Montreal, $45,000. G. N. Ducharme, S. D. Vallieres, W. C. Strachan, S. E. Stewart, P. Lacoste, Montreal.

The Rexford Bishop, Montreal, $100,000. W. I. Bishop, W. C. Strachan, H. Murray, W. G. Mitchell, W. S. Hart, Montreal.

The Lemcke Tug Co., Lion's Head, $20,000. C. Pedwell, C. Lemcke, J. Waugh, Lion's Head, Ont.

The Canada Carbog Co., Montreal, $1,000,000. P. J. Hubert, E. Lefrancois, L. E. Martel, C. Gosselin, L. O. Boisvert, Montreal.

Canadian Lake Transportation Co., Toronto, $100,000. J. S. Lovell, W. Bain, R. Gowans, E. W. McNeill, H. Chambers, Toronto.

The Niagara Iron and Steel Co., Toronto, $1,000,000. The Hon. J. K. Kerr, J. A. Paterson, W. Davidson, G. F. McFarland, A. McKenzie, Toronto.

The Raven Lake Mining and Development Co., Hull, $1,000,000. J. Caron, H. Dupuis, J. N. Fortin, F. A. Gendron, H. A. Goyette, J. E. Gravelle, G. H. Millen, J. Renaud, Hull; W. H. Rowley, Ottawa.

The Imperial Supply Co., Montreal, $100,000; H. H. Bradfield, Morrisburg; W. R. Duckworth, H. G. Meyers, Montreal.

Canadian Lake Transportation Co., Toronto, $100,000; J. S. Lovell, W. Bain, R. Gowans, H. Chambers, Toronto.

Industrial Development Co. of Canada, $750,000; F. de Chalot, E. P. Gingras, A. Gobeil, N. Desjardins, Ottawa; L. J. Demers, Montreal.

The Bonaventure and Gloucester Interprovincial Ferry Co., Bonaventure, $15,000; A. Noel, J. Henry, A. Desbiens, Bonaventure; L. Noel, Levis; F. Bugeaud, Bonaventure.

The Kaine and Bird Transportation Co., Quebec, $100,000; J. C. Kaine, M. P. Connolly, M. H. Kaine, C. E. Taschereau, Quebec; J. Bird, Canton, N.Y.

Canada Screw Company, Hamilton, $2,500,000; C. A. Birge, Hamilton; C. Alexander, Providence, R.I.; F. H. Witton, J. O. Callaghan, W. F. Coote, C. S. Wilcox, Hamilton; W. Gibson, Beamsville.

Ontario.—Zone Consolidated Oil Co., Thamesville, $40,000. J. Dean, J. W. Baxter, J. H. Thomas, Pittsburgh, Pa.; G. C. Friedrich, Alleghany, Pa.

Elk Lake Prospecting and Development Co., Toronto, $250,000. C. D. Scott, J. P. MacGregor, R. E. Alexander. Toronto.

Cochrane Cobalt Mining Co., Toronto, $1,000,000. H. M. Martin, W. A. Sadler, D. H. Glanville, Cobalt; N. A. Timmins, Haileybury; J. W. Kay, Detroit, Mich.

Cobalt Magnet Mines, Toronto, $600,000. J. F. Boland, H. J. Macdonald, C. L. Bray, Toronto.

Northern Gold and Silver Mining Co., Ottawa, $1,000,000; F. Gourdeau, H. G. Ketchum, W. Foran, J. A. Clayton, J. B. Spence, Ottawa.

Queen Alexandra Mining Co., Toronto, $40,000. H. D. McCormick, F. A. Lewis, D. A. Rose, E. Gillis, G. T. Veale, Toronto.

The Gold Belt Mining and Development Co., Toronto, $40,000. J. Chatelain, Thuro, Que.; A. A. Lapointe, C. LeBlanc, C. N. LeBlanc, E. Bourque, R. Chevrier, Ottawa.

The Ontario Coal Co., Peterborough, $40,000. A. J. McClellan, G. K. Rackham, C. Currier, H. Ritchie, Peterborough.

The Aberdeen Cobalt Silver Mines, Toronto, $1,000,000. H. S. Pritchard, F. Watt, E. L. Bastedo, J. J. Hubbard, J. Burgess, Toronto.

The Silver Cross Cobalt Mining Co., Ottawa, $500,000. L. B. Jennings, J. G. Chapman, D. S. Sawyer, A. Haydon, A. K. McLean, Toronto.

Bawden Machine & Tool Co., Toronto, $100,000. W. B Mudie, W. F. McRae, C. C. Sequin, G. Tillie, C. W. Mitchell, Toronto.

The Empress Tilbury Oil and Gas Co., Chatham, $150,000. J. T. O'Keefe, T. A. Drew, J. Taff, F. Stone, Chatham; B. V. Hole, C. B. Keenleyside, London; W. H. Gates, Toronto.

The Chaudiere Mines, Ottawa, $1,500,000; C. E. Plain, R. B. White, A. A. Fournier, J. Cuzner, P. Clarke, J. M. Wylie, P. O'Reilly, Ottawa.

Canadian Pacific Cobalt Development Co., Ottawa, $3,500,000; R. W. Eyre, E. E. Wallace, H. C. MacDonald, S. N. Berry, Toronto; H. W. Briggs, Ottawa.

Elk Lake Silver Mines, Haileybury, $100,000; F. Pottage, A. N. Morine, G. O. Merson, Toronto; J. A. Mitchell, Haileybury.

The Brockville Malleable Iron Co., Brockville, $60,000; H. A. Stewart, J. Connolly, J. A. McKenzie, G. I. Mallory, W. H. Harrison, H. A. Clarke, Brockville; C. H. Graves, Delphi Falls, N.Y.

The Caldwell Bit and Tool Co., Toronto, $50,000; C. A. Seguin, W. F. McRae, J. C. Mitchell, C. W. Mitchell, W. Kelly, Toronto.

The Ontario Electric Smelting, Milling and Refining Co., Ottawa, $2,000,000; J. Bishop, J. C. Scott, J. Kent, W. L. P. Smith, A. A. Sears, Ottawa.

Anglo-Canadian Cobalt Minisg Co., Toronto, $1,100,000; J. T. Richardson, D. C. Ross, L. B. Spencer, D. M. Builder, E. V. O'Brien, Toronto.

The Berlin District Steam Co., Berlin, $100,000; A. Bricker, P. S. Lautinschlager, J. D. Moore, J. M. Schneider, R. F. Wilson, H. J. Sims, Berlin; G. E. Bradshaw, Toronto.

Dominion Larder Gold Mines, Cobalt, $3,000,000; N. R. Green, Cobalt; W. Ryan, Pembroke; W. Davies, H. D. Graham, G. C. Legge, Haileybury.

The Big Hundred Larder Gold Co., New Liskeard, $2,500,000; J. Matthews, O. J. Thorpe, W. V. Cragg, C. A. Wismer, G. W. Weaver, P. J. Knox, J. W. Simpson, New Liskeard.

The Niagara Falls Mining and Drilling Co., Niagara Falls, $40,000; J. H. Richard, P. Charpantier, T. Mascott, G. C. Jones, Niagara Falls, N.Y.; F. W. Hill, Niagara Falls, Ont.

Laplata Cobalt Mines, Toronto, $1,000,000; G. H Sidgwick, A. T. Struthers, W. H. Syms, G. E. McCann, L Davis.

Blue Bell Gold Mines, Toronto, $5,000,000; D. A. Rose, F. W. Rose, H. D. McCormick, R. H. Lundy, E. Gillis, Toronto.

Silver Square Mining Co., Cobalt, $50,000; J. Shilton, W. H. Wallbridge, H. L. Dunn, J. Porter, J. Constable, Toronto.

The Robinet Brick Company, Sandwich, $40,000; H. W. Allan, A. F. Healy, Windsor; J. Robinet, F. J. Robinet, Sandwich.

Canadian Engineers, Ottawa, $40,000; T. T. Simpson, R. W. Farley, S. J. Chapleau, P. Whitney, T. A. Beament, Ottawa.

The Viceroy-Cobalt Mining Co., Toronto, $300,000; J. F. Boland, H. J. MacDonald, C. L. Bray, M. Rusk, L. Pickup, Toronto.

Dr. Rerdick Larder Lake Mines, Ottawa, $2,000,000; J. S. Virtue, G. R. Lipsey, J. B. Bedard, J. Radley, J. T. Hammill, Ottawa.

Argyle Silver Mining Co., Toronto, $500,000; W. Postlewaite, E. Manning, N. Manning, F. W. Moore, G. Marks, Toronto.

Silver Pick Cobalt Mining Co., Ottawa, $1,000,000; C. T. Moffat, C. G. Brown, E. Marriott, A. Macfarlane, W. J. Fenton, Ottawa.

Jehke Development Co., Windsor, $40,000; C. D. Joslyn, J. H. Harrington, A. Kelly, J. B. Eldert, W. P. Eldert, Detroit, Mich.

The Stadacona Cobalt Silver Mining Co., Cobalt, $1,000,000; J. A. Ouimet, A. Ross, F. H. Manley, F. G. Lyman, C. L. Shorey, Montreal.

Golden Horn (Larder Lake) Mines, Toronto, $500,000; P. J. Montague, F. Pottage, B. M. Cook, G. B. Strathy, W. C. Mackay, Toronto.

Little Larder Lake Gold Mining Company, Haileybury, $100,000; J. E. Day, J. M. Ferguson, E. V. O'Sullivan, A. W. Bixel, M. Donevan, Toronto.

Lake George Cobalt Silver Mining Company, Toronto, $600,000; W. McBain, T. A. Silverthorn, E. M. Carruthers, L. Hatt, R. M. Martin, Toronto.

Excelsior Constructing and Paving Company, Toronto, $30,000; J. G. Murphy, W. Mitchell, S. H. Bradford, A. Murphy, C. Mitchell, Toronto..

Trussed Concrete Steel Company, of Canada, Walkerville, $200,000; G. Kahn, D. C. Raymond, W. F. Evans, G. B. Reynolds, C. L. Wiman, Toronto.

Northern Larder Lake Mining Company, Haileybury, $1,000,000; M. P. Wright, W. S. Blackwall, S. D. Briden, G. A. Bagshaw, F. A. Day, Haileybury.

Barnard's Point Gold Mining Co., of Larder Lake, Hamilton, $1,000,000; H. Barnard, B. Broughton, W. Marshall, G. P. Jenkins, H. S. Lees, Hamilton.

The McConnell Silver Mining Company, of Cobalt, Ottawa, $200,000; A. McConnell, J. T. Baskin, J. G. Stewart, H. G. Campbell, W. L. Leslie, Ottawa.

Canadian Mines Syndicate, Ottawa, $100,000; J. F. Kidd, J. P. Dickson, J. B. Watson, A. L. Ogilvie, J. D. Courtenay, T. A. Beament, A. H. Armstrong, Ottawa.

The Sarnia Automobile and Bus Co., Sarnia, $40,000; S. Hitchcock, R. MacKenzie, J. W. Ryder, Sarnia; W. Richardson, Point Edward; B. P. Corey, Petrolia.

The Lincoln Nipissing Development Co., St. Catharines, $160,000; C. J. E. Baby, J. Titterington, E. C. Kidder, T. Nihan, St. Catharines; F. A. Goring, Niagara.

The Dunnville Consolidated Telephone Co., Dunnville, $60,000; R. A. Harrison, T. Marshall, A. W. Haun, M. L. Parry, E. E. Anderson, W. J. Aikens, Dunnville.

St. Lawrence Cobalt Mining Co., Bridgeburg, $40,000; E. J. Plumley, G. A. Sanborn, W. E. Waterman, Buffalo, N.Y.; G. A. Cotton, Depew, N.Y.; H. W. Eaton, Boliver, N.Y.

Island Oil and Gas Co., Maintowaning, $100,000; R. W. Wallace, Manitowaning; R. E. Flinn, W. B. Beecher, A. F. Holliday, Pittsburgh, Pa.; J. C. Trees, Oakmont, Pa., M. L. Benedum, Wheeling, Va.

New Brunswick.—T. McAvity & Sons, St. John, $600,000. T. McAvity, J. McAvity, St. John, N.B.

The Northern Coal Co., Fredericton, $100,000; H. Von Hagen, L. Davenport, J. M. Seeley, New York, N.Y.; I Purdy, Purdy Station, N.Y.; M. F. Keith, Moncton, N.B.

Manitoba.—Bithulithic and Contracting, Limited Winnipeg, $150,000; W. M. Macphail, A. B. Loudon, H. A. Robson, J. B. Coyne, R. V. Harris, Winnipeg.

McCulloch & Boswell, Winnipeg, $60,000; J. Boswell, D. Boswell, A. Emmett, W. Jackson, G. D. Minty, Winnipeg.

Canadian Vessel Agency, Winnipeg, $20,000; W. R. Allan, E. F. Lang, G. K. Killam, R. McKay, E. S. Parker, Winnipeg.

WORLD'S COPPER PRODUCTION.

Last year, and for the two previous years, Canada has taken eighth place as a copper producing country. In 1904 the total output was 21,500 metric tons (1968 pounds) in 1905, 24,000 and in 1906, 24,000.

These figures have been published by Messrs. A. Hirsch & Son, Germany.

The following shows in metric tons the copper production of the world for three years, commencing with 1904:

Copper Production of the World

	1904	1905	1906
United States	366,522	397,545	417,411
Spain and Portugal	50,000	48,000	51,000
Mexico	52,500	60,000	60,000
Chile	33,000	33,000	30,000
Japan	32,000	31,400	37,000
Germany	24,500	25,500	26,200
Canada	21,500	24,000	24,000
Australia	30,000	35,000	43,000
Peru	7,000	8,000	11,500
Russia	10,700	9,000	10,000
Cape Colony	7,250	9,000	8,500
Norway and Sweden	6,000	6,000	6,500
Italy	3,250	3,300	3,100
Newfoundland	2,000	2,200	2,500
Bolivia	2,000	2,000	2,000
Austria-Hungary, including Servia and Bosnia	1,500	1,500	1,500
Turkey	1,500	1,400	1,000
Other countries	1,300	1,000	1,500
Total	652,522	697,845	736,711

In 1906 there was an increase of 5.6 per cent. over the previous year. The increase of output in the United States being 19,866 tons, or 51.1 per cent. of the total increase.

Australia comes second on the list, with Japan third; the output of the Dominion remaining the same. A large percentage of the copper produced is now being used for electrical purposes. In the United States alone 383,352 tons were used in 1906, nearly 74 per cent. of all the copper produced and imported.

British Columbia and Ontario are the two main contributors to Canada's output, the former supplying about 79 per cent., the latter about 18.5 per cent.

In British Columbia the mines of the Boundary camp are estimated to have contributed about three-quarters of the output of the province; Rossland being the second in importance, with the mines operated along the Pacific Coast making up the balance. The rest of the Dominion output is represented by the copper contents of the nickel-copper mattes shipped from the Sudbury mines, with a small contribution from Quebec, representing the copper contents of the pyrites ores shipped from the mines of the Eastern Townships district. Throughout the whole country the much higher prices ruling for the metal have stimulated the search for new deposits and the re-opening of old mines, some of which will contribute to this year's production.

ORDERS FOR AMERICAN RAILWAY EQUIPMENT.

During the 12 months ending with February 1907, Canadian Railway Company's placed orders in the United States for 132 locomotives, valued at $1,026,424, an average value of $7,776. These ranged in price from $12,301 to $2,800.

During the same period 65,735 tons of steel rails were ordered, valued at $1,843,602, or $28.04 per ton. These figures give some idea of the amount of development work that has taken place on Canadian Railways during the past year.