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The Canadian Engineer

ESTABLISHED 1893.

WITH WHICH IS INCORPORATED

THE CANADIAN MACHINE SHOP.

VOL. XIV.—NO. 1. TORONTO, JANUARY, 1907. PRICE 15 CENTS $1.00 PER YEAR.

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THE CANADIAN MACHINE SHOP

ISSUED MONTHLY 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, JANUARY, 1907.

CONTENTS OF THIS ISSUE.

NINETEEN HUNDRED AND SEVEN.

"The Canadian Engineer" wishes its subscribers and friends all the good fortune they deserve this year—and even more. The signs are for continued good times. Up-to-date business methods will reap their just reward. The man who gets after orders; and makes his quality known will get his share of whatever is going. "The Canadian Engineer" is fortunate enough to receive pleasing meed of appreciation. The experience is not singular. It is a multipliable quality. If good wishes would do the multiplication every reader hereof would have a splendid new year.

THE ONTARIO POWER SITUATION.

At the time of going to press it seems likely that the model by-law to be submitted to the electors in western Ontario municipalities, authorizing local councils to make contracts, under the ægis of the Hydro-Electric Commission, for the purchase of Niagara power, will pass everywhere. The friends of the Commission have carried on an energetic, well-conducted campaign, in which on the whole, the fallacies in the report upon which the whole enterprise is based, have been cleverly handled. Before such bodies as the Engineers' Club, of Toronto, much distrust has been expressed of the calculations made in the historic document. But Mr. Beck and Mr. Cecil B. Smith stick to their guns. As far as the model by-law can do it, the municipalities will most likely be committed to becoming wholesale dealers in electric power.

Talk of an injunction, prohibiting the submission of the by-law on the ground of insufficient information not having been given the electors, did not produce litigation. The wisdom of such a course was doubtful, because it would only tend to deepen the enthusiasm of those who have become devoted to the idea of municipalization under a Government umbrella; and to develop that kind of controversy in which a constantly-fostered mistrust of corporations of all kinds is apt to become the winner at the polls. The opinion of Mr. Shepley, K.C., to the effect that the by-law would be nullified in a court of law was wisely published. But the question of faulty drafting of an Act of Parliament is small beside the general principle, to which the Government is committed; and which courts or no courts, will be submitted to the public with a minimum of delay.

Unquestionably there is ambiguity in the Ontario Act constituting the Hydro-Electric Commission. It is possible, from a reading of different sections, to hold the view which has been adopted by the Commission and the municipalities—that councils may be authorized by plebiscite to enter into a contract for a minimum quantity of power at the maximum price for a given period—and also to hold that the details of the contract must be submitted to the electorate at the very beginning. Obviously, it would be unbusinesslike to ask the voter to endorse now a contract which, in the first place must necessarily be too technical in expression for him to understand and, in the second place, cannot be worked out in complete detail, because there is so much to be determined as regards the production, transmission and distribution of energy, before the final terms to cover a lengthy period can be fixed.

"The Canadian Engineer" assumed a strongly critical attitude towards the report upon electric power in the Niagara Peninsula. The responsibility for proceeding with the different enterprises lies upon those who have devised the scheme, and have practically mortgaged the provincial credit to it. It is no use crying over what can't be helped. It is evident that those who have the ear and the pocket of the public will insist on going ahead. The interest, therefore, of the situation centres not so much upon the wisdom of a great company of civic fathers, in venturing an indeterminable hazard, but in the amount of business which municipal electricity is likely to make for those branches of industry concerned in the manufacture of supplies for transmission and distribution lines, and of machinery for use in manufactures.

The Hon. Adam Beck pledges his reputation that the scheme for which he is the enthusiastic sponsor will save to the city of Toronto $500,000 a year. Throughout the Niagara Peninsula there is to be a correspondingly large saving in cost of power and a consequent expansion of manufacturing through greater facility for competition, with factories in the United States and other parts of the country.

In so far as the proposition is one for obtaining cheap power it must command the sympathy of every local citizen. Waiving the question of the accuracy of the original estimates, the effort to obtain cheap power is commendable. It is not a question of friendship for existing companies. They are well able to take care of themselves. There is no need to dread a declining demand for power because it is cheap. The cheaper it is sold, the greater will be the demand.

Business men, like Mr. P. W. Ellis, are enthusiastic for Government-controlled electricity. Though their high reputations would not meet any deficit which the public treasury might incur, their experience and standing have undoubtedly given to the public mind a certain confidence in the feasibility of their proposals; so that if the by-law carries, an honest effort to make it work to the public advantage may be expected.

If—and the size of the "if" is an enormously important factor in the case—the event realizes the expectations of the power enthusiasts, or even the major part of them—a contingency which the history of prophecies unfilled does not seem to predicate—nobody will be more delighted than "The Canadian Engineer." For there must be a great expansion of industry in Ontario, and the whole complexion of commercial enterprise in the area served by an unsurpassed concatenation of water-falls will be changed out of knowledge.

THE TIME TO BUILD SHIPS.

The Dominion Government is being urged to grant a bounty of $6 per gross ton to builders of steel ships in Canada. The mercantile interests of Nova Scotia laid the case before the Tariff Commission, and at Mr. Fielding's request have set forth afresh their arguments through the mayors and presidents of the Boards of Trade of Halifax and Dartmouth. Recently a strong deputation of Toronto shipbuilders urged the same case upon Mr. Fielding and other Ministers. The Nova Scotians have reduced their argument to pamphlet form, and, like wise men, have circulated it widely. The case for a bounty is about as strong as any case for a bounty can be. The Halifax deliverance does not state it with maximum force, and leaves it unnecessarily to the imagination to predicate the effects of a wise encouragement of steel shipbuilding. Facts about other countries are enumerated usefully; but the application of them to Canada might have been more cogently set forth.

There are ways and ways of granting Government help to the shipping industry. In Canada it is possible to call a bounty a bounty. In Great Britain the sacred shibboleths of free trade must be respected, though art and learning, laws and commerce fail. So help to shipmasters is given in the form of payment for carrying mails, and for a call upon the services of fast vessels in time of war. Already John Bull pays over $5,000,000 a year in subventions to steamship lines. Next year the Cunard Company will put its two 25-knot vessels on the Liverpool-New York passenger service, and for them will draw nearly $15,000 a week additional from the taxpayer. Without its great receipts from the public exchequer the Cunard Company would not be much of a commercial proposition, for its dividends for over eight years have averaged only 2 per cent. The P. and O. Company receives about $1,750,000 a year from the Government for its services in Eastern waters.

Of course, the mail service is valuable; but in comparison with what the Government pays common carriers on land for transporting letters and newspapers, the shipping companies receive fabulous amounts.

The decadence of Canadian shipbuilding is one of the deplorable features of our history. We were once the fourth shipbuilding nation in the world. We are the eleventh. To be the fourth was to be eminent: to be seven lower down the list is to be insignificant. The change in the construction of vessels from a maximum of 2,000 tons to anything above 20,000 tons inevitably meant the decline of the Nova Scotian yards, and it is not pertinent to enquire whether by employing cleverer methods, they could have been saved from the worst declension. It was not possible on our Atlantic coast to develop the construction of iron ships simultaneously with the shrinkage of wooden building. Almost any skilful man can soon learn to build a lugger with good timber and a sharp adze; but it takes capital, organization, scientific training to produce iron vessels.

To the general proposition that it is desirable to establish extensively iron shipbuilding in Canada, there can be no objection. The work to be accomplished would not mean any reversal of the decrees of nature. It would only be in line with that trend of things which has become known as the National Policy. Mr. Fielding has said that legislative fostering of a tin plate industry could only be accomplished at a cost, which in the interests of the consumer of tin generally, would make the game not worth the candle. The same cannot be said fundamentally of steel shipbuilding in a country which has some of the finest waterways in the world among its possessions, and which formerly was more highly distinguished among those who defied the dangers of the deep.

The Great Lakes tonnage of 1904 was: Canadian, $7,975,487, and the United States, $7,400,613. The advantage of Canada is more apparent than real, and does not represent the extent to which each country is exploiting its natural openings for this class of trade. The shipbuilders complain that though British-made ships are imported for lake traffic as free of duty as those which come to Halifax or Montreal; they have to pay heavy duty on materials for use in the yards, which makes it impossible to compete with the British builder. The "Midland Prince," launched at Collingwood recently, is the largest vessel constructed on Canadian stocks. The bounty on her of $1.15 a ton amounts to only about one-fourth of the duty paid on material used in her.

SOME FACTS THAT TELL.

Cheapness in transportation is a factor in the progress and prosperity of any country, second only to the possession of natural or manufactured products to be marketed. To secure this it is necessary either to purchase or build vessels for the carrying trade. Building is the more preferable method.

Freight rates on wheat from Chicago to New York, show the following reductions per bushel:—

Year.	Lake & Canal.	Lake & Rail.	All Rail.
	cts.	cts.	cts.
1868	22.79	29.	42.6
1905	5.51	6.44	10.20

Ocean rates have also been reduced as follows:— Grain from St. Louis to Liverpool, per bushel.

	cts. Via New Orleans.	cts. Via New York.
1882	22.66	23.66
1905	10.00	16.62

Chicago to Liverpool:—

1896	$0.335
1905	0.1916

New York to Liverpool:—

1864	3,3/16 pence.
1905	1,3/8 "

The cost of transportation of wheat from Chicago to Buffalo decreased from 9.89 cents per bushel in 1860, to 1.32 cents in 1905. Senator Frye, chairman of the National Waterways Commission, reported in 1892:

"A dimunition of one mill per ton per mile, freight "on United States railways effects a saving of $100,- "000,000 to shippers."

Mulhall states the cost of transporting one ton of freight one mile, in cents, is as follows:—

United Kingdom	$2.80
Italy	2.50
Russia	2.40
France	2.20
Germany	1.64
Belgium	1.60
Holland	1.56
United States	0.80

The tonnage of Pittsburg, owing to cheap carriage of coal and iron, has come to exceed that of any port in the world. In 1902, the rail and river shipments exceeded 86,000,000 tons, the water shipments 11,000,-000 tons, or more than either London or New York.

The parallel between the two countries might be carried still further to show that the internal transportation facilities of Britain and the foreign transportation facilities of the United States have both been neglected by their respective governments; both have maintained excessively high rates, in the one case to the disadvantage of the English consumer, and in the other to the loss of the American shipper.

From 1884 to 1904, the protected coastwise steam tonnage of the United States increased 161 per cent., and sail vessels 20 per cent., the decrease in shipping being in foreign carrying vessels.

The construction of the Panama Canal gives great possibilities to the American coasting trade, which is jealously guarded as an exclusive reservation for American built vessels.

On the other hand, American foreign carrying trade has passed into the hands of foreigners. American vessels engaged in it:—

1861	2,642,628 tons.
1905	954,513 "

It costs $3 to carry a ton of coal in an American bottom from Newport to a Mediterranean port; it costs $1 from Wales to the same port. The foreign shipping industry in the United States is in a constant state of bankruptcy, receiverships and re-organizations. Nearly $100,000,000 invested in shipbuilding yields no interest.

Clearly, there is much to be done before Canada can be adequately served in seagoing transportation. Port facilities, for instance, must be improved. Only a short time ago the expert representative of an English city, which has expended $30,000,-000 on dock improvements, was sent to Canada to open up traffic between that port and our ports, derided the trans-shipping facilities of Quebec and Montreal; and generally scorned us for our failure to recognize that transportation by sea demands continually improving methods in every one of its contributory departments. The necessity for encouraging the building of iron ships is, therefore, part of the need for a larger, stronger, more courageous maritime policy on the part of those who have these affairs in charge. A vigorous representation now and then by mayors, boards of trade, and individual shipowners and builders will not produce a maximum of result unless they are a part of a determined programme of mercantile policy which will be preached everywhere with as much zeal and energy as are generally devoted to the unearthing of some petty parliamentary scandal, or the crippling of some legitimate enterprise on the plea that it is not conceived and operated solely in the interests of "the people."

SCARED OF THE G.T.P.

One might draw a very lugubrious picture of the futilities of Grand Trunk Pacific engineers if one were affected by an article upon the new transcontinental system which the Ottawa correspondent of the London "Economist" sent to that journal recently. The correspondent is Mr. Farrer, one of the best known Canadian journalists. His article might have done considerable mischief to Canadian enterprise, because the "Economist" is eminent for conservatism and reliability, and anything which it admits to its columns is likely to be seriously regarded by the investing public across the water. But Canada is so popular nowadays in the United Kingdom, and there are so many channels of information uninspired by hostility to any sound enterprise, that the pessimism of which the "Economist" was made the medium cannot be very contagious.

According to Mr. Farrer, the company is now thought not to have made as good a bargain for itself as was originally believed. The criticisms of the Opposition, and a good many Canadian friends of the Grand Trunk proper are supposed to have shaken public confidence in some degree. First, the company is receiving no Government aid worth speaking of, in comparison with the enormous risks it assumed; secondly, the 500 miles of road from Quebec to Moncton will be built almost within hailing distance of the

Intercolonial, the rates on which, though lately increased ten per cent., are still exceedingly low; thirdly, the 1,500 miles from Quebec to Winnipeg will yield little freight and attract few settlers until all the western lands are occupied; fourthly, the 500 miles from the Yellow Head Pass to the Pacific coast will entail immensely heavy work, with a problematical return, and, finally the best sections of country through which the line will pass are already supplied with branch lines, or main lines by the Canadian Pacific and the Canadian Northern, and the stretch from Edmonton will be dominated by the two senior systems before the Grand Trunk Pacific can reach that territory.

As against this the report of Chief Engineer Lumsden to the Transcontinental Railway Commission is interesting. Mr. Lumsden says the country from Moncton to Weymontachene is more or less settled, and from Weymontachene westerly 100 miles it is very rough and broken. After crossing the headwaters of the Obaska Lake, the country is generally much flatter, and from here to the boundary between Quebec and Ontario, 120 miles, construction will be comparatively easy. From the Ontario boundary westerly to within 10 miles of the Kashkagama River, 402 miles, the country consists of clay loam, with here and there sandy ridges, small areas of muskeg or swamps, but these latter are only covered with from two to four feet of moss, with clay sub-soil. There will be considerable bridging here. A large portion of the country north and south of the railway is well suited for settlement. From the Kashkagama River to Lake Superior Junction the country is rough and broken, there being little or no agricultural land west of Lake Nipegon. From the Junction westerly for 185 miles work is very heavy and consists largely of rock cuttings and timber trestles, with only a few areas of timber land of merchantable value. To Winnipeg, 66 miles, the road will pass through prairie land, the latter portion being excellent farming land.

There is another unimpeachable witness as to the possibilities of what Mr. Farrer calls the "hyperborean desert." President Mackenzie, of the Canadian Northern, has announced that that line between Sudbury and Port Arthur will pass north of the Canadian Pacific through twenty-five million acres of territory covered with timber growing on clay soil suitable for arable farming. Mr. Mackenzie knows what he is talking about.

The pessimist is only happy when he is miserable. The next step will be a regular jeremiad predicting that Grand Trunk Pacific trains will not earn enough money in Northern Ontario to pay for their axle grease. The "hyperborean desert" is quite a rich phrase, when you remember the history of railroad enterprise in northern latitudes. It is a waste of breath to recite the story of the falsification of the doubts and fears of the pessimists of thirty years ago about the prairie country. There were also inveterate pessimists when the Temiskaming and Northern Ontario Railroad was projected, but as the Canadian Pacific discovered the nickel mines of Sudbury, so the Temiskaming and Northern Ontario line unearthed the riches of Cobalt, and in its infancy, earned a revenue which has surprised its builders.

The mistaken viewpoint of Mr. Farrer is also clearly indicated in his lament that the Grand Trunk Pacific between Winnipeg and Edmonton will have Canadian Northern on its north, the Canadian Pacific on its south. It must surely be a long time since the able correspondent traversed the West. He must have temporally forgotten that it does not take an enormous breadth of grain producing country to support a railroad. The Canadian Northern, for instance, is building a line from Brandon to Regina to connect with the road from Regina to Prince Albert, which it recently acquired from the Canadian Pacific Railway, and is placing its rails between the Canadian Pacific main line and a branch which runs east and west, few miles south of the Pipestone creek. The Canadian Northern does not build branches for the sheer pleasure of seeing empty trains run through deserted districts. It has a very lively sense of the benefits of five per cent. There is plenty of room for the Grand Trunk Pacific, and there will be plenty of business for it. It will make great demand on the country's engineering resources for many years to come.

EDITORIAL NOTES.

The city of Winnipeg has overwhelmingly endorsed the Government policy of independent telephones for the city and the Province. The by-law authorizing the establishment of the independent system in municipalities of Manitoba has been carried in a minority of the districts, sufficiently large to ensure the ultimate dominance of the independent policy. Where it failed to carry, there appears to have been no lack of sentiment in favor of the principle. But, as is always the case with a proposition emanating from a party Government, there were criticisms of the method pursued by the Roblin administration; which, in places where the Government is not in favor, strongly militated against the adoption of the by-law. It is a pity that a question so important to the commerce and convenience of the population should become in any degree the sport of party politicians; and be conditioned by the kindness with which the Government's action in other affairs is regarded. On the whole, independent telephony has done remarkably well in Manitoba. The only wise point of view from which to regard matters of this kind is the extent to which a public service makes the transaction of business easy. The telephone is not an end in itself. By quickening transactions, it saves money, and makes money, and should, therefore, be made as cheap as possible. The question is not fundamentally a question of "the people" versus monopoly. It is a question of everyday business efficiency. The more efficient and cheaper the service can be, the greater will be the demand for wires and instruments, the manufacture of which means prosperity for important industries which this journal desires to flourish.

* * * *

Elsewhere will be found an announcement of the impending publication in book form of Dr. Stansfield's articles in "The Canadian Engineer" on electric smelting. The book will mark an epoch in a new industry, and will undoubtedly be the best of the kind yet produced. Indeed, there is no book extant which treats of electric smelting in anything like the comprehensive way which has distinguished Dr. Stansfield's articles in this journal. The material will be revised and brought absolutely up-to-date by those whose processes are described. It is hoped to include in the volume a complete description of the plant which is being constructed in California under Dr. Heroult's auspices, by Mr. Turnbull, and which, it is explained, will be in operation about two months hence. We have this week arranged for a quantity of ore from Cobalt containing high-grade percentages of arsenic and a low percentage of silver to be electrically smelted, and the results will, no doubt, be set forth in Dr. Stansfield's pages. A proposal was made to republish Dr. Stansfield's articles by an eminent English house, but the arrangement to issue from this office was already concluded. Letters given elsewhere show that the book is likely to be used very widely as a text book in universities and technical schools. The articles that have already appeared will be re-set, so as to be more readable and permanently agreeable. A large demand is expected for the volume.

* * * *

Tribute was paid at the banquet given to Mr. Mackenzie and Mr. Mann by the Toronto Board of Trade to the skill of the engineers who have contributed to the wizard-like upbuilding of the Canadian Northern Railroad. Indeed, the progress of that system is probably even more interesting to engineers than to financiers. The facts given on this page as to its mileage, the amount of money invested, and the expectation of growth in the immediate future, are one of those rare combinations of commerce and romance to which Canada is becoming accustomed. Perhaps the practical experience of Mr. Mackenzie and Mr. Mann in building wooden bridges in the Rocky Mountains for the Canadian Pacific Railroad in the early eighties had a great deal to do with giving them the resourceful courage, in the face of apparently insurmountable obstacles, which has been the predominating feature of their remarkable rise to the position of the foremost developers of new territory which this continent has produced during the present generation. It is an interesting experience to come in contact with some of the men who worked with Mr. Mackenzie and Mr. Mann in those not-so-far-off days; and who, at nightfall, reposed with them in tents on the mountain-side. There has been an almost strange absence of publicity from the careers of Mr. Mackenzie and Mr. Mann. You cannot hide a railroad system under a bushel, and the Canadian Northern and its subsidiary enterprises have had much written about them. But the partners have kept out of sight. There has been so much to do, that they have had little time to be seen and heard of the multitude. The characteristic of reticence also applies to some of their leading helpers. There is no more modest, unassuming man in the profession than Mr. M. H. McLeod, the son of the Hebrides, who is the chief engineer of the Canadian Northern, who is in and out of Winnipeg a hundred times a year. Mr. McLeod has traversed the northern prairies possibly more than any other living man. He has become so accustomed to laying out main lines and branch lines, and planning viaducts and bridges, that what to most of us would be a leviathan undertaking, is to him a mere matter of course. The Canadian Northern has more long steel bridges in the prairie country than any other railroad. It has been a point with the company to purchase material made in Canada. Though the demand upon the capacity of various works has occasionally caused delay in crossing great rivers, there has been a cheerful sacrifice of time so long as Canadian industry might be served.

CANADIAN NORTHERN HISTORY.

Summary of a Chapter of Romance Given at the Toronto Banquet.

The proceedings at the Toronto Board of Trade banquet last month to Messrs. Mackenzie and Mann would have been incomplete without some reference to the rapid growth of the Canadian Northern Railroads. The two guests of the evening were naturally too modest to speak upon this point, but Mr. Z. A. Lash, K.C., gallantly assumed the role of historian and carried his listeners back to the time when the Canadian Northern was but a little baby road of 125 miles in length.

There was a general knowledge among the people of Canada, said Mr. Lash, that Messrs. Mackenzie and Mann were great railway builders, and there was an erroneous impression that they had been so largely bonused and subsidized by public lands and money that they did not deserve much credit for what they had done. But the two gentlemen deserved the respect and admiration of their fellow-Canadians for their accomplishments, and their future assistance. The first line of the great system was the Lake Manitoba Railway and Canal Company, 125 miles in length. In ten years a system which extended, with few interruptions, from Quebec City to the foothills of the Rockies, comprising, with its branches, 3,400 miles, had grown, and this was the work of Mackenzie and Mann, with small aid from the Governments. No land grants had been made to the lines which were built since the charter was granted. The Lake Manitoba Railway and Canal Company was formed in 1899, with the usual statutory land grant. Not till some years later did Mackenzie and Mann get control of it, build it, and earn the lands.

Old Charters Revivified.

The Winnipeg and Hudson's Bay Railway was founded in 1882. Its owners borrowed $256,000 on the 256,000 acres of lands granted. The company failed, and Mackenzie and Mann took it over, and finally paid over the $256,000. A similar history was that of the Manitoba and South-eastern Railway, chartered in 1889. The lands later became valuable, and had been of real assistance in the building of the Transcontinental. So far the proceeds had gone to the Canadian Northern, and not a penny had gone to the two guests of the evening, who paid for the lands they owned out of their own resources. The Manitoba and South-eastern was purchased. Then the Ontario and Rainy River Company's charter was acquired, authorizing a line from Port Arthur into Minnesota. This process went on until the whole system, from Quebec to Edmonton, was made up of twenty-seven different concerns now included in the three corporations—The Canadian Northern, the Canadian Northern Ontario, and Canadian Northern Quebec. All this had been accomplished by these two men, whom, Mr. Lash thought, could be called the greatest railway builders the Dominion of Canada had ever known.

During the ten years the two gentlemen had not drawn one dollar of salaries or travelling expenses, and had risked millions of money. The Governments of Manitoba, Ontario and the Dominion had guaranteed the bonds of a number of the company's lines. Mr. Lash had heard criticism of the railway builders for retaining the control of the system, continuing the existence of a small board of five directors, and not permitting the public to acquire an interest in the road. He took the responsibility for this phenomenon, which he had advised on the ground that it avoided the inconvenience and delay of large meetings. Moreover, undue publicity had been prevented. As an instance of the prompt and confidential action, Mr. Lash said that the purchase of the Quebec and Qu'Appelle road was first discussed at 11 o'clock in the morning and the bargain was closed at 4 in the afternoon.

At a meeting of the C. S. C. E. held on Thursday, December 13th, the following papers were read:—"The Distribution of Stress in Rivetted Connections," by C. R. Young, and "An Investigation on the Value of the Indentation Test for Steel Rail," by H. K. Dutcher.

THE ELECTRIC FURNACE: ITS EVOLUTION, THEORY AND PRACTICE

By Alfred Stansfield, D. Sc., A.R.S.M., Professor of Metallurgy in McGill University, Montreal.

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These letters speak for themselves. They are similar to others received:—

UNIVERSITY OF WISCONSIN, COLLEGE OF MECHANICS AND ENGINEERING.

Madison, Wis., Dec. 7, 1906.

Dr. Alfred Stansfield, Professor of Metallurgy, McGill University, Montreal, Can.

Dear Sir,—I have been deeply interested in a serial running in "The Canadian Engineer" dealing with the electric furnace, and under your authorship. This appears to me by far the best treatment of the electric furnace from the applied standpoint that has been attempted, and it is helpful to me in connection with my instructional work.

I was much disappointed to learn that "The Canadian Engineer" cannot furnish me the back numbers containing your contributions, and thought that by some chance you might have this available for distribution in another form. If so, I should like to secure it.

I am in hopes that you will publish this in book form so that I may use it as a text. Is there any prospect of this being done?

Yours very truly,

C. F. BURGESS.

* * * *

Worthington, Ont.,

Dec. 13, 1906.

"The Canadian Engineer," Toronto, Ont.

Gentlemen,—Kindly forward me the September number of "The Canadian Engineer." I also wish to enquire whether the series of articles on "The Electric Furnace," by Alfred Stansfield, may be obtained in book form, and if so, where, and for how much. Thanking you for this information,

I remain, yours truly,

A. C. SCHAEFER.

* * * *

[The proprietors of "The Canadian Engineer" have pleasure in announcing that the articles by Dr. Stansfield, which have been running in "The Canadian Engineer" for the past eight months, and which will be concluded in Engineer," on fine paper, and will be tastefully bound. will be printed from new type, larger than that used in "The Engineer," one fine paper, and will be tastefully bound. So as to meet the needs of university students the price has been fixed at the low figure of $2. Orders can be given at the head office of "The Engineer," 62 Church Street, Toronto, and at the subsidiary offices, 32 B, Board of Trade Building, Montreal; "Free Press" Building, Winnipeg, and Northern Bank Building, Hastings Street, Vancouver.]

VI.

Other Uses of the Electric Furnace.

The production of iron and steel in the electric furnace is still in its infancy; and will be limited until the high price of electrical energy is reduced. But there are many other uses to which this source of heat has long been profitably applied, as has been indicated in the first two articles of this series. In some of these processes, electrical heat is alone able to produce the required result, while in others the value of the product and the greater economy of the electrical method has enabled it to supplant the older processes, even though the latter employed cheap fuel as the source of heat. Some of these uses of the electric furnace will now be considered.

The Ferro-Alloys.—The alloys of iron with certain metals, such as manganese, chromium, tungsten and titanium, or with the metalloid silicon, are often known as the ferros, and are usually equivalent to cast iron; that is, iron with a large percentage of carbon, in which part of the iron has been replaced by one of the above metals or metalloids. In some cases, however, carbon is present only in small amounts or not at all, and, on the other hand, more than one of the alloying metals may be present in the same ferro. The ferros are used in the production of steel as convenient means for introducing into the steel the manganese or other metal contained in the ferro; it is usually less costly to obtain these metals as ferro alloys than in the pure state, and the presence of the iron is not objectionable in additions made to steel; although the carbon, which is also usually present, is sometimes undesirable.

The metal manganese resembles iron in many particulars, but it is more difficult to reduce from its ores, and when this is effected in the blast furnace, with iron ore to furnish enough iron to collect and alloy with the manganese, some 2½ or 3 tons of coke are required to produce one ton of the 80 per cent. ferro-manganese, and about 20 per cent. of the manganese is lost in the slag owing to the imperfect reduction of the ore. Such an operation is very wasteful, both in fuel and in the valuable manganese ore, and the electric furnace is so much more economical in both these particulars that it can be used in competition with the blast furnace method. Silicon-eisen, that is low-grade ferro-silicon containing some 10 per cent. or 15 per cent. of silicon, can be made in the blast furnace by using siliceous charges and a great excess of fuel, the silicon being derived from the silica in the charge. In the electric furnace, however, using quartz as the source of silicon, with coke to reduce the quartz to the metallic state, and some iron ore or scrap iron to alloy with the silicon, an alloy containing as much as 80 per cent. of silicon may be obtained; and the electric furnace ferro-silicon has largely displaced the blast furnace product, as the cost of the former, per unit of silicon, is so much less. Some other ferro-alloys are also made more cheaply in the electric furnace.

The ferro-alloys may be produced in electric crucible furnaces, such as the Siemens vertical arc furnace, Fig. 2, p. 170, or the Heroult ore-smelting furnace, Fig. 22, p. 437, in which a carbon electrode dips into a carbon-lined receptacle, which forms the other electrode. In such a furnace the alloy will usually absorb a considerable amount of carbon from the lining, and if a carbonless alloy is required, a furnace like the Héroult steel furnace, Fig. 25, p. 326, should be used, in which two carbon electrodes are employed, which need not touch the molten metal, and the lining of the furnace is not made of carbon.

The electro-metallurgy of silicon is described by Albert Keller,* who states that at Livet, with 4,000 H.P., he was able to turn out 20 tons of 30 per cent. ferro-silicon per day, and that one ton of the alloy requires 3,500 kilowatt hours for its production from quartz, scrap iron and coke, the furnaces being each of 650 H.P.

The production and probable uses of ferro-titanium are discussed by Auguste J. Rossi,† who reduces titaniferous iron ores in the electric furnace, either with carbon or with the assistance of molten aluminium, which serves to reduce the metal from its ore. He has obtained alloys with from 10 per cent. to 75 per cent. of titanium, which, when aluminium was used as the reducing reagent, only contained a few tenths of one per cent. of carbon. Rossi states that titanium is not really such a bugbear to the iron metallurgist as is usually supposed, but that on the contrary ferro-titanium, added to either pig iron or steel, markedly improves the mechanical properties of the metal. In the case of steel he suggests that the well-known property of titanium

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*Keller, Journ. Iron and Steel Inst., 1903, Vol. I., p. 166.

†Rossi, Mineral Industry, Vol. IX., 1901, and Trans. Am. Inst. Min. Engs., Vol. XXXIII., 1903, p. 191.

of combining with nitrogen may enable it to remove this gas from the molten metal, and in this way to improve its quality.

The manufacture of ferro-nickel, ferro-chrome and other alloys of iron that are used in the production of steel are described by O. J. Steinhart.‡ Ferro-chrome, containing from 50 to 60 per cent. of chromium, was made at one time by heating chromite with charcoal in crucibles, and later in small blast furnaces, but is now made, almost entirely, in the electric furnace. The Wilson Aluminium Co. employ 4,000 E.H.P., and turn out 200 to 250 tons per month of ferro-chrome having 5 to 6 per cent. carbon and over 70 per cent. chromium.

The following are typical analyses of some of the ferro alloys:—

	Ferro-manganese. Blast furnace.	Spiegel-eisen. Blast furnace.	Ferro-silicon. Blast furnace.	Ferro-silicon. Electric furnace.	Silicon spiegel. Blast furnace.
Manganese	80	20	.3	?	19
Iron	12	73	83	?	66
Carbon	6.8	5.0	1.7	Trace	1.7
Silicon	1.0	1.1	14.8	50	13
Sulphur	.02	.02	.08	Trace	.08
Phosphorus	.10	.10	.12	.02	.10
Arsenic	.10	....	....	....	....

Ferro-chrome.

	Crucible furnace.		Electric furnace.	
Chromium	45	60	72.7	68.2
Iron	45	30	21.4	29.9
Carbon	8.6	9.1	5.3	1.3
Silicon	.6	.5	.6	.11
Manganese	.4	.3	....	....
Sulphur	.05	.05	....	.01
Phosphorus	.05	.05	....	.01

In dealing with these and other products of the electric furnace, it should be remembered that they will sometimes evolve explosive gases if allowed to come in contact with water. This may be due in some cases to small quantities of calcium carbide formed at the high temperature of the electric furnace, but in one case, that of some ferro-silicon, which produced a number of explosions in Liverpool a few years ago,** the explosive gas was found to be phosphoretted hydrogen. The alloy was very pure, containing nearly 60 per cent. of silicon, with 2.7 per cent. of aluminium, .2 per cent. of carbon, .14 per cent. of calcium, .17 per cent. of magnesium, and .56 per cent. of phosphorus.

Manganese, nickel, chromium, tungsten and other metals can also be obtained in a carbon-free and nearly pure state, suitable for use in the manufacture of special varieties of steel by the Goldschmidt process of mixing the oxide of the metal with powdered aluminium and igniting the charge by means of a small primer, which starts the reaction between the oxide and the aluminium. The reaction once started continues throughout the mass, producing an intense heat, which is sufficient to melt the reduced metal and the resulting alumina.

Calcium Carbide.—This important product of the electric furnace has already been referred to, p. 172, and the Willson carbide furnace was illustrated in Fig. 7.

The equation, $CaO + 3C = CaC_2 + CO$, representing the formation of the carbide, shows that 56 parts of CaO, usually as lime, combine with 36 parts of carbon, coke being usually employed, to form 64 parts of calcium carbide. The lime and coke, which should not be too finely powdered, as this would cause loss by dusting, are mixed together and heated in the electric furnace to a temperature which is supposed to be 2,000° C. or 3,600° F. The carbide is molten at this temperature, and may be allowed to build up a block of carbide, which gradually solidifies as the zone of fusion is raised in the furnace, or the carbide may be retained in a fully molten state until there is enough to tap into a mould. The Willson furnace is of the former type. The production of one long ton of a commercial product containing 80 per cent. of pure carbide requires the expenditure of about 4,000 kilowatt hours of electrical energy.

Aluminium.—This is the most important metal that is produced solely in the electric furnace. Originally it was obtained by complicated chemical methods involving the use of metallic sodium as a reducing agent, but the electrical method, described on page 171, entirely supplanted the older processes. The common metals—iron, copper, lead, tin, zinc, etc.—occur in their ores as oxides, or can easily be converted into oxides by a roasting operation, and these oxides are easily reduced to the metallic state by the action of carbon in an ordinary furnace, because, at such temperatures, oxygen has a greater affinity for carbon than it has for the metal, so that carbon is able to combine with the oxygen contained in the oxide and leave the metal free. Other metals, however, such as aluminium, calcium, silicon, sodium, and others have a greater affinity for oxygen than those already mentioned, and it is very difficult, and in some cases impossible, to reduce the oxides of these metals by means of carbon at ordinary furnace temperatures. With the aid of electricity, however, any metal can be reduced, in some cases by heating the oxide to a very high temperature, at which the affinity between the metal and oxygen is lessened, so that the latter can be removed by means of carbon, or by dissolving the oxide or other ore of the metal in a suitable solvent, and applying a direct electric tension to tear, by electrolysis, the compound into two parts, thus liberating the metal. Aluminium, calcium, and other metals can be reduced by carbon at the high temperature of the electric furnace, but immediately combine with a further quantity of carbon, forming a carbide. It is, therefore, necessary, when the pure metal is desired, to employ electrolysis instead of direct reduction with carbon. As examples of the electrolytic reduction of metals at furnace

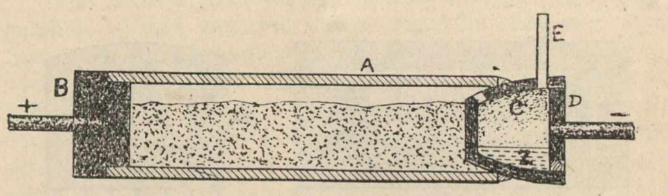


Fig. 30.—Cowles' Electric Zinc Furnace.

temperatures, may be mentioned the production of aluminium already described, and of sodium, which will be described later.

Zinc.—Although one of the common metals, and one that has long been produced in furnaces fired by coal or gas, the volatility of zinc and the ease with which it becomes oxidized present serious difficulties in the treatment of its ores, and many attempts have been made to overcome these difficulties by smelting zinc in the electric furnace.

In the usual process of zinc smelting, the ores are first roasted to remove the sulphur in the case of sulphide ores, or the carbonic acid in the case of carbonate ores, and the resulting oxide of zinc is mixed with about one-half its weight of coal and heated in retorts or muffles made of fire-clay. In order to complete the reduction of the oxide to the metallic state it must be heated to a temperature above the boiling point of the zinc, which is consequently given off as vapour, and passes in that form out of the retort, and is condensed to the liquid metal in a condenser, from which it can be removed and poured into moulds.

The residue is then removed from the retort and the operation repeated. The retorts are heated externally by coal or gas firing, and as the ore must be heated to about 1,200° C. or 2,200° F., the retorts cannot usually be made very large, and frequently only hold about 100 pounds of ore mixture, from which it will be seen that the cost of labor in zinc smelting is likely to be high. The utilization of heat in these furnaces is also very poor on account of its slow transmission through the walls of the retorts, the heat

‡ Steinhart, Trans. Inst. Min. and Met., Vol. XV., 1906, p. 228.

**A. Dupré and M. B. Lloyd, Journ. Iron and Steel Inst., 1904, Vol. I.

efficiency of such a furnace being given by Prof. Richards* as under 7 per cent. At the high temperature of zinc distillation the retorts only last about a month, and their renewal forms a considerable item of expense. Other difficulties are met in the condensation of the zinc vapour, as this does not all collect in the liquid state, but in part as a powder, which cannot be melted together, and a part of the vapour escapes altogether.

Most of the difficulties that have been referred to are caused by the necessity of heating the ore in a number of small retorts, heated externally, instead of in a large furnace in which the heat could be produced in close contact with the ore. Attempts have been made to reduce the ore in some form of blast furnace, but the zinc was too easily oxidized by the furnace gases, and it was not possible to condense the zinc to the liquid state, as the vapourized metal in a very diluted condition was present in the gases leaving the furnace. Zinc oxide suitable for making paint is, however, produced by means of small blast furnaces, and is filtered out of the gases by passing them through woolen bags.

In the electric furnace heat can be produced without the necessity of blowing air into the charge, the atmosphere in the furnace can be made thoroughly reducing, so that no zinc will be oxidized, and the gases leaving the furnace are no more than leave the zinc retort in the usual process, so that the condensation of the zinc should be satisfactory. The production of heat electrically in the midst of the ore mixture enables the furnace to be made of any convenient size, and thus reduces greatly the expense for labor, while, as the heat has not to be transmitted through the furnace walls, these will be far more permanent and a great source of expense will thus be removed.

Although the advantages that could be gained by smelting zinc ores electrically were very obvious, the practical application of electrical heating to this process has not been easy. The first electrical furnace for distilling zinc ores was patented by the Cowles brothers in 1885, and consisted, Fig. 30, of a fire-clay tube, A, closed at one end by a carbon plug, B, and at the other end by a carbon crucible,

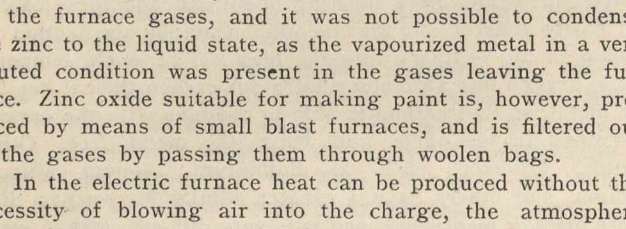


Fig. 31.—Johnson's Electric Zinc Furnace.

C, and lid, D. The charge or roasted ore and coal was contained in the tube, and electrical connections were made to the carbon plate and crucible so that an electric current flowed through and heated the ore in the tube. The tube was surrounded with some suitable material to reduce the loss of heat. The vapourized zinc and other gaseous products of the process escaped through a hole into the crucible, where the zinc condensed to a liquid at Z, while the remaining gases passed away by the pipe E. The furnace was practically an electrically heated zinc retort, and, as shown in the figure, the process was intended to be intermittent in action, one charge being exhausted and then discharged before another could be introduced. Provision could, however, have been made for the continuous charging and discharging of such a furnace, but the process was never completed.

A furnace recently patented by W. McA. Johnson,** of the Lanyon Zinc Co., Fig. 31, is practically the same as the Cowles' furnace, but it is designed on a larger scale, and care has been taken to prevent the overheating of the walls of the furnace. It consists of an arched chamber, A, with end walls, B and C, and a flue, D, through which the zinc and other gaseous products of the operation can pass. The whole furnace is supported upon I beams, thus enabling the air to pass underneath and prevent overheating. The furnace is constructed of fire-clay bricks, but as additional protection, a layer, M, of refractory material, such as silica, high-grade fire-clay or bauxite, is placed on the hearth. The ore mixture consists of roasted ore mixed with enough coke to reduce the zinc and to carry the electric current. Some of the ore to be treated contains considerable amounts of iron, lime, lead and copper, and would be likely to flux the walls of the furnace. This low-grade ore is, therefore, placed in the middle and upper part of the furnace at K, being separated from the floor and walls by a layer of purer ore, J. All the ore is mixed with enough coke to reduce the zinc it contains, but in order to prevent the overheating of the walls care is taken that the mixture K shall be a better electrical conductor than the mixture J so that the current will pass mainly through the middle of the furnace. E and F are heaps of coke serving as electrodes, the current flowing between E and F through the ore mixture. Electrical contact is made with the coke by means of graphite or carbon blocks and rods passing through the front and back of the furnace. G and H are connected to one cable bringing the current, and make contact with the coke F, while two similar terminals connect the other cable to the coke E. This furnace is the same in principle as on ordinary zinc retort, but the production of the necessary heat within the retort, which can only be effected electrically, enables the dimensions of the retort to be increased to any desirable extent, and the walls, instead of being thin, as was necessary when the heat had to pass through them, can be made of any suitable thickness. The furnace is necessarily intermittent in action, and would be allowed to cool somewhat to allow of the spent ore being removed through some convenient opening and a fresh charge being carefully arranged in the furnace before it could be again heated. The zinc vapours passing through the flue D would enter a system of condensing chambers, the first section of which would be kept at a temperature above the melting point of zinc in order to obtain that metal in the molten condition.

The electric zinc furnace of C. P. G. de Laval, Fig. 32, was patented some years ago, and has this advantage over the Johnson furnace, that the ore mixture can be continually charged into the furnace, and that the residues are fused and can be tapped out at intervals without interrupting the operation of the furnace. The heating is effected by an arc which is maintained between two carbon electrodes, one of which is shown at E. The ore mixture is introduced continuously by means of a charging shaft, A, or by a hopper and screw feed through the wall, F, and forms a heap, C, in the furnace, where it is gradually heated, the zinc reduced to the metallic state and distilled, and the residues finally melted by the heat of the arc. The vapourized zinc and the gases produced by the action of the coal on the ore escape by a passage, D, to condensing chambers, where the zinc is obtained in the liquid state. The heaping up of the ore in the furnace serves to protect the charging aperture and the gradual heating of the ore is probably an important feature of the process, as it allows the zinc oxide to be reduced to the metallic state, and the resulting zinc to escape from the ore before fusion sets in, as it is difficult to liberate the metal from its ore when in a pasty or fused state. The utilization of the electrical heat in this furnace is not perfect, but the operation is simple, and, therefore, not likely to give trouble. Information with regard to the actual working of the furnace is not available, so that it is impossible to say exactly how much power is needed to reduce the zinc, how perfectly the zinc is extracted from the ores, or how completely the distilled zinc condenses to the liquid state. The process has been in operation commercially for several years in Europe, where three plants are now in operation. Three thousand H.P. are employed at Trollhattan (Sweden) in the reduction of ore and zinc ashes (galvanizers' waste), 4,000 H.P. at Sarpsborg (Norway) in the reduction of zinc ashes, and 1,800 H.P. at Hallstahammar in the smelting of ore. †

*Richards' Metallurgical Calculations, Part I., p. 80.

**W. McA. Johnson, Electric Zinc Furnace, U.S. Patent 814,050, filed May 24, 1904.

†Report of the Commission to investigate the zinc resources of British Columbia and the conditions affecting their exploitation. Ottawa, 1906.

M. A. Salgues* wrote an account of the electro-metallurgy of zinc, and figured two or three furnaces, one of which, intended for use with 100 kilowatts, is illustrated in Fig. 33. It consists of a chamber, built in two parts, A and B, to facilitate cleaning and repairing, an off-take, C, for the passage of the zinc and other gases, a tap-hole, D, and two charging and poking holes, one of which is shown at E. Heat is produced in the charge of ore by the passage of a current between the carbon electrodes, F and G, F being movable and supported by a suitable carbon holder, while G is set in the base of the furnace, and electrical contact is made with it by the bar of metal, H. The furnace is built of firebricks inside an iron jacket, which is cooled by sprinklers shown at K, the lower carbon holder having a special water-cooling device, shown at L. The hearth of the furnace is, however, lined with sand, J, as is common in many smelting furnaces.

Salguès draws special attention to the means by which he keeps the furnace air-tight around the upper carbon and at the poking and charging holes. For this purpose he provides a heavy cast iron plate, M, in which are holes for the electrode and for charging, the latter being closed by lids, O. The gases in the furnace, being under a slight pressure, rush out through any opening, such as the crack around the electrode, but a ring of asbestos, N, delays the gases a little, and the zinc vapour will then condense on the iron plate (which is cooled by a jet of water), and immediately closes the crack. In the same way, after charging or poking, the crack between the lid, O, and its seat is immediately sealed by the zinc, which condenses there.

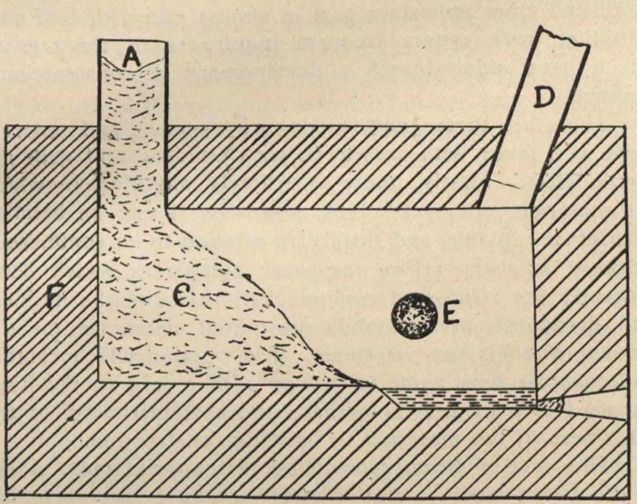


Fig. 32.—de Laval's Electric Zinc Furnace.

The charge, consisting of roasted ore and the necessary carbon for its reduction, being introduced at E, from time to time, lies around the carbon, F, and as it becomes heated the zinc is reduced and volatilized, passing through C to condensing chambers, while the residue of the ore, which would need to be fusible, collects in the molten state at R, and is tapped out at intervals. This furnace is continuous in operation, and incidentally allows of the smelting of associated metals, such as lead, which will collect in the furnace and be tapped out with the slag. The heat may be produced in this furnace by the passage of the current through the molten slag, R, but if the electrode, F, were raised higher an arc would be produced. Salgues experimented at Champagne (Ariège), France, with a modified carbide furnace of 100 kilowatts, and using ores carrying 40 to 45 per cent. of zinc, fed cold into the furnace, he obtained a yield of 5 kg. of zinc (probably zinc dust) per kilowatt day.

A notable defect in the electric smelting of zinc ores is the difficulty experienced in attempting to obtain the distilled zinc in the liquid state. In the older processes a large proportion of the zinc condenses as a liquid in the clay condensers, which are fitted to the end of each retort, and are hot enough to keep the metal liquid, a small portion passing on to the cooler "prolong" and condensing in this as a metallic powder; but the electric furnace makes very little liquid zinc, nearly all being in the state of powder. The explanation of this is probably that in the older process the ore was heated very gradually in the retort, and the reduction of oxide to metal was partly completed before the zinc began to distil from the retort. In this way the carbon monoxide, moisture and other products of the ore and the coal had been partly driven off before the distillation began, and the zinc vapours were in consequence more concentrated, and condensed more readily to the liquid state.

The conditions for the production of liquid or powdery zinc will be seen at once when it is remembered that the former corresponds to rain and the latter to hoar-frost or snow. A hot, moist wind being cooled to some temperature above the freezing point will form rain, while, if the air is so dry, that is, the water vapour is so dilute, that the air must be cooled below the freezing point before saturation occurs, hoar-frost or snow will result. Besides this general consideration there is the need of time and points on which the precipitation may occur; the slow distillation in the older retorts would, therefore, be more favorable to the condensation of zinc than the rapid work of an electric furnace, with a rush of gas carrying the zinc vapour into the colder parts of the condenser before the metal has had time to condense into drops. Salguès describes an arrangement for condensing the zinc in the powdery form in a series of tubes, the zinc being protected from oxidation and re-distilled in an auxiliary furnace, in which, as the vapour is quite concentrated, liquid zinc can be obtained.

It is in the smelting of mixed ores containing both zinc and lead, usually associated with silver, that the greatest advantage of electrical smelting may be expected. Such ores are very difficult to treat by ordinary furnace methods, because, if smelted as a lead ore in the blast furnace, the zinc makes infusible slags and chokes up the furnace with deposits of fume, and none of the zinc is recovered. If treated as a zinc ore, the lead makes the ore fusible so that it corrodes the retorts, besides yielding an impure zinc containing some lead. Treated in this way, the lead and silver can be recovered by smelting the residues from the zinc retorts.

The Broken Hill ores are notable examples of a mixed sulphide of lead and zinc which cannot be separated at all completely by mechanical means and must be treated as a whole by smelting or chemical methods. It occurred to the writer many years ago that such ores could be smelted electrically so as to recover at one operation the zinc, lead and silver from the ore; the zinc being distilled and condensed, while the lead, carrying the silver from the ore, collects in the molten condition as in ordinary blast furnace practice. Numerous experiments on a laboratory scale showed that this could be accomplished, and that the extraction of the lead was particularly good, only traces of that metal remaining in the slag.

The cost of smelting sulphide ores of zinc is materially increased by the necessity of a very complete roasting operation before the distillation of the zinc. Any sulphur left in the ore to be treated by the ordinary process holds as a rule about twice its weight of zinc in the residues, and it is, therefore, the practice to leave no more than about one per cent. of sulphur in the roasted ore. So complete a removal of sulphur involves a prolonged roasting at a very high temperature, thus largely increasing the cost as well as the loss by volatilization of the lead and silver in the ore. Some inventors have tried to avoid this by smelting the ore, unroasted, in the electric furnace, with the addition of some reagent for absorbing the sulphur, iron, iron ore alkaline salts and lime being suitable for this purpose.

F. T. Snyder, of the American Zinc Extraction Co., has patented* a process for obtaining zinc from a sulphide ore of this metal without roasting. The ore is mixed with carbon and fluxes (iron and lime) and smelted upon a bath of molten slag in an electric furnace from which the air is excluded. The inventor claims that the carbon reacts with the sulphur of the ore and forms carbon bisulphide, which is volatilized, liberating the zinc. It is not stated whether the iron and lime used as fluxes played any part in absorbing the sulphur and liberating the zinc. Direct current is used,

*Salguès, Bull, Soc. Ing. Civ., 1903, p. 174.

* F. T. Snyder, U.S. Patent 814,810, filed June 23, 1905.

and some electrolytic effect takes place, as the zinc is liberated at one electrode and the carbon bisulphide at the other electrode. The two vapours can, therefore, be kept apart and the zinc vapour, being undiluted, should be easily condensed. Even if the two vapours could not be kept separate, the amount of carbon bisulphide formed would only be about half as much as the carbon monoxide that would have been formed if the ore had first been roasted, and, therefore, the zinc vapour would be more concentrated and likely to condense better.

In an experiment, ore containing 20 per cent. zinc, 20 per cent. iron, 5 per cent. lead, 35 per cent. sulphur, and 20 per cent. of silica and alumina was mixed with iron and lime (and carbon) and fed into an electric furnace provided with carbon electrodes, between which scrap lead had been placed for starting the furnace. A direct current of 1,500 to 1,800 amperes at 7 to 15 volts was employed, heating the furnace to about 1,200° C. The ore melted and was reduced, zinc being liberated in the form of vapour near one electrode, while carbon bisulphide was formed near the other electrode. It is claimed that at least 94 per cent. of the zinc in the charge can be recovered by this process.

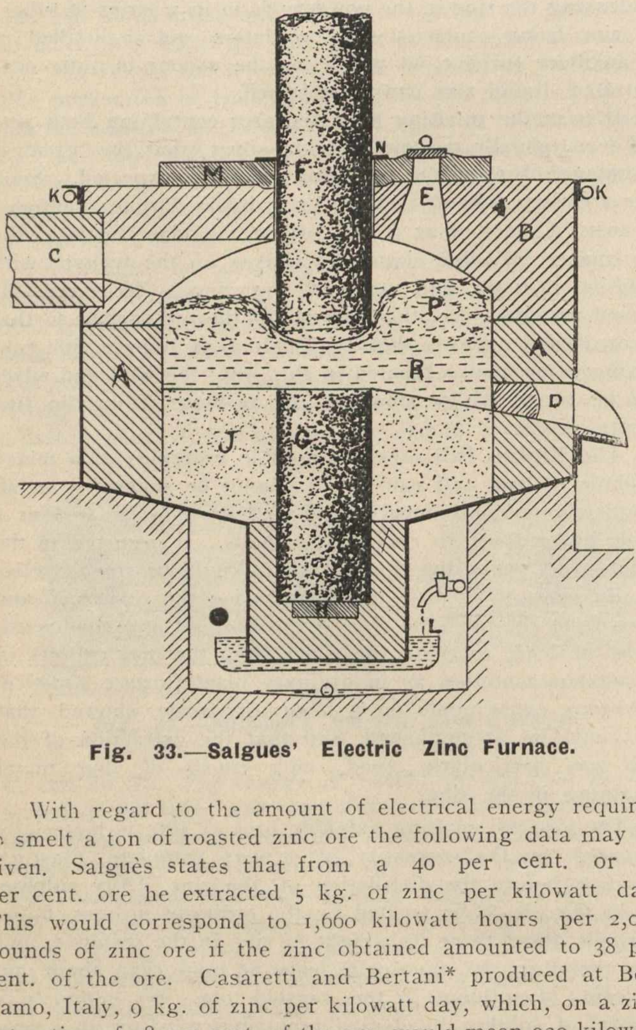


Fig. 33.—Salgues' Electric Zinc Furnace.

With regard to the amount of electrical energy required to smelt a ton of roasted zinc ore the following data may be given. Salguès states that from a 40 per cent. or 45 per cent. ore he extracted 5 kg. of zinc per kilowatt day. This would correspond to 1,660 kilowatt hours per 2,000 pounds of zinc ore if the zinc obtained amounted to 38 per cent. of the ore. Casaretti and Bertani* produced at Bergamo, Italy, 9 kg. of zinc per kilowatt day, which, on a zinc extraction of 38 per cent. of the ore, would mean 920 kilowatt hours per 2,000 pounds of ore. The writer, using a mixed lead zinc ore carrying about 25 per cent. of each metal, was able to extract both metals with an expenditure of from 800 to 850 kilowatt hours per 2,000 pounds of ore, using the ore cold, and in a small furnace of only 15 kilowatts. Snyder† has made a calculation, based partly on the fuel needed in blast furnace lead smelting and partly on the heat theoretically needed to reduce and distil zinc from its ores, and gives the formula, 623 + 5.4 per cent. of zinc for the kilowatt hours needed per 2,000 pounds of a lead zinc ore. From the above data it may be fairly inferred that smelting mixed lead zinc ores in large electrical furnaces would take less than 800 kilowatt hours, while for ores running higher in zinc, say, 40 to 50 per cent., about 900 kilowatt hours would be needed. These figures correspond to the treatment of the cold ore which had previously been roasted to remove the sulphur; if the ore could be charged hot from the roasting furnace, or if the carbon monoxide resulting from the smelting operation could be used to preheat the ore, a decidedly lower figure should be sufficient.

* Casaretti and Bertani, Report of Commission on zinc resources of British Columbia, 1906, p. 131.

† Snyder, Journ. Can. Min. Inst., Vol. VIII., 1905, p. 130.

PROGRESS IN CEMENT AND CONCRETE.

It is a somewhat difficult task to keep pace with the progress of industrial Canada. For a moment one's attention is drawn, on account of some special feature or other connected with it, to some particular industry. The steel and iron trades, for instance, have recently monopolized the attention of those interested in the industrial welfare of the Dominion. It is possible to become so engrossed in just one or two of the businesses that assist in making the country prosperous, it is perhaps excusable for the average man to sometimes overlook signs of development in corners least expected. The cement and concrete industry has placed itself, by its merits alone, in the category of successful Canadian enterprises. The fact that these materials are playing a more and more important part in almost every kind of construction work causes frequent inquiry as to the reasons which have induced such a development in constructional practice.

There are three good reasons why cement and concrete have won favor with architects, with builders, and with the public alike. Firstly, there is scarcely anything in which the materials cannot be used; secondly, it can be handled with great rapidity; and thirdly, in relation to its commercial value, it is cheap. Fire insurance companies watch complacently the reinforced concrete building; and the builders and occupants are granted substantial decreases in the amount of their fire premiums. The relation which cement and concrete have come to occupy with regard to the huge annual losses by fire, is perhaps the best testimony to the usefulness of the materials in building construction.

This fact is being recognized and appreciated. Away in the West, where factories and warehouses are springing up one after another in order to keep abreast of these good and prosperous times, one may observe that the most up-to-date buildings are in reinforced concrete. When a captain of industry establishes a big warehouse in a locality where, perhaps, fire organization is not as complete as he would desire, he is loth to trust his building by constructing his warehouse largely in timber, to the tender mercy of fate or to the whim of the will-o'-the-wisp incendiary. He greatly diminishes his risks simply by instructing his architect to prepare plans for a concrete building.

The industry has reached the stage of having its own exponent in the press. Much about it can be learned from a perusal of the columns of the "Canadian Cement and Concrete Review," a bright, informative illustrated monthly which is devoted to the interests of the trade, and which will undoubtedly prove of great assistance in guiding the footsteps of the industry of Canada, of recording its progress throughout the country, and so far as the Canadinan cement and concrete business is concerned, to advocate the motto "Canada First."

ACKNOWLEDGMENT.

In the December issue a very valuable article appeared, entitled, "Measurement and Volume, Pressure and Horsepower, at Pressures of One to Ten Pounds Per Square Inch." Through some inadvertence acknowledgement of the data and illustrations was overlooked. Publications was only made possible through the courtesy of the B. F. Sturtevant Company of Hyde Park, Mass., who permitted the use of the material, and also loaned the electrotypes. The article is an extract from their very excellent catalogue relating to "Steel Pressure Blowers."

CANADA'S NEW TARIFF

AS IT AFFECTS THE IRON AND STEEL INDUSTRY.

The iron and steel bounties, which are of the greatest importance to the Canadian iron and steel industry, would have expired in 1907, but under the new tariff they will run on for another four years, and at a higher rate per ton than at present.

When explaining the budget Mr. Fielding stated that judging from the information they had it would be necessary to encourage these industries by an extension of the time during which the bounty systems would be in vogue.

"Beginning on January 1st," said Mr. Fielding, "we propose to take the bounties of a year ago as a starting point, and so arrange them that they will run out at the end of four years. While we wish to encourage the iron industry generally, we particularly want to encourage iron made from native ore in order to encourage the development of the ores of Canada. We, therefore, make a special scale of rates for iron ore from native ore, the object of which is to show a more decided difference in favor of native ore than would be shown by adopting the old sliding scale.

Bounties.

"In 1897, we regarded it as important, that the cost of iron and steel to the consumer in Canada should not be too high, because iron and steel at moderate cost are the foundation of an immense variety of industrial enterprises. Therefore, we cut down the customs on iron and steel, and we arranged a system as follows:—On iron from native ore $3 per ton; upon foreign ore, $2 per ton; upon steel, $3 per ton. These bounties were fixed on a sliding scale, and gradually diminished. Last year they were fifty-five per cent. of the original amount. This year, since the 1st of July, they stand at thirty-five per cent. of the original amount. They will expire on the 1st of July next, under existing legislation. As we have six months to run yet, that means an extension period of three years and a half, four years from the 1st of January, but one-half year is provided under the existing law.

"We adopt to some extent a sliding scale. On pig iron manufactured from foreign ore for the calendar year 1907, $1.10 per ton; and for 1908, $1.10; for 1909, 70c.; for 1910, 40c. On steel ingots, we propose, in 1907, $1.65; in 1908, $1.65; in 1909, $1.65; in 1910, 60 cents. Iron bars are treated in the same way as steel ingots, but as they are not made in any considerable quantity, they are not of any practical importance.

"To-day the bounty on iron from Canadian ore is 35 per cent. of $3, that is equal to $1.05 per ton. The bounty on iron from foreign ore is 35 per cent. of $3, which is 70 cents per ton. The difference to-day is 35 cents per ton. This difference is not sufficient to encourage native industry. Those interested have represented that if we could have kept that difference of $1 there would be some inducement, some larger prospect of the development of native ores.

"For the year 1907 the bounty on iron from native ore will be $2.10, and on foreign ore, $1.10. For the next year we keep the figures the same, $2.10 for native ore, and $1.10 for foreign ore. For the third year the bounty on iron from native ore will be $1.70, whereas on iron from foreign ore it is reduced to 70 cents. Then for the fourth year we reduce the bounty on the native ore to 90 cents, and the bounty of the foreign ore to 40 cents, keeping up the difference of 50 cents between the two.

"We propose that these bounties shall not apply to articles exported. There are rumors that the great steel trust of the United States may come into Canada to do business in the ordinary way; well and good, but if it comes here to make up iron and steel for export it might add largely to our burden. We think it is well to have it understood that we are giving these bounties for the encouragement of iron and steel for consumption in Canada, and if any parties undertake to export these articles they shall not be entitled to the bounty upon it.

"Then there are bounties at present on angles, plates and iron rods. With respect to angles and plates there is a bounty of $3 and a duty of ten per cent. We have decided to abolish the bounty and allow these articles to fall as a rule into a third class at $7 per ton, subject to the preferential reduction. The bounty is at present $3 and the duty ten per cent.; we strike out the bounty and put them in with the usual tariff instead of the bounty in this case.

"The result of the change is to give about the same degree of protection but to get rid of the bounties.

"The resolution on iron and steel bounties is as follows:

"Resolved: (1) That it is expedient to repeal chapter 8 of the statutes of 1899 and chapter 60 of the statutes of 1903, from and after the 1st January, 1907.

"(2) That it is expedient to provide that the Governor-in-Council may authorize the payment from the consolidated revenue fund of the following bounties on the under-mentioned articles manufactured in Canada for consumption therein, viz.:

"(a) In respect of pig iron manufactured from ore, on the proportion from Canadian ore produced during the calendar years—1907, $2.10 per ton; 1908, $2.10 per ton; 1909, $1.70 per ton; 1910, 90 cents per ton.

"(b) In respect of pig iron manufactured from ore on the proportion from foreign ores produced during the calendar year—1907, $1.10 per ton; 1908, $1.10 per ton; 1909, 70 cents per ton; 1910, 10 cents per ton.

"(c) On puddled iron bars manufactured from pig iron made in Canada, during the calendar years—1907, $1.65 per ton; 1908, $1.65 per ton; 1909, $1.05 per ton; 1910, 60 cents per ton.

"(d) In respect of rolled round wire rods not over three-eights of an inch in diameter, manufactured in Canada from steel produced in Canada from ingredients of which not less than fifty per cent. of the weight thereof consists of pig iron made in Canada, when sold to wire manufacturers for use in making wire in their own factories in Canada, on such wire rods made after the 31st December, 1906, $6 per ton.

"(e) In respect of steel ingots manufactured from ingredients of which not less than 50 per cent. of the weight thereof consists of pig iron made in Canada, on such ingots made during the calendar years—1907, $1.65 per ton; 1908, $1.65 per ton; 1909, $1.05 per ton; 1910, 60 cents per ton. Provided that bounty shall not be paid on steel ingots from which steel blooms and billets for exportation from Canada are manufactured.

"(3) That it is expedient to provide that the Governor-in-Council may make regulations to carry out the intentions of these resolutions.

"(4) That it is expedient to provide that the Minister of Trade and Commerce shall be charged with the administration of the foregoing provisions."

Many who raise objection to this system of giving bounties fail to take into consideration the inevitable result if it was not adopted. It would be necessary to increase the duty on iron and steel, as otherwise many of our large industries, employing a considerable number of men, would probably be compelled to close their doors, a state of affairs which it is not desired should come about.

The British Preference.

The British Preference will be maintained, as Canada has become prominent, and derived an advantage from it. British sales to Canada decreased from 43 millions in 1890 to 29½ millions in 1897, in which year the preference was given; and since then the sales have increased to 69 million dollars. Dutiable goods have increased from 20 to 52 millions.

The money brought into Canada since the preference, through the lower duties on British goods, is estimated at 28 millions. The low British prices also govern to a considerable extent the sales from foreign countries in this country.

"The British preference schedule, while adhering to the general principle of one-third off, would have the duty applied to each specific article, and in some cases this would vary from 33 1-3 per cent. In some cases the preference would be less; in some higher; but on the whole it would be more favorable to Britain.

"Special account was being taken of British metals, and the preference on these would be increased, and would enable Britain to better meet severe competition.

"In future articles qualifying for the preference would require to have had 25 per cent. of their value put into them in the shape of British labor. This would prevent foreign countries sending goods here through Britain without work of much cost being done on them in Britain."

The Intermediate Tariff.

The object of this tariff is to provide Canada with a means to enable us to conduct negotiations with any country which is willing to give us more favorable trade conditions. It will grant a lower rate of duty than the general tariff. Where the duty under the general tariff averages 30 per cent. the intermediate tariff will be about 10 per cent. less. The advantage, however, enjoyed by countries under the British preference will still be very material.

"All we do then," said Mr. Fielding, "by adopting this intermediate tariff is to hold it up to countries abroad and say: 'This is something which you may obtain, if you desire, by entering into negotiations with Canada; you may obtain the whole tariff for equal compensation, or you may obtain a part of that tariff for compensation. You may obtain it from day to day by reciprocal legislation, or you may obtain it by a treaty, brought about through proper diplomatic channels. We do not, therefore, bring this middle tariff into operation at once, but we put it before the world as a statement of the terms and conditions upon which we are willing to negotiate with other countries, and in order that we may induce them to give us better terms and take from us a larger share of products of Canada."

Drawbacks.

The changes in the drawback clause amount to practically nothing. With the exception of a few articles it will remain the same. On some articles the regular duty will have to be paid upon entry, and after it has been ascertained that the material was used only for the purpose for which it was imported, a refund of 95 per cent. in the shape of a drawback, will be made.

Anti-dumping Duty.

The anti-dumping duty will remain the same as before, but will be of wider scope. Formerly it was applied only to goods subject to an ad valorem rate of duty. It is now unlimited in its application. Goods in which the duty is a specific sum per unit, or goods that came in free of duty may have as much as 15 per cent. ad valorem imposed upon them if it is found that they were bought at so much below the regular purchase price in the country of production. Speaking precisely, the anti-dumping duty is to be the difference between the buying price and the regular selling price, but is not to exceed 15 per cent. ad valorem.

A LARGE PRODUCER GAS PLANT.

There is being erected at the works of the Simonds Canada Saw Company, Limited, St. Remi, Montreal, the largest industrial producer gas plant in Canada. This plant is of 600-B.H.P. capacity, and is to be used both for driving gas engines and providing gas for the various furnaces in the works. For almost a year Messrs. Simonds have had a 50-B.H.P. suction gas producer and engine operating part of their plant, and the great saving effected by its use has gone far in inducing them to put in the present installation. The new plant consists of two independent producer units of 300-B.H.P. each, both having independent cooling and scrubbing apparatus, but discharging into one large gas-holder of the gas works type.

After leaving the producers which are of the Dowson type the gas is first thoroughly cooled in a series of horizontal cast iron coolers which have an exceptional radiating surface, it is then passed through a double water sealed box of special design, from thence through coke scrubbers of large capacity, and finally through dry purifiers, the gas is in this manner thoroughly cleaned of all tar, dust, and other impurities.

The first of the large engines will be erected early this year, and will be a four-cycle single cylinder horizontal unit of 150-B.H.P.

This engine is what is classed by English builders as "Special Electric Light Type," having extended crank shaft with outer bearing and only one fly-wheel of extra large diameter, and weighing ten tons. The crank-shaft bearings are of the continuous oiling type, similar bearings being also provided for the secondary shaft. The cylinder is provided with a removable liner, and all the valves are seated into loose boxes, the exhaust valve is fitted with the latest type of relief gear. A great feature of the engine is its water cooling arrangements; independent water cooling is provided for the cylinder, piston, cylinder head, exhaust valve and exhaust valve seat, in this manner premature ignition due to over-heating of the parts named is eliminated. Ignition is effected by a powerful magnetic machine.

The operator is provided with means of independently controlling the amount of air or gas, the time and intensity of the spark, and the engine speed. The engine is started quietly and easily by means of compressed air, one man only being required.

When completed Messrs. Simonds will have a plant to be proud of, and they are to be congratulated on their enterprise in thus setting forth in so practical a manner their faith in the future of producer gas.

The whole of the above-mentioned plant is being supplied by The Producer Gas Company, of 11 Front Street East, Toronto. G. P. Wallington, the manager, informs us that his company is looking forward to erecting many similar installations in the near future.

The erection of the plant is in the hands of S. G. Doyle, Engineer to the Producer Gas Company, and the building of the producer house, furnaces, foundations, etc., is being done by J. C. Miller, Messrs. Simonds' Engineering Superintendent.

The plant supplied is of British manufacture, but in future the producer plants will be of Canadian manufacture, built to the Producer Gas Company's own designs.

ELECTRICAL TRADES EXPOSITION: CHICAGO.

The second annual exhibition of the Electrical Trades Exposition Company, to be held in the Chicago Coliseum from January 14 to 26, is looked forward to with keen interest, and promises to be a much greater success than the one of last year. Indications are that by the time the big show opens the immense floor space of the exhibition hall will be completely exhausted. Telephone manufacturers and supply houses are taking special interest, owing to the fight between the Independent and Bell forces being centred around Chicago just now.

A splendid opportunity to observe the constant advancement in this important industry will be furnished, for the display of novelties will surpass any previous attempt. Telephone men particularly will be interested especially in a number of new features relating to their business.

During the exposition a number of organisations identified with the electrical business will hold their annual conventions at the Coliseum or at the hotels so that the delegates and members can attend both events. The Northwestern Electrical Association will hold its annual meeting January 16, 17 and 18, transferring the meeting-place from Milwaukee, where it usually convenes, to Chicago on account of the electrical show that will be in full blast at that time. The Western Electrical Association, the Electrical Salesmen's Association, the Allied Electrical Trades and other organisations will meet in Chicago the same week.

Manufacturers of telephone apparatus will exhibit all the modern equipment and visitors will be able to obtain many valuable and new ideas of the progress made in this line. Independent telephone men from all over the country will be represented by the exhibiting companies participating in the show.

DUST ON CITY ROADS: A PREVENTIVE.

In "The Canadian Engineer" for May, 1906, appeared an article directing the attention of municipal engineers to an alleged remedy for dusty roads. It appears that in England—the land of good roads—over 200 municipalities are using "Akonia," with satisfactory results. The trials at Harrowgate, Wembley, Harrow, Cheltenham, Buxton, etc., proved so eminently successful, that the Crown Commissioners have applied it to Regents Park, London, and other roads in their jurisdiction. The main streets of Athens are treated with this excellent road dressing. Notable instances of its application—where clouds of disease-spreading dust had hitherto been an almost intolerable nuisance—are at Brighton, for the motor races, and at Ascot for the "Derby." At the latter place a road area of 60,000 square yards was treated with "Akonia" on the occasion of the above meeting, and the result proved entirely satisfactory, although the weather was very dry, and upward of 1,000 motor cars and 1,500 other vehicles passed over the roads treated. Perhaps the best unbiased evidence available is the official report of Mr. J. Percy Bennetts, engineer and surveyor to the Harrow Urban District Council:—

The time has arrived (says Mr. Bennetts) when it is necessary for this council to consider what they intend doing this year to deal with the "dust problem," and for your guidance I beg to submit a report on the methods we adopted last year.

In September, 1904, I made a report to the council on the prevention of dust, giving details of a small experiment made with "Akonia," from which the following extracts are taken:—

(a) As a result of the above experiments and careful watching of the roads during the time, I am able to say that "Akonia" as a dust preventer is effective, the portions of the various roads treated during the experimenting periods being absolutely free from dust.

(b) From the appearance and state of the road after the use of "Akonia" I should also say that it acts in some degree as a road preserver, as it forms a coating to the surface which must somewhat protect the macadam from disintegration from vehicular traffic as well as atmospheric influences. I also found that after rain the quantity of mud formed over these surfaces was much less than on the untreated portions.

(c) "Akonia" is quite free from odor, which is the great objection to some of the other patent dust preventers, and it is claimed that it is not injurious to horses' feet, metallic substances, rubber tires, leather, clothes, etc.

After the above report the council decided to use "Akonia" last year, and certain roads, having a total length of about 6⅜ miles, with a superficial area of about 70,000 sq. yds., were treated, 53 tons of "Akonia" being used during the year.

From the more extended experience I can say that (a) and (c) of the above report have been fully borne out, as I think it will be agreed that in spite of it being a very dry summer, Harrow was practically free from dust last year, but I modify my opinion a little with reference to (b), as I noticed during the winter we had a larger quantity of mud than usual, and the roads appeared to be more easily picked up by the traffic than formerly, although at the present time they have again resumed their usual condition.

One reason for this increase may lie in the fact that the dust being bound with "Akonia" makes it a heavier and stickier substance than the ordinary mud, and, therefore, not so easily washed by rain, which under ordinary circumstances would have assisted in cleansing the road. Another factor to be taken into consideration is the excessive damp weather we had during the winter; out of ninety days in January, February and March rain was registered on fifty-six days, and the quantity was usually only just sufficient to keep the roads wet, and not such as would have assisted in keeping the roads clean. During these three months the roads hardly had a single chance to become dry.

On consideration it stands to reason that a material which keeps the roads damp in the summer will be sure to have the same effect in winter, and dust which under ordinary circumstances in the summer season would have been blown about and carried away by the wind is held down by the binding properties of "Akonia," so long as the road is regularly treated, but when the wet season sets in, and the treatment is discontinued, the "Akonia" is gradually removed and the dust released to appear in the form of mud. The question, therefore, naturally arises, Does the extra amount of mud formed in the winter warrant the disuse of "Akonia" as a dust preventer in the summer? I am inclined to think it does not, as where there is traffic a certain amount of mud in the winter is inevitable, and the extra quantity will not cause very much more inconvenience. The dangers to health from dust are well known, and I need not enlarge on them, except that I might mention the irritation caused to the eyes and throat and consequent complications, and the danger of dust accumulating on food exposed for sale. The relief to pedestrians, tradespeople and to residents cannot be estimated, while the extra inconvenience in the winter would hardly be noticed.

I am of opinion I used the "Akonia" excessively last year, as I depended upon it solely in dealing with the dust, but if the council agree to its use again, I suggest that it should not be used quite so often, but only as an auxiliary to ordinary watering and I would also propose to stop it at the end of August.

As the cost of watering is not kept separate for each road I am unable to compare that of ordinary watering with what we carried out last year, and the fact that the council own their own horses, the charge for the use of which is not dissected among the various details in connection with the council's work, prevents one from arriving at a proper esti-

Fig. 1.—Before Treatment with "Akonia": Clouds of Dust.

mate; but I am, however, able to give you a comparison of Mile and Station Roads, as the lengths known as Lyons, charge is made to the county council each year for these portions. The basis of the charge is the actual cost of the water and 10s. per day per horse cart and man.

	£	s.	d.
Average cost per year of ordinary watering for the four years ending March, 1905, about two miles in length	96	0	0
The cost with "Akonia" last year	116	10	0

I have received several letters from residents abutting on the "motor" roads asking that the treatment should be again carried out, and expressing their appreciation of what was done last year.

Since the advent of the motor car, the streets of our cities, and highways into the country, in the summer months —owing to the clouds of disease bearing dust sent up by the rapid travelling vehicles—have become almost intolerable,

Fig. 2.—An Hour after Treatment with "Akonia": No Dust.

In considering these figures it must, however, be borne in mind that there is no watering done on Sunday (when it is as much, if not more, needed than other days), and whereas ordinary watering did not cope with the dust, the "Akonia" proved effective. If Sunday watering had been included, say, to water the above streets once in the morning, the additional cost would have probably been from £8 to £10.

and at the same time dangerous to health. Hence, anything which will mitigate or remedy the dust nuisance should be welcomed. The evidence in favor of "Akonia," as a simple and comparatively inexpensive dust-preventer and road preserver, is worthy of serious attention by all city engineers and municipal authorities

ENGINEERS' CLUB, TORONTO.

At the regular weekly meeting, on December 6th, the engineers discussed power rates and factors which influence them. The question of Niagara power was uppermost in the speaking, which was critical of the Hydro-Electric Commission.

Mr. R. G. Black, of the Toronto Electric Light Company spoke on the cost of distribution, and declared that $4 per horsepower was absurdly insufficient for distribution of electric power in a city.

Mr. J. L. Aikens believed that instead of the $16 outlined by the Commission, more than double that figure would be required.

Mr. J. Stanley Richmond gave figures and arguments to prove that the cost per horse-power to manufacturers in Toronto would be $30.05, instead of the $17.89 which the Commission's report had estimated.

On December 13th Dr. Chas. Sheard, superintendent of the Medical Health Department, Toronto, addressed the Club on the subject of "Sewage Disposal Works."

Dr. Sheard says that the city's sewage should be purified by means of septic tanks, and then filtered. He believes that the pouring of the sewage into Lake Ontario, at a point nine miles east of the intake pipe of the waterworks would be positively dangerous, as when strong east winds are prevalent the sewage would be carried towards the mouth of the intake.

Dr. Sheard also says that the city water should have been filtered years ago.

A different view was presented by City Engineer Rust, who was called upon to express his opinion. Mr. Rust said that experience in other cities had shown that there would be no serious damage by pollution from a sewer outlet nine miles from the intake pipe. He had examined the water within a half mile of the sewer outlet at the Old Fort, and found it remarkably free from contamination.

Dr. Galbraith, of the School of Practical Science, and Mr. Willis Chipman made brief representations favoring the septic tank and filtratious process.

MARITIME POLICY WANTED.

In order to bring before the public of the Dominion generally, the great necessity of development in Canada's maritime enterprises, and the neglect of naval defence, the executive committee of the Navy League, Toronto branch, has passed the following resolution:—

"That it is not consistent with the true interests of Canada, either from a political or from an economic point of view, that we should continue to neglect all preparation to take our part in the naval defence of the British Empire, and that it is a duty we owe to ourselves, to our floating commerce, and to the Empire, that we should lay the foundations of a broad national maritime policy, in which naval preparation will go hand in hand with the development of Canadian mercantile marine, with the encouragement of the Canadian shipbuilding industry, and with securing for Canada her fair share of the world's maritime transportation."

BOOKS RECEIVED.

Producer Gas.—By J. Emerson Dowson, M. Inst. C. E., M. Inst., M.E., and A. T. Larter, B.Sc., London: Longmans, Green & Co. Size 6" x 9", pp. 295. Illustrated. (Price $2.52 net).

The Engineer's Sketch Book of Mechanical Movements.—By Thomas W. Barber, M. Inst. C. E. London: E. and F. N. Spon, Limited, 57 Haymarket. Size 6" x 8¾", pp. 355. Illustrated. (Price 10s. 6d. net).

The Anatomy of Bridgework.—By William H. Thorpe, Assoc. M. Inst. C. E., London: E. and F. N. Spon, 57 Haymarket. Size 5¼" x 7½", pp. 190. Illustrated. (Price 6s. net).

A Short Course on Differential Equations.—By D. F. Campbell Toronto: The Macmillan Company of Canada. Limited. 90c. net.

Qualitative Analysis.—(As a Laboratory Basis for the Study of General Inorganic Chemistry). By W. C. Morgan, Ph. D., Toronto: The Macmillan Company of Canada, Limited, $1.00 net.

Immediate Care of the Injured.—By Albert S. S. Morrow, M. D., Attending Surgeon to the Workhouse Hospital and to the New York City Home for the Aged and Infirm. Toronto: J. A. Carveth & Co., 6" x 9¼", pp. 340; 238 illustrations. $2.50 net.

NEW PUBLICATIONS.

Section of Mines, Annual Report for 1904.—By Alfred D. Ingall, M.E., A.R.S.M., in charge of the Mines Section of the Geological Survey of Canada. Size 6½ x 9¾, pp. 162.

The American Society of Mechanical Engineers.—Proceedings Mid-November, devoted exclusively to the presidential address "On the Art of Cutting Metals," by F. W. Taylor. This is a brilliant contribution to technical literature, and outshines anything previously presented before a society of this kind. Size 6 x 9, pp. 248. It includes 24 folders, containing tables and diagrams.

Proceedings for December, containing annual report of the council, and papers presented at the regular monthly meeting. Size 6 x 9, pp. 896.

* * * *

The Canada Year Book for 1905 is a comprehensive blue book compiled by Mr. Archibald Blue, chief officer of the Census Statistics Office. The volume contains an interesting summary of the events of the year—last year—but so far as Canadian history is concerned, much water has flowed down the St. Lawrence since the events noted occurred. That the volume is one of the most valuable issued cannot be denied. It is perhaps the handiest Canadian reference book published, and its value is enhanced by the fact that the statistics have been prepared as far as practicable in comparative form.

MITCHELL'S SELF-TESTING SAFETY CODE.

Mr. Mitchell of Colborne St., Toronto, has published, at $25 per copy, a revised edition of his Self-Testing Safety Code, which is constructed on a different basis from any other code in existence. Every word consists of ten letters. By the most ingenious arrangement you may get many words in one. One word will express any numeral from one to nineteen million, as well as any price in £ s. d. up to £1,000.

Words are also constructed in such a way by the placing of vowels that a mistake can be detected on sight by a reader familiar with the scheme, which is easy to master. Where a mistake in transmission occurs the chances are a hundred to one that the context will supply the lost meaning.

The code is full of tables applicable to every class of commerce, for the compilation of which Mr. Mitchell travelled around the world so as to ensure authoritative accuracy. They cover every stock quoted on the New York as well as Canadian Exchanges. Indeed, there is nothing you cannot say by means of the code much more cheaply and securely than by any other method known.

As part of a word you can give the address of any firm rated by Dun's or Bradstreet's, and arrangements have been made by which users of the Mitchell Code, who wish to communicate with firms in distant countries who do not have it can send their message to a Mitchell agent, who will decipher it and transmit by local wire, and so effect a considerable saving.

The "Canadian Engineer" has examined the code, and cannot endorse it more effectively than it has by acquiring copies of it for its own use. Here is one example taken from an engineering table:

"YLUASYVAYW YDUMKUCJIN"—Want to purchase on equipment trust basis, balanced compound, Anth. coal, wanted for fast freight service. 2-6-2. Prairie type locomotive, cylinders 20" diameter, 26" stroke, diameter of driver 70", total weight 190,000 lbs., boiler pressure 200 lbs.

CORRESPONDENCE.

Editor "The Canadian Engineer:"

Sir,—In commenting upon my "Impressions of Canada" in the September issue of your journal, which owing to absence from headquarters I have only just seen you complain that I made no observations about the Canadian weather. But is it just? How can you expect a man from a tropical country, to think of the Canadian winter—which is what you had in view—in the middle of August?

You will be interested to know that a Canadian winter is far more enjoyable and salubrious than its English brother, which closely resembles the one on the Pacific coast, in being damp, chilly and sickening with its gloom. In my opinion, you get more sunshine in Canada on an average winter-day than they do at Brighton, Eng., mid-summer. You have to thank your own countrymen for their unnecessary, apologetic, and almost pathetic nervousness when discussing your winter with foreigners. But your newspapers go a little farther. Think of a paper talking of ears and noses freezing at Montreal in the first fortnight of December, and at other times proposing that any man who talks of ice-palaces should be sent to a penitentiary.

I am confident the public would like to hear my view of the Canadian winter—as that of one born and brought up, as well as his forefathers, for centuries before him, in a tropical country.

Yours obediently,
NANABHAI D. DARU.

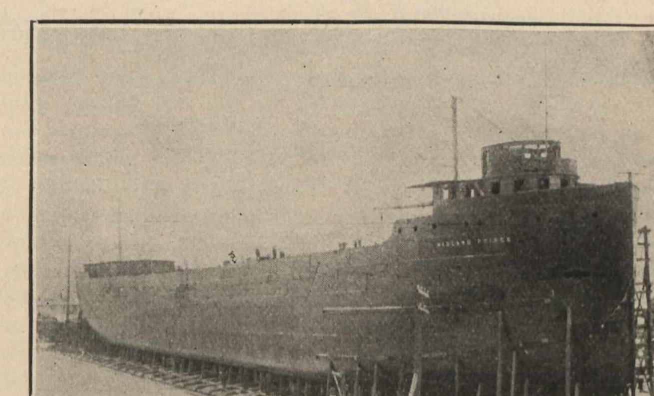
Ottawa, December 17th, 1906.

[In a subsequent letter, dated December 19, Mr. Daru says that this is not the first Christmas he has seen in the Dominion, having been in Canada in the winter time on a previous occasion.—Editor.]

THE MIDLAND PRINCE.

The largest boat ever built in Canada was launched at the yards of the Collingwood Shipbuilding Company recently. The steamer is being built for the Midland Navigation Company, of which James Playfair is president. She is 486'-0" long, 51'-0" wide, and 31'-0" deep, and will carry a cargo of 10,000 tons on a draft of 20'-0".

The equipment of the new steamer will be of the latest type. It will consist of two Scotch boilers, 15'-6" in diameter by 12'-0" long. These will supply steam to a triple expansion engine with 23" and 38½", and 63" diameter cylinders, with a stroke of 42". The engine will develop



The "Midland Prince."

2,200 H.P. The boat will also have the latest type of steam stearing gear, deck winches and steam mooring gear.

When making her initial trip next spring she will be complete in every particular, and will be able to handle cargoes safely and expeditiously, at a minimum cost.

The "Midland Prince" will enter upon the grain and general lake trade from Port Arthur, Fort William, Duluth, Chicago, and other ports, to points on Georgian Bay and the lower lakes. Her great length prohibits trading below the Welland Canal. The approximate cost of the steamer is about $365,000.

EXTRACTS FROM AN ENGINEER'S NOTE BOOK

HINTS ON TESTING A BOILER.*

How the Results Are Worked Out.

It is usually considered to be quite a simple and easy matter to conduct a test on a boiler. As with many apparently easy things there are two ways of doing the job. You may, if you wish to do it all in a slovenly fashion, just weigh the quantity of coal which you feed into the furnace, and also the quantity of water pumped into the boiler, and ergo, you have the result! But, of course, it is not so. With these two facts you have the bare statement that x pounds of coal evaporates y pounds of water—something which is rather worse than useless, for it may be misleading.

It is hardly necessary to relate the many fallacies which are to be met with among stokers. But let me give one point of advice. If a real good result is wanted, get hold of a real good stoker. There are few more difficult treasures to discover than such a man. Some inexperienced engineers think that any sandwichboard man will do to shovel coal on to a fire, which is the gravest error it is possible to make. Pick your stoker.

The Readings Needed.

At stated intervals certain readings should be taken. I will assume that the boiler only is being tested, and that the steam is running to waste, or being used in a manner which does not affect us. We will tabulate the readings to be taken.

Time.—The various readings must be taken at definite time intervals. On a long run perhaps once every fifteen minutes is sufficient, although readings once every five minutes are preferable.

Pressure.—The steam-gauge pressure must be noted. Tap the gauge before reading it as it may be that the pointer is stuck. If possible, be certain that the gauge is accurate.

Water.—Measure by means of a graduated tank, or, if necessary, by weighing, the amount of water fed into the boiler. Take the level of the water in the gauge-glasses accurately at the commencement of the trial, and finish with the same level of water in the boiler. Take the temperature of the feed-water.

Fuel.—Weigh carefully the fuel fed into the boiler and note the condition of the fire, and remember that you do not stoke a locomotive boiler in the same way that you stoke a water-tube boiler. Make the stokers keep the fire fairly uniform.

Take the air temperature and also the flue temperature. At the end of the trial take the mean of all the various readings. The following trial was run on a locomotive boiler, and is fully worked out.

The average pressure during the trial was 78.8 pounds per square inch, which gives an average evaporation temperature of 323.3 degs. F.

The total heat of steam from 32 degs. F.

$$= 1{,}082.1 \times .305 \times 323.3$$
$$= 1{,}082.1 \times 98.5$$
$$= 1{,}180.6.$$

This, allowing for the average feed-water temperature of 46.85 degs. F.

$$= 1{,}180.6 - 46.85 \times 32$$
$$= 1{,}165.75.$$

$$\text{Factor of evaporation} = \frac{1{,}165.75}{966}$$
$$= 1.206$$

The water evaporated per hour per pound of coal

$$= \frac{\text{Water per hour} \times 1.206}{\text{Coal per hour}}$$
$$= \frac{84.5 \times 1.206}{105.25}$$
$$= 9.68 \text{ pounds.}$$

The B.T.U.'s supplied per hour

$$= \text{Coal bunt} \times \text{calorific value} - \text{Ash left} \times \text{calorific value}$$
$$= 105.25 \times 14{,}500 - 9.417 \times 12{,}000$$
$$= 1{,}412{,}500.$$

The B.T.U.'s usefully employed per hour

$$= 84.4 \times 1{,}165.75$$
$$= 985{,}195.$$

The flue gas was analysed to find the proportion of carbon di-oxygen.

A special apparatus was used, in which the flue gas was passed into potassium hydrate, to absorb the carbon-di-oxyde, and into phosphorus to absorb the oxygen.

The flue gas was drawn into a central tube by means of a mercury reservoir being lowered and sucking the gas in. As soon as the tube was filled the pressure was adjusted to atmospheric pressure and the volume read on the scale. The gas was then passed three times into the vessel containing potassium hydrate, spread over gauze to present a large absorbent surface. This was sufficient to absorb all the carbon di-oxyde, and the gas having been passed back into the central tube and the pressure readjusted to atmospheric by means of the mercury column, the volume was read.

The gas was then passed into the vessel containing the sticks of phosphorus three times, and the volume again read after readjusting the pressure.

The percentages of carbon di-oxyde and oxygen could then be found by simple proportion.

The volume used in each case was 103.5cc, and the average percentage of oxygen found to be 17.3 per cent.

The average percentage of carbon di-oxyde was found to be 4.9 per cent.

Combined total is 22.2%.

Tabulated Results.

Grate area	8¼ sq. ft.
Heating surface	246½ sq. ft.
Duration of trial	4¾ hrs.
Average pressure during trial	78.8 lbs. sq. in.
Average temperature of evaporation	323.3 degs. F.
Fuel	Mardie coal.
Calorific value of fuel per pound	14,500 B.T.U.
Ash left	45 lbs.
Calorific value of ash per pound	12,000 B.T.U.
Total fuel burnt	500 lbs.
Average fuel burnt per hour	105.25 lbs.
Pounds of fuel burnt per hour per square inch of grate area	12.75 lbs.
Feed temperature average	48.85 degs. F.
Factor of evaporation	1.206
Total water evaporated in pounds	4,015 lbs.
Total water evaporated in pounds from and at 212 degs.	4,842 lbs.
Water evaporated per hour per pound of coal	9.68 lbs.
Extra evaporation due to level falling	170 lbs.
Water evaporated per hour from and at 212 degs.	1,019.3 lbs.
Chimney temperature. Average	342.8 degs. F.
Chimney temperature. Variation	91.0 degs. F.
Temperature of air supply. Average	70.0 degs. F.
Flue gas analysis. Carbon di-oxide	4.9 per cent.
Flue gas analysis. Oxygen	17.3 per cent.
B.T.U.'s supplied per hour	1,412, 500
B.T.U.'s usefully employed per hour	985, 200
Efficiency	69.7 per cent.
B.T.U.'s transmitted per square foot of heating surface per hour	4,000.

*C. A. Smith, B. Sc., in "Engineering Times."

GREAT BRITAIN AFLOAT.

The British Board of Trade has just issued an interesting blue book dealing with the world's shipping. It is more valuable than the average blue book, and is in fact quite a departure in official statistical literature, being arranged so that extensive comparisons may be made. The British flag was last year carried on vessels aggregating 12,332,404 tons net, which is practically half of the total tonnage of the world. While there was a steady increase in British tonnage, that of the United States has gradually declined. Fifty years ago over two-thirds of the shipping which crossed between this country and the United States was American owned; to-day the proportion is less than one-eighth, almost the whole trade being in British hands. The United States shipping has declined till it is less than half what it was in 1854. The decline began in 1860, and was continuous until 1892, since when there has been a slight revival. The following table represents the tonnage of different nationalities which passed between ports in the United States and the United Kingdom in the years indicated:—

	British.	United States.	Other Countries.
1854	780,142	1,908,004	89,937
1860	1,025,922	2,339,101	178,134
1870	2,675,396	832,628	299,585
1890	8,219,872	259,965	849,883
1905	12,177,641	943,987	1,846,567

The total tonnage registered with the American authorities for oversea purposes is 954,503, or not much more than a third of what it was in 1860.

America shows an increase in its coasting trade, its tonnage having doubled in forty years. Although so far behind in oversea trade, the States comes second to Britain in the coasting figures:—British Empire, 12,332,404 tons; United States, 6,456,533 tons; German Empire (1904), 2,353,575 tons.

ERRATA.—Folios from 483 to 499 should read 17 to 32.

DEVELOPMENT OF THE ROE PUDDLING PROCESS *

By James P. Roe, Pottstown, Pa.

In order to understand fully the object of the various steps which have been taken, as outlined in the history of the development of this process, it is desirable to have a fairly clear conception of what takes place in the ordinary puddling furnace, and a general idea of the different types of mechanical puddlers which have been tried or suggested by others.

The puddling furnace of to-day is a direct descendant of that built by Joseph Hall about 1830, with practically no change in its design or mode of operation. The furnace is simple in construction, consisting of a fire chamber, a chimney and a working hearth, the sides and bottom of the latter being formed of oxides of iron.

The puddling process consists of the following steps: first, making bottom and fixing, or fettling, the sides; second, charging the pig iron; third, melting; fourth, adding scale or ore to the bath, that is, making oxiding additions; fifth, agitating the bath by means of rabbles—the puddling proper; sixth, balling; seventh, drawing; eighth, and possibly the most important of all, firing, which is continuous throughout all the other steps. Without entering into full details of all of these steps, it is necessary to dwell more fully upon some of their important features.

A skilful puddler, one who does his work with relative ease, is always a good fireman and one who recognizes the importance of this period.

It is very important to fuse the whole charge as nearly at one time and at as low a temperature as possible. This is accomplished by moving the pigs about with a paddle, as they approach the fusion point, thus exposing fresh surfaces to the flame and to the dissolving influence of the bath. It also has the additional object and effect of preserving the bottom and keeping it smooth for the subsequent manipulations. The early and thorough disiliconization of the metal facilitates the working, and reduces the time of the operation, and this is usually brought about by means of the relatively pure oxide of iron remaining in the furnace from the previous heat.

Practice varies as to the period of charging the oxidising agents, some charging them prior to the pig iron while others do so after the iron is melted. When "bleeding" is practiced the latter is the better plan, and also when large furnaces are being used. Usually, however, the choice is largely a matter of personal preference on the part of the management. A large part of the silicon and some of the manganese is oxidised during the melting. The elimination of the manganese follows closely upon that of the silicon and is continuous until complete. The elimination of the silicon, however, is checked as the temperature of the bath becomes higher.

During the puddling proper nearly all of the carbon, together with most of the phosphorus and sulphur are removed from the metal by oxidation. This is accomplished by agitating or stirring the bath in the presence of suitable cinder and gases of the right composition and temperature. During the first part of this period the bath is agitated wholly by means of energetic stirring with rabbles, the object being to produce as uniform conditions as possible throughout the bath and to bring the iron and cinder into intimate contact. It also prevents the iron from sinking to the bottom, and the cinder from rising to the top.

The "high boil," which may be termed the second part of this period, begins upon the accession of sufficient temperature for the rapid combination of the carbon of the iron and the oxygen of the cinder. The carbonic oxide escapes in bubbles all over the bath and very materially increases its volume. The evolution of this gas is a most efficient agitator, provided the earlier steps of the process have been skilfully taken, but the use of rabbles is still required, although their principal function at this period is to prevent the iron from settling to the relatively cold bottom in a partly refined condition. During this period grains of iron may be seen carried about by the ebullition of the bath. They start to form when comparatively little carbon has been eliminated, enough, however, to cause solidification at the then existing temperature. As the temperature rises they are remelted, more carbon is eliminated, and they again solidify and so on, in a continuing cycle, to the end; some grains being formed while others are being fused, otherwise the action would be an explosive one. The operation is completed when the carbon has been so reduced in amount that the heat is not great enough to maintain the iron in a fused, or partly fused, condition. The evolution of gas has by that time almost entirely ceased, causing the "drop" of the bath, and the grains of iron rest on the bottom in irregular clusters, with the free cinder spread tranquilly between them. Besides the cinder enveloping each grain of iron, a considrable volume is contained in pockets in the clusters: the bulk of which is subsequently removed by squeezing and rolling. If the process has been skilfully carried out, all of the iron is now uniformly ready, except that resting directly on the bottom. The mass only needs to be turned once and is then ready for balling.

I wish to emphasise the desirability of a free "high boil," as, in its absence, undue physical exertion is demanded of the puddler; that is, the bath must be thoroughly agitated by one means or the other and maintained in an open, well-mixed condition. If this is not done, clusters of iron which are "ready" are apt to form about cores of partly refined iron which cannot be subsequently acted upon efficiently, thus furnishing a prolific cause of blisters in the finished product.

Proper cinder is vital during all of the periods. Its composition is controlled by additions, the temperature and character of the gases (these being regulated by the condition of the fire and the position of the damper) and by the absorption of some of the bottom and fettling, which adjusts itself automatically to a great extent. This feature of drawing upon the fettling for correction of the cinder, together with its capacity for self-regulation, is a very important one and saves a large percentage of the iron made, since the process is not infrequently carried out in a very haphazard manner.

In the process as conducted at the present time, the weight of the iron reduced from the oxides in the bath is greater than that of the metalloids oxidised. This should give a gain in puddle bar over the pig iron charged, but, from the period of the drop to the end, oxidation of the iron occurs by reason of its immersion in the cinder and from the air drawn into the furnace through the door or other openings. This commonly results in a net loss.

It is desirable to retrace some of the steps noted, and observe what takes place when the process has been unskillfully carried out. In so called hot melting, when the pigs are not moved about, one of two things happens and sometimes both. A portion of some of the pigs that is exposed to the greatest heat drips down at too high a temperature, and, being allowed to rest, cuts holes of various sizes and depths in the bottom. This is always disastrous and frequently results in "aproning," that is, a slight reaction starts but is checked by the chilling of the iron, which sticks fast to the bottom. Later, as the process progresses, the "ready" iron fastens itself to this "apron" of raw or partly refined iron, causing serious loss in quality and weight of iron and a sacrifice of time. Again, much of the iron may be fused and some pieces of pig remain unmelted. Then, while these are being melted, the portion already fused becomes unduly hot and the cinder rises to the top with a rapidity and persistency impossible to prevent with rabbles, so small in proportion to the size of the bath and applied by manual power. This excess temperature results in slow disiliconisation, which, in turn delays the elimination of the carbon, makes a slow and arduous heat in the absence of a free "high boil," and leaves too much to be done in the period of turning and balling.

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* Paper read before the Iron and Steel Institute, London, England.

The temperature and composition of the cinder are very important. If it becomes too highly oxidising, either from the additions or from the gases, the elimination of carbon becomes too rapid, resulting in a "gobbed heat," that is, the grains of iron are coarse and clot together too early in a compact mass of impure iron, difficult to turn and ball. On the other hand, the absence of sufficient oxygen in the bath, either from lack of additions or from too reducing a flame, results in a slow working heat, high in carbon, and of a steely nature if the furnace be hot.

In closing this brief description of the ordinary puddling process, I again wish to emphasize the necessity of keeping

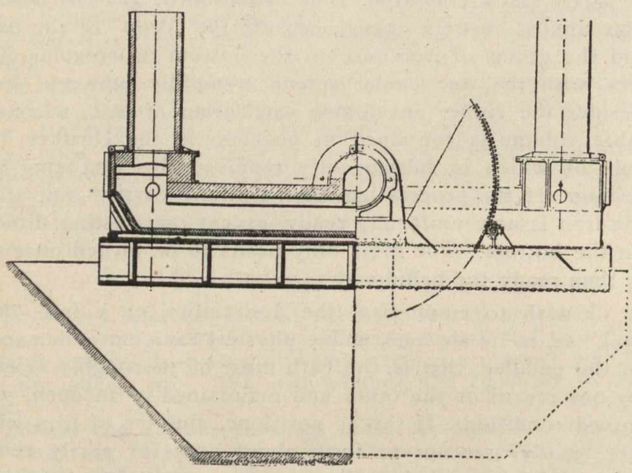


Fig. 1.—Roe Puddling Process.

a clean and smooth bottom and of getting the iron which forms on it, early in the heat, up to the top; since the bottom, being protected from the flame by the bath, is relatively cold. Both of these objects are readily achieved in the ordinary puddling furnace by proper care and skill.

The arduous character of the work in puddling and its consequent high cost, early suggested the desirability of lessening them by the introduction of mechanical means. These means have assumed various forms, too numerous to be discussed in detail. The space at my disposal will only allow the consideration of typical instances.

The mind of man commonly and naturally runs along the line of making modifications in old channels rather than that of seeking for new ones. Therefore, as was to be expected, the earliest efforts were to retain the furnace as it existed and to substitute mechanical for manual power in manipulating the rabbles. These were evolved rather by the mechanical mind than by that of the practical puddler and, although they assumed many forms, they were all open to the same objections. Perhaps as good examples as any of this type of puddler may be found in those of Messrs. James Whitman, John Griffith and F. W. Stoker.*

Since the sides of the hearth are, from the very nature of the lining, irregular in form and, as explained, are called upon to feed the bath, they are constantly varying in size and shape. They are, therefore, ill adapted for rabbles of this type, since the first requirement of a successful mechanical application is a constant condition, or a constant cycle of conditions. The mechanical rabble only attempted to cover the one step of puddling proper, and ignored those of charging, moving the pigs, turning the iron, balling and drawing. It made no improvement in the methods of fettling and firing and was, as a whole, an unproductive complication.

Revolving furnaces may be roughly divided into three classes: namely, those having a variable axis of revolution, those having an approximately vertical axis and those having a horizontal axis. Those having a variable axis, of which the Godfrey-Howson puddler† is the best example, had the advantage over the other revolving furnaces in that they could discharge the ball when finished, but they had most of the disadvantages of the others and, like them, failed to keep the iron open or apart towards the end of the heat, and balled the iron before all of it was ready.

* Jour. L. and S. Inst., 1873, Vol. I., pp. 95, et seq.
† Jour. I. and S. Inst., 1877, No. I., pp. 146, et seq.

The furnaces with axes, which were nearly vertical, had stationary fire chambers, flue sections, roofs and side walls, the latter having the necessary openings for charging, etc. The hearth was shaped much like a saucer and revolved on a plane only slightly inclined. The turning of the pan, even with the assistance of the inclination, failed to produce sufficient agitation of the bath to do more than very slightly hasten the refining and utterly failed to clean the bottom or ball the iron. It was necessary to resort to the use of rabbles and paddles for this work, as in the ordinary furnace, and fettling and firing was done in the old way. They were, therefore, practically in the same category as the ordinary furnace, plus a complication which produced little, if any, improvement. The Pernot* furnace may be considered in this class.

Furnaces revolving about a horizontal axis generally consisted of stationary fire chamber, revolving hearth and removable flue section, the latter being moved to give access to the hearth for fettling, charging and drawing. In some cases the hearth was polygonal in cross section, as in the Spencer furnace,** instead of being circular, or was bodily removed from between the fire chamber and flue as in that of Menelaus,*** instead of having the latter removed from it. The Danks† and the Crampton‡ furnaces may be taken as the highest types of this class. They succeeded in reducing the manual labor of puddling and balling the iron, and possess the important feature of working on a hot bottom. They looked exceedingly promising but ended in failure as far as producing puddled bar was concerned, and their product was only available as stock for the open-hearth furnace. Their shortcomings, common to all, were the excessive time and labor required for fettling: the difficulty in drawing the ball, or balls, the troubles connected with the fact that the lining was alternately serving as roof and bottom so that pieces of the fettling dropped off and were enclosed in the ball: and, worst of all, the balling of the heat before all of the iron was ready and the impossibility of modifying or delaying it in any way, which resulted in raw iron in the ball and blisters in the finished product. The designers of the rotary furnaces generally showed more knowledge of the practical requirements of puddling, but still failed to grasp all of the conditions of the problem.

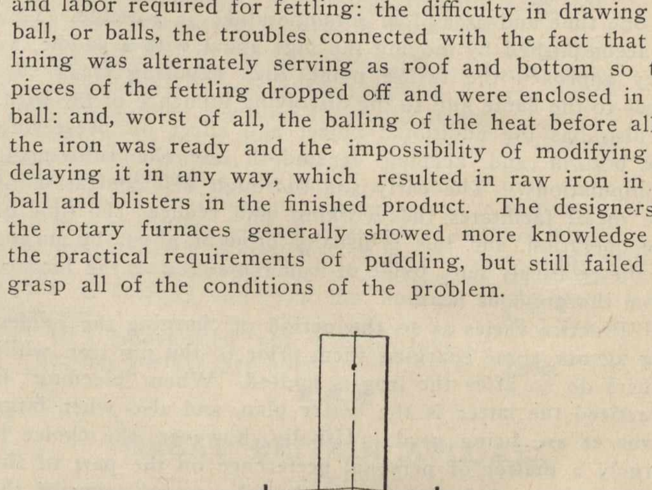


Fig. 2—Roe Puddling Process.

The only remaining kind of furnace to be considered is that in which the hearth is tilted or rocked. There were several varieties of this type. Some of them like regular puddling furnaces mounted upon transverse trunions, the

* Jour. I. and S. Inst., 1874, No. I., pp. 143, et seq.
** Jour. I. and S. Inst., 1872, Vol. I., p. 318, et seq.
*** zeit des Ver. deutscher Ingenieure, 1865, Vol. II., p. 107.
† Jour. I. and S. Inst., 1871, Vol. 2, p. 258, et seq.
‡ Jour. I. and S. Inst., 1874, p. 42, et seq.
‡ Jour. I and S. Inst., 1874, p. 384, et seq.

fire chamber moving with the hearth, while the flue made sliding connection with the stack. These furnaces agitated the bath in a measure and hastened the puddling proper, but they were limited in the angle they could assume by the washing of the bath over the bridge wall and could neither clear the bottom, ball the iron, nor discharge it when balled.

The Gidlow and Abbott furnace* is a good illustration of this type.

Another variety had hearths which rocked either on transverse or longitudinally arranged trunions inside a chamber which had fixed roofs, sidewalks, fire chambers and flues.

Here again the construction limited the angle of oscillation, so that the cinder and iron would not splash or flow over the sides or end of the hearth, since, besides the loss of iron, such splashing would soon prevent the hearth from moving at all by chilling on the walls of the chamber. These furnaces could neither clear the bottom, turn the iron, ball nor discharge it. The Jones† and Daelen‡ furnaces are, perhaps, the best types of this class.

Besides these comparatively simple furnaces there were a number of others which were most complicated in construction, difficult to operate and utterly impossible to maintain in the presence of the active chemical comparatively high temperature. Generally speaking, all of the designs briefly alluded to above, were hampered by too narrow mechanical limitations, some were too complicated, and all of them have failed to prove themselves capable of effecting the whole of the process, that is, puddling, balling and drawing. Those that showed the most knowledge of puddling also showed the overhanging influence of the ordinary puddling furnace, while those that appeared to have been designed by mechanics show an absence of knowledge concerning the details of practical puddling.

The puddling process is really very simple and early appealed to the writer as one that admitted of mechanical solution, provided it was approached broadly as a process and tradition was ignored. Further, it seemed to him necessary that mechanical means should be associated with large units and the use of metal direct from the Blast furnace, that is, that the same broad means that have made possible the low cost in the modern production of steel should be utilised as far as possible. In looking over the field for means of agitation, that of simply flowing by gravitation had strong attractions, due to its simplicity. That is, given an inclined trough properly enclosed and heated, the angle with the horizontal increasing as it descended, lined either with oxide of iron or some neutral material, and then having a charge of molten iron and cinder poured in at the top. Theoretically, a crudely shaped ball should result by the time the metal reached the bottom, provided the trough was long enough. Although attractive, the proposition was an impracticable one, first, because it was ill adapted for experimental purposes on account of expense, since the trough would have had to be about 2,000'-0" long, and elevated about 600'-0" at the top; and, secondly, the cinder would almost always separate itself from the iron and lead in the race for the bottom, it being more fluid at most stages of the process, and the iron being retarded by friction on the bottom. The idea was neither better nor worse than many of the puddling machines proposed, but it contained the germ of what has since been worked out.

The underlying thought was that the long incline, with the wave effect it naturally produced, was good. Following along this line, it became evident that a trough of considerable length, down which the bath could flow, first in one direction and then in the other, would possess all the advantages of the long fixed trough, together with the additional one of a sudden arrest at each end, by which the bath would be forced through itself, and greatly increased thoroughness of mixture would be obtained. This arrangement would also utilise the retardation of the lower stratum of the iron by friction on the bottom, producing the effect of waves running up a beach, at the same time correcting it before it became excessive. It was first determined to make the trough 50'-0" long, but a compromise was finally made with the scrap pile at 28'-0", since that was the extreme length of the old girders on hand. I may say that the scrap pile had great influence upon the design of the first machine, which fact, besides its economical features, pointed out many things to avoid in later construction. The details of the machine can be seen from the longitudinal and cross sections shown in Fig. 1 and 2. It was not inaptly described by a visitor, who saw it in operation, as looking like a steam boat on land, hunting for water. The two long girders formed the substructure, upon which all of the moving parts rested, and were suspended from two hollow trunions placed opposite each other at the middle of the length. The flames from two stationary coal fire chambers passed through the trunions into the furnace and out of the stacks at each end. The trough, forming the bottom, was made of steel plates and was double, water passing through it to preserve the covering.

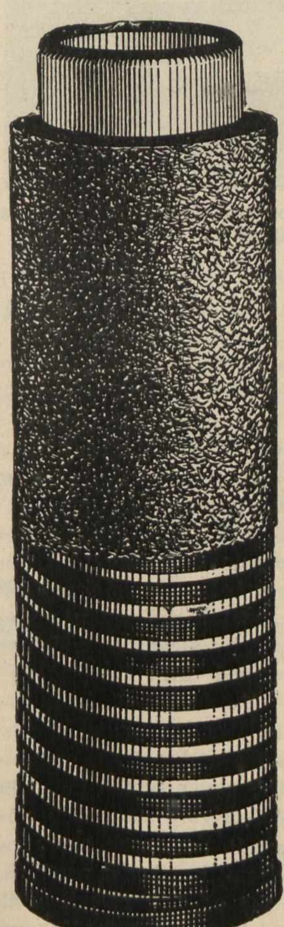
The question as to the material to be used for the first working bottom was important and complex. There being no definite data on which to base a decision, it was finally decided to lay a course of ordinary fire-brick on the flat, and to tamp upon this a 2" layer of rolled scale and tar. This was selected on account of its easy application rather than because of any supposed special fitness. It was not anticipated that the cooling influence of the water would be sufficiently felt through the brick to preserve them from combining with the oxide of iron of the covering, but it was hoped that it would last long enough to give valuable data.

(To be Continued.)

*Jour. I and S. Inst., 1878, No. I., p. 240.
†Am. Manufacturer, Vol. 49, 1881, p. 282.
‡German Patent, No. 4686, Aug. 4, 1878.

WOODEN WATER PIPES.

In the vicinity of coal mines, where the water is extremely bad and contains a large amount of sulphur, in tanneries, or in fact any place where metal pipes are subject to corrosion, the wooden pipe is fast proving its superiority. Metal pipes do not last long and the expense of frequently replacing same soon becomes a rather large item, particularly in places where long runs of piping are in use.



Metal Wound Wooden Pipe.

The pipe described is manufactured by A. Wyckoff & Son Co., Elmira, N. Y. It is composed of staves made of white pine jointed together with tennon and socket, and banded with steel hoops spirally wound, and over all is a covering of asphaltum cement. Pipes ranging in diameter from 6" up to any size required are constructed of white pine staves with regular tennon and socket, and 1½" steel hooping, which steel hooping is made acid proof by the application of the cement coating. This pipe will withstand a maximum pressure of 160 pounds per square inch.

A cement covered wooden elbow is also manufactured to fit the various sizes of pipe. This elbow is in the shape of a square box and is bolted together, the number of bolts depending upon the pressure that it is required to stand.

Our illustration shows the construction of the metal wound pipe, the spirals of the winding being spaced according to the pressure to be withstood.

THE STERILISATION OF WATER

In the sterilisation of water for drinking and industrial purposes the use of ozone has advanced rapidly within the last few years. The Municipal Waterworks of the city of Paderborn, Germany, affords a very interesting instance of the results obtainable. At these works ozone operations have been carried on continuously for about three years and a half, which has resulted in typhoid fever disappearing from the town.

Ozone, as well as being adaptable to central waterworks, also lends itself to the sterilising of water in small-sized apparatus, destined either for industrial work or for small

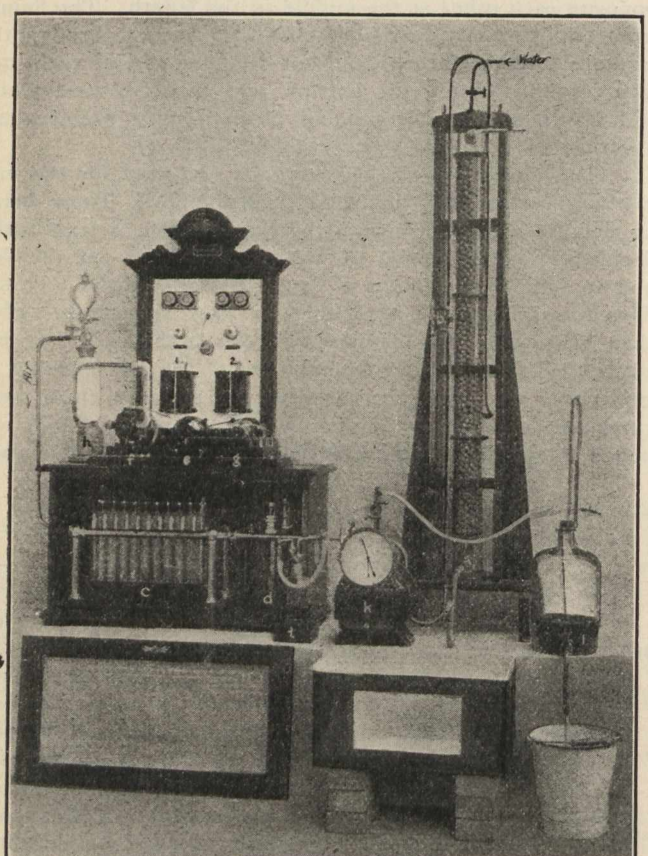


Fig. 1.—Ozone Sterilisation Apparatus for Bacteriological Research Work.

communities; or, finally, for military uses. Nor should its use in connection with experimental plants intended for scientific bacteriological research work be omitted.

A specially designed apparatus, for this purpose, is shown in Fig. 1 which may be connected with the ordinary socket used for incandescent lighting. The apparatus consists of a cylindrical sterilising tower made of glass, about 63" in height, an ozone apparatus mounted independently in a wood casing, and an outfit for gauging the amount of ozone.

The sterilising tower *a* is designed for a water current arriving on the top and issuing from underneath, and is filled with small glass, clay, or porcelain balls. It is fitted with a gauge tube with throttle valve, and a differential manometer *b* inserted in the ozone circuit, by means of which the amount of ozone may be ascertained with the aid of a standardised table.

The ozone apparatus inside the wooden casing consists of a 10-piece glass tube ozone outfit and a transformer *d*, while the apparatus installed on the cover of the box comprises a small direct-current motor, driving on one hand a small blower *f* that supplies the air to the ozone apparatus, and on the other hand a rotating circuit breaker *g*, producing an intermittent direct current for the primary circuit of the transformer. On the cover of the box is mounted a wash bottle *h* for drying the working air by means of sulphuric acid or calcium chloride, and on a switchboard are mounted two switches and two regulating resistances for the two circuits 1 and 2, viz., the direct-current motor circuit and the primary circuit of the transformer respectively. The ozone outfit comprises ten parallel ozone tubes, consisting of two concentrical glass tubes fused together at the top, the outer tube being placed in cooling water, whilst the inner is filled with water to enable it to be used also as a conductor to admit the high-working tension to the discharging poles of the ozone apparatus.

In a branch conductor, starting from the main ozone conduit between the tower and ozone apparatus, there have been arranged in series the following apparatus, serving to gauge the ozone in course of operation: A glass bottle *i*, fitted with mercury seals and filled with potassium iodide, intended for the absorption and titration of the ozone; a gas meter *k*, which further serves to measure the drawn off ozone; while a suction bottle *l* is used as a gas gauge in the place of the gas meter. Whenever the gas pressure allows the ozone to be thrown through the potassium iodide solution this suction bottle may be dispensed with.

In order to start the apparatus the motor circuit is first closed, and when the rotating circuit breaker is rotating properly the transformer circuit is completed through the switch at 2, the order being reversed for stopping. An alternative current may be used to advantage in many cases, when the working current will be supplied by a small direct-current, alternate-current converter.

A laboratory plant of the above type, susceptible of being adapted to any one of the usual tensions, requires for its operation about ¼ to ½ horse-power, according to the kind of current; and when using atmospheric oxygen in the shape of dried air, will supply, with an air current, 11 to 22 gallons per hour, as much as 76 to 92 grains of highly-concentrated ozone, as measured by passing it into a slightly acidulated potassium iodide solution. When using pure oxygen in the place of air an amount two or three times greater may be obtained, according to the rate of flow.

Some interesting stationary ozone plants for small water outputs (700 to 1,000 gallons per hour) have been recently installed in St. Petersburg, for the sterilisation of drinking water; in Astrachan (Russia) for mineral water, and in a Munich brewery for the sterilisation of rinsing water. This type of plant, Fig. 2, includes a scrubber-shaped sterilising tower filled with pebbles, and in which the ozone air comes in contact with a back current of water dropping down, a direct-current motor being coupled to an alternate-current machine, and driving at the same time a blower and a water pump. In this plant an automatic cut-off is used to stop the supply of raw water to the tower as soon as the tension of the transformer drops below the admissible limit, or if the flow of ozone air decreases below a given figure. The ozone apparatus comprises eight ozone tubes, having isolated internal aluminium cylinders and external glass cylinders surrounded by cooling water. The switchboard contains a switch voltmeter and fuses, as well as a starting resistance and a regulating resistance for the exciter.

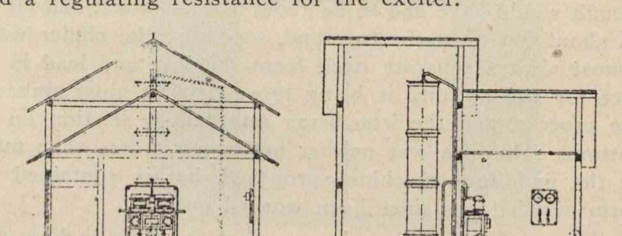


Fig. 2.—Water Sterlising plant for Operation on 110-220 volt Direct Current Circuits. Output 2,200 Gallons per hour.

A portable type plant has been designed for military purposes, and was in use by the Russian army in Manchuria, and is to be adopted by several governments for the water supply of fortifications, or as reserve in the case of epidemics in camps, is shown diagrammatically in Fig. 3. This military plant comprises two cars, viz., an apparatus car and sterilising car, on the former of which all motive outfits are located, while the other contains any stationary parts of the sterilising plant.

On the apparatus car is fitted a benzine motor of the well-known automobile motor type, an alternate-current machine direct coupled to the axle of the latter, and producing

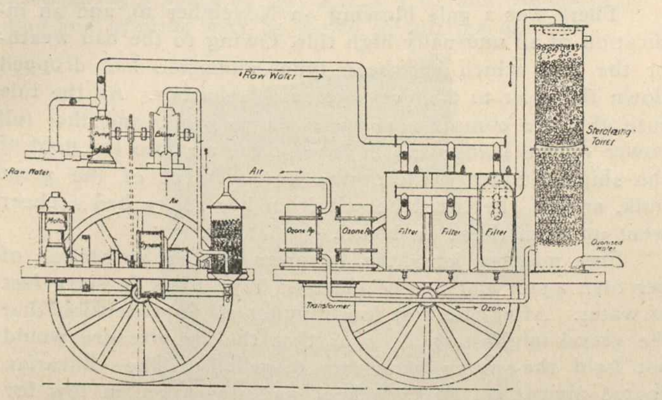


Fig. 3.—Transportable Ozone Plant for Military Purposes.

the low-tension primary alternate current for the transformer; a small toothed wheel water pump drawing in the raw water and throwing it into the sterilising tower, a small blower, supplying the air for the ozone apparatus, and the sterilising tower, and some spare parts.

The sterilising car contains two spring-supported Siemens ozone cases (one of which serves as a reserve), with eight ozone tube elements each; a transformer for generating high-tension current from the low-tension primary alternate-current derived from the apparatus car; three parallel preliminary filters, consisting of sheet metal cylinders that contain closed filter bags, through which the raw water is thrown before its admission into the tower, so as to be freed from any coarser impurities; a cylindrical sterilising tower made of iron sheets. This latter is filled with pebbles of the size of pigeons' eggs, or with cement-coated pumice stone; and consists of two parts placed one above the other, which may be inclined to one side.

The two cars are placed side by side in the course of operation, the water pump of the apparatus car throwing the raw water through a thick suction and pressure hose into the quick filters and the sterilising towers, while the air from the blower of the apparatus car traverses a thinner hose on its way to the ozone apparatus, and thence to the lower part of the sterilising tower. The primary current of the alternate-current machine is finally supplied through a cable to the transformer on the sterilising car.

The plant has been designed for an output of 500 to 600 gallons of water per hour, and the car requires for its operation an expenditure of about 2-H.P. It works without any circulation of the ozone air current, the ozone being generated with such a surplus as to be used only to one-third or one-half even in the case of the worst quality of water.

THE STEAMSHIP BAVARIAN RAISED

A feat the account of which will be interesting to engineers generally, and marine men throughout the world, was the floating of the Allan liner Bavarian, which was fast on Wye Rock in the St. Lawrence River, 38 miles from Quebec, since November 4th, 1905.

The Bavarian, which is a 12,000 ton vessel, 500 feet long, was practically turned into a huge steel bubble by being pumped full of compressed air, in order that she might float free of the rock.

Robert O. King and W. W. Wotherspoon are the young engineers who have successfully fought to free the great steamship from the grasp of the rock on which she was held fast for nearly a year, by the principle of compressed air as used in the construction of the large New York tunnels.

When the ship ran on the rocks on the night of November 3rd her bottom was badly pierced amidships. Many of the apartments filled with water, and when she settled down the engines were forced up so that the inner funnel showed 18" above the rim of the outer one, and the plates were so badly torn that the wreckers, after making a careful examination, declared that the raising of the vessel would be a most difficult proposition. More than $150,000 was expended by expert wreckers to reclaim the vessel, but it was of no avail. The owners worked on her for several weeks, and then turned her over to the London Lloyds, and the underwriters, after having tried all the old methods for raising ships, gave up the attempt, and reported that they would receive tenders from anyone who would undertake the work.

Last June Robert O. King, a graduate of McGill University in Civil Engineering, consulted a friend of his, W. W. Wotherspoon, a young engineer who was employed on the work of tunneling the East River, New York. He referred to the caisson work they had seen in connection with a large bridge, when visiting New York, when Mr. King asked Mr. Wotherspoon how a caisson sunk in the river differed from a ship without a bottom, and he remarked that he believed the water could be expelled from a wreck in the same manner that it was forced from the caisson. Mr. King then stated that he believed the Bavarian could be raised by using compressed air to force the water from her holds.

After a visit to the steamer it was decided that this method would prove successful, and the two young men made up their minds to tender for the salvage of the vessel. A contract, however, had already been awarded to Captain Leslie, of Kingston, who was again going to attempt the raising of the steamer. The plans were laid before the Captain, and he agreed to join the engineers in the salvage of the great ship, which was estimated to be worth at least $1,000,000.

Some difficulty was met in raising money for the enterprise, but after the plans had been approved by such men

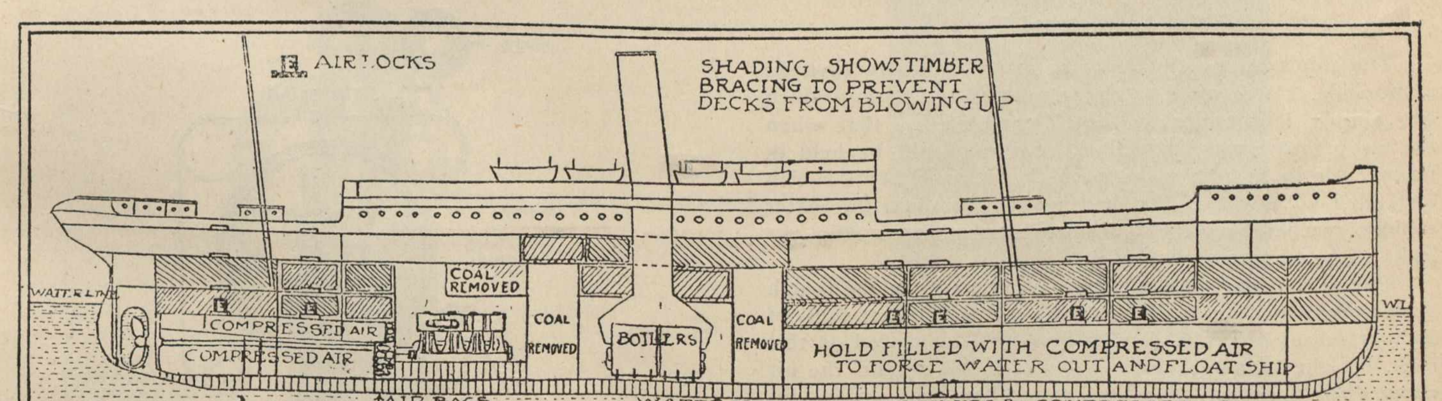


Diagram showing how the wrecked R. M. S. Bavarian was floated by compressed air.

as Judge Charles F. MacLean, of the Supreme Court; W. G. Rainsford, and Captain Thomas C. MacLean, of the U. S. Navy, and as it was deemed desirable to secure Canadian capital, a company was formed to carry out the work. The capital was furnished by Charles R. Hosmer of the Canadian Pacific Railway; T. J. Drummond, Montreal, and several New York men, and the engineers were given orders to proceed. A complete plant was arranged for, and the work begun.

Mr. Wotherspoon, who was to have charge of the work up to the bulwarks of the vessel, began getting his crew together at once, and as he had worked for a long time in and around the tunnels in New York he knew just what kind of men he needed for the task in hand. He had a close acquaintance with the genus "sand hog" that remarkable class of men whose ability to work under ground or under water in an atmospheric pressure several times greater than normal has excited the wonder of those who read about them.

"Sand Hog" Crew

Mr. Wothserpoon collected his crew with great expedition, many of the "sand hogs" and mechanics being engaged actually as they came off shift from the different tunnels of New York, and forty were engaged the day it was decided to hire them. They were put on board a train that night and started for Montreal.

Within two days these men, together with thirty more hired in this country, and the air compressing plant, were were taken by tugs from Quebec to the steamship. It took but a few hours to set up the machinery on deck and the men who had been brought from New York looked the Bavarian over.

There was a feeling among the men that the attempt to float the ship would be a failure and talk that if the vessel could be made to float by pumping her full of air she would turn turtle as soon as she got off into deep water. This fear was aggravated by some of the men who had been hired here, and who expressed doubts about going below under the air pressure. These fears were quickly dispelled, however, and the men went to work with a will.

Examination had shown that the Bavarian's bottom amidships was in a very ragged condition. The plating had been torn by the jagged rocks, and to patch it was impossible. The holes were so large that it would have been useless to try to pump the water out, so the preparations to blow it out through the rents in the bottom were hurried forward.

Holes Are Patched Up.

The ship's compartments were made as nearly air-tight as possible. Hatch after hatch was closed by plating which was simply laid under the hatch combing, so that when the air pressure was applied the covers would be held in place. Air locks were placed on the compartments which had filled with water. As the air was forced in the water rapidly receded and the workmen were able to stop the leaks with temporary plating.

One of the most difficult leaks to stop was in the fourth peak tank, which in the Bavarian is a great ballast tank of about 115 tons capacity. An air lock was not placed on this tank, but the manhole cover was put in place, and the air compressor applied. When the water had been driven out until the bottom was within a few feet of the surface, the manhole cover was taken off quickly, and the superintendent and a "sand hog" hurriedly dropped through. The manhole cover was put on and the air applied. This time the water was forced to the bottom, and the workmen closed the leak so completely that they were able to leave the tank at their leisure.

It had been planned to float the vessel November 15, on which day it was expected there would be a normally high tide, but instead a storm came on which caused a very low tide and the floating of the ship had to be postponed.

It was during this wait that the strain on the men's nerves was most apparent. Some of the "sand hogs" and the Italians who had been hired to take coal out of the bunkers began to murmur. They reminded each other that there was seven fathoms of water off the rock on all sides and that if the ship should turn turtle as soon as she floated off it would be pretty serious for all on board.

It was in this emergency that the presence of Mrs. MacLean, who had come on board two or three days before with her husband, Judge MacLean, proved fortunate, as she went among the men and reassured them by her composure.

She Floats Clear.

There was a gale blowing on November 16, and an indication of an unusually high tide. Owing to the bad weather the tugs which had been lying alongside had dropped down the river to a more comfortable harbor. As the tide rose the air compressors were set to work and the full power of the plant used in forcing the air into the hold of the ship. Suddenly there was a movement of the great hulk, and as she lifted herself from her rocky bed a cheer went up from those on board.

Five minutes later the Bavarian was in possession of her own again and floated clear of Wye Rock in sixty feet of water. After the first few minutes all apprehension that the vessel might turn over or that the air pressure would not hold the water back was dispelled. The Bavarian floated almost on an even keel, and was taken in tow for Quebec, where she lies beached near Wolf's Cove.

Estimates show that the cost of putting the Bavarian in a safe place, by the carrying out of this plan, was less than one-fourth the amount expended by those who attempted to salvage the vessel previously by the use of old wrecking methods. Only $30,000 was spent, and if the salvage is half the value of the vessel, the prize is worth approximately $500,000 to the company.

A CONTINUOUS BLUE-PRINTING MACHINE.

The Everett-McAdam continuous type blue-printing machine recently placed on the market has a number of novel and interesting features, which, through the courtesy of the Revolute Machine Company, of New York, we are enabled to describe and illustrate.

The principal feature of this machine is its ability to use blue-print direct from the roll without cutting into sheets, and to feed this paper to a continuously acting machine to which the tracings are supplied continuously and as rapidly as the printing can be done. As shown in figure 1, the roll of paper is placed at the top of the machine, and is fed through an opening to the printing apparatus, which consists of a rotating glass cylinder lying in a series of nar-

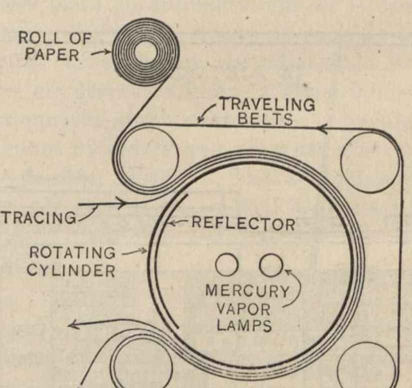


Fig. 1.—Diagram of Electric Blue-Printing Machine.

row belts, and within the cylinder are placed two mercury vapor lamps. The blue-print paper is fed continuously between the belts and the cylinder. If only a few prints are wanted, sheets of paper previously cut may be fed in. The tracings are inserted between the paper and the cylinder, and after passing around three-fourths the circumference of same, are deposited with the paper in a box in the front part of the machine. The printing is done from the inside of the cylinder as the paper and tracings travel around it.

To those who have to do with blue-prints the advantages of this arrangement are at once apparent. The blue-print paper itself is not touched by the hands; there is no limit to the length of prints, and prints as wide as 5 ft. may be made, which is the full width of the roll. The mercury vapor lamp which is used requires no attention, and as the printing is done from the inside all the rays strike the surface at practically right angles. The rays from this lamp are actinic, so that a very effective transformation of electricity into chemical action is obtained.

The machine is self-contained and only needs connecting to the nearest electric light circuit, when the motor and lighting apparatus are ready for operation. It is very compact, requiring a space of only 2 ft. x 5 ft., and the speed of feeding and printing may be varied to suit the operator.

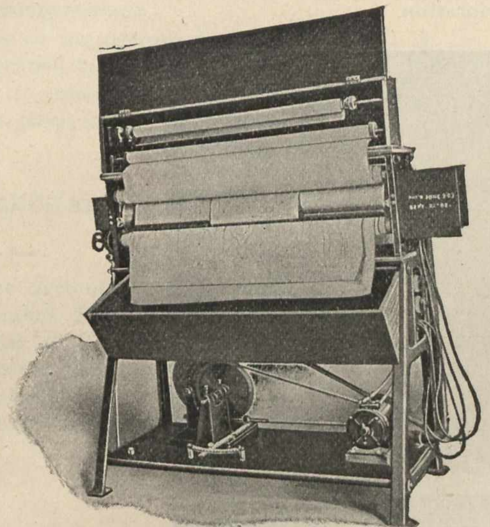


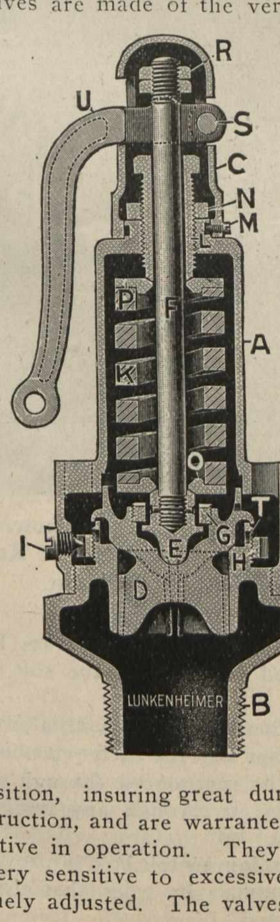
Fig. 2.—Everett-McAdam Electric Blue-Printing Machine.

A point that may be mentioned is that when printing large tracings from which a number of prints are required, the leading edge may be again fed into the machine as the trailing edge disappears, and the wasting of the paper is entirely eliminated.

Although the machine has been on the market only a year, forty of them are already in use daily, and the demand for them is steadily increasing.

IMPROVED POP SAFETY VALVE.

A recently re-designed Pop Safety Valve, which now fulfills, in all respects, the most rigid requirements is that manufactured by the Lunkenhimer Company, of Cincinnati, Ohio. These valves are made of the very highest grade of



bronze composition, insuring great durability; are very simple in construction, and are warranted to be reliable, accurate and positive in operation. They have full relieving capacity, are very sensitive to excessive pressure, and admit of being finely adjusted. The valves are provided with lock-key attachment, to guard against their being tampered with, and adjustments of pop lid and pressure can be made from the outside of the valve without taking it apart.

The springs rest between ball socket plates, which equally divides the pressure on the disc; are also encased, hence the valve cannot be affected by back pressure. They have bevel seats, at an angle of forty-five (45) degrees to the vertical axis of the valve; are provided with suitable levers, by means of which the discs can be raised from their seats, and they are allowed at the highest rating, i. e. one square inch of valve area to every three (3) square feet of grate surface of boilers.

To take the valve apart, the lever U is removed, then the bonnet C, after which the load on the spring is relieved by unscrewing the regulating screw L. The regulating ring screw I is then removed, and the bell A unscrewed. To set the valve for a higher pressure, it is only necessary to turn the regulating screw L down, and for a lower pressure, to turn it up.

The pop or action of the escaping steam is regulated by the ring H, in the base of the valve, which is easily accessible without taking the valve apart, and it is held securely in place when set by the regulating ring screw I on the side of the bell. If the valve pops suddenly, and does not relieve the pressure enough, the ring H is turned up, which covers the drill holes and causes the disc to remain longer off its seat. If the valve pops too much, opening and closing gradually, then the ring H is turned down.

When the desired adjustment is obtained, the ring is secured by means of the screw I.

There are a great many of these valves in use, and the demand for them is steadily increasing, as they are giving perfect satisfaction wherever installed.

ENTERTAINMENT BY TELEPHONE.

A demonstration of the possibilities of the telephone in transmitting, over one instrument, speeches, or vocal and instrumental music to be heard by a large audience,

Fig.. 1.—Horn and Telephone Receiver Suspended From Trees.

was recently made at Riverview Park, Chicago. With the exception of Coney Island, this park is the largest of its kind in the United States. Its attractions and entertainments are of the highest order, so that the demonstration was given one of the most critical tests that could be made.

During the intermission in the musical programme in the evening, the audience was entertained by vocal or instrumental selections that sounded as if coming from the trees. So well was the transmission made that many believed the musicians were concealed among the branches, while others thought ventriloquists were at work. That it was the echo of some powerful voice or instrument, was the opinion of others. None attributed it to the telephone, so well was the instrument hidden.

for whistling solos 12 volts are used, and for ordinary conversation to be heard clearly over a broad area 24 volts give the best results.

Though one of these transmitters has been used on this work the entire summer season and becomes so heated at every evening's entertainment when in continued operation for 15 or twenty minutes that one could not bear to touch the outer transmitter cup, it is said to have shown no signs of deterioration.

Fig. 2.—Simple Arrangement of Transmitter Suspended on Wall for Transmitting Piano Music.

The mystifying part of the performance was that the music came from trees in different parts of the garden at short intervals during the same selection, such as the cornet obligato in "Il Trovatore," which was accompanied by the orchestra in the band-stand.

The equipment used was the new transmitophone recently devised by the International Telephone Mfg. Co., of Chicago, consisting of one sending instrument with three reproducing lines and an accompanist's circuit.

Figures 3 and 4 show the sending station apparatus, consisting of a local battery portable telephone with batteries and battery case, head receiver and a three-line circuit

Fig. 3.—Sending Station Apparatus, with Cornetist Playing Directly in Front of Transmitter.

changer and other auxiliary apparatus, which was located in a room in the casino at one end of the park.

The telephone is equipped with an International transmitter made so that it will not fry, pack, sizzle or go dead when used with sufficient battery to produce a vibration of the receiver diaphragm strong enough to throw the sound through a megaphone so that it can be heard by a large audience.

For cornet or vocal solos 18 volts or 12 cells of "1900" dry batteries are connected in series with one ohm primary winding of the induction coil, through the transmitter and back to the battery which completes the primary circuit;

The durability and efficiency of this instrument is said to be due to the quality of the electrodes and granular carbon used in its construction. The carbon is made from selected crystal coal with the granules broken to a uniform and proper size, smoothly polished, thoroughly cleaned, and made as hard as possible.

The granular carbon is retained with the electrodes in a chamber that is supported on the diaphragm, and the sharp vibrations of the diaphragm when the instrument is used keeps the granules agitated and prevents packing.

All the working parts are so accurately made and adjusted and the transmitter diaphragm so evenly dampened,

Fig. 4.—One of the Sending Stations Showing Head Receiver Used by Soloist to Assist Her in Keeping Time With Accompaniment.

that the loud blasts of a cornet or brass horn are transmitted as clearly and distinctly as the soft, sweet voice of the lady singer.

The sending station is provided with a switching arrangement with a cam lever key for each reproducing circuit, so that the music can be reproduced through any one of the receivers at intervals, or through any two, or through all three simultaneously.

The circuit changing switch box is provided with proper binding post terminals in order that the lines may be conveniently connected.

The batteries are connected with a cut-in jack mounted at one side of the battery cabinet, so the sending instrument may readily be connected with the desired voltage. The sending station is also provided with a head receiver which is connected by a separate circuit to a highly sensitive transmitter placed in the band-stand as shown in Figure 3 at the left of the piano, to enable the soloist to hear the orchestra and band and keep in time and tune with the accompaniment.

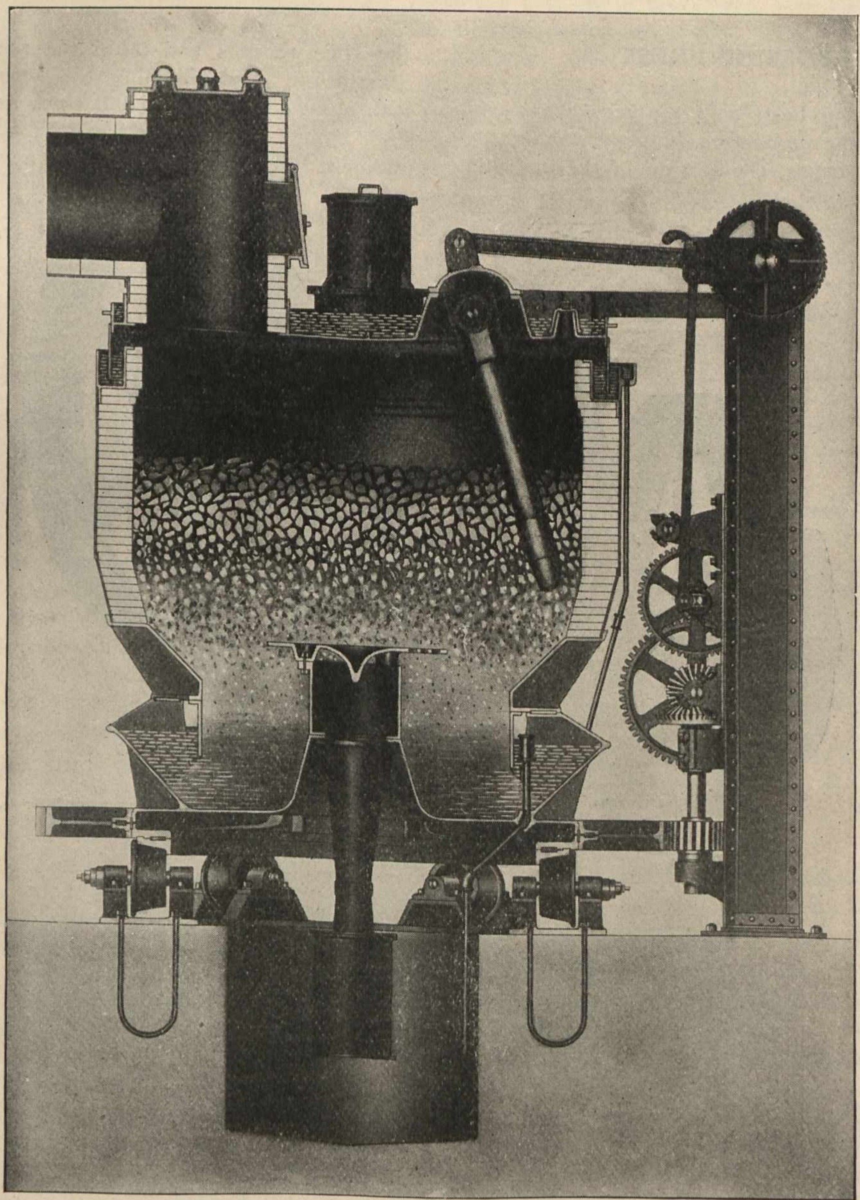
One of the reproducing instruments is shown in Figure 1, suspended in a tree at the right of the centre of the picture. It consists of a very powerful bi-polar horse shoe magnet receiver, provided with a large megaphone attached to the earpiece. The megaphone is painted black so it is not easily seen when placed in the trees above the lights.

The rubber covered wire which is used to connect the reproducers with the sending station is run diectly into the receivers and is thoroughly wrapped, where it enters the shell, with rubber tape to prevent moisture entering the working parts.

This demonstration not only opens a field for telephone apparatus that may be developed to an extent almost without limit, but it also shows the great efficiency and durability of the transmitter, as made at the present time, which is of considerable interest to every manager and owner of an independent telephone system.

A MECHANICALLY POKED CONTINUOUS GAS PRODUCER.

The accompanying illustration is a sectional view of the Hughes Patent Mechanically Poked Continuous Gas Producer, which is manufactured exclusively by The Wellman-Seaver-Morgan Company, Cleveland, Ohio. The special feature of the producer is the mechanical poker, which is a water-cooled steel casting suspended from a trunnion. The poker is oscillated by an eccentric rod in connection with a ratchet wheel, which in turn is oscillated by a pawl connecting with a crank driven through a reduction gearing from the main shaft. This mechanism moves the poker back and forth radially, agitating and breaking up the mass of coal while it is revolved bodily with the producer, and also assisting in distributing the coal and working down the ashes for removal. Thus hand labor in poking is eliminated and the fuel is not subjected to the variations in treatment incidental to hand poking. The uniform treatment secured by the mechanical poker has proved especially beneficial, it is stated, giving better and more uniform results as to the quality, quantity and supply of gas, and thus reducing the number of producing units and the size or number of buildings required for a given capacity. Under average conditions the capacity of the mechanically poked producer is claimed to average 25 lbs. per hour per square foot of producer area, and frequently 30 lbs. per square foot may be gasified for long intervals. The nominal capacity for the Hughes Mechanically Poked Continuous Gas Producer is one ton of coal per hour per producer, basing this estimate upon the standard size of producer, which is ten feet in diameter inside of the fire brick lining.



Mechanically Poked Gas Producer.

The main shaft and gearing are supported by steel frame work securely braced to the top of the producer. The gearing is accessibly located for removal or repairing. The producer shell is of steel plate and is secured to a cast iron base ring, to which is bolted a cast iron water seal, forming an ash receptacle. The base rests upon a cast iron revolving turntable, which, as it turns, rotates with it the body of the producer and the ash pan.

The bottom of the turntable is fitted with a steel tread resting on conical rollers. As the producer shell revolves, the ashes work down and are deposited in the rotating water sealed ash pan, from which they may be shoveled directly to a car by a man standing at one side of the producer, no special machinery being required. The producer is arranged for the usual fire brick lining. The producer top is a steel casting flanged and ribbed to provide for water cooling, a water seal being formed by a top flange at the outer circumference of the producer cover. The use of a steel casting for this part adds materially to its durability, as experience has demonstrated that steel castings withstand exposure to heat much better than cast iron, and decrease the expense for repairs.

The producer top is equipped with two feed hoppers fitted with counterbalanced bells and water-tight swing covers. These hoppers are located at different distances from the centre of producer top, and deposit the coal in concentric rings as the producer top revolves, thus facilitating the proper distribution of the material. To the top of the producer is attached the gas outlet, provided with cleaning door, peek holes, etc., and having a short flanged neck, to which a connection from the gas outlet to the gas flue may be made. The base of the producer has a gas inlet pipe, with a cast iron deflecting plate covering the air opening, as shown, and a suitable blower is furnished.

The quality of the gas produced by the mechanically poked producer, using bituminous coal, has been found, from repeated tests, to be very uniform, many of these tests showing between 3 and 4 per cent of CO_2, and from 26 to 28 per cent. of CO. It is claimed that an average uniform quality of gas can be maintained of the following composition by volume:

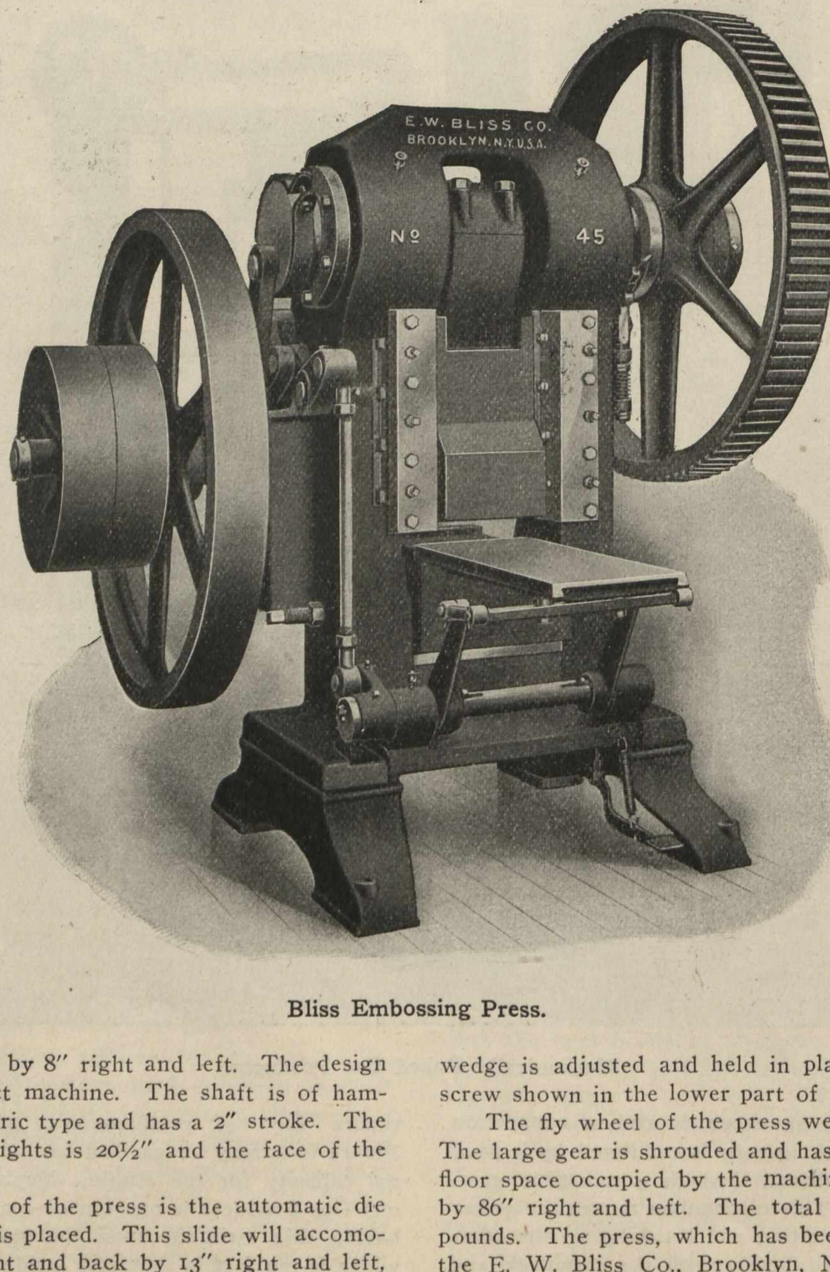
CO_2	CO	Hydro-Carbons	H	N
4%	25%	3 to 4%	13%	53%

These producers are usually driven by alternating or direct current electric motors, 3 HP. being sufficient to operate a single mechanically poked producer. The labor rerequired depends somewhat upon the arrangement of the plant and the facilities for coal and ash handling. In plants where the coal is delivered overhead into bins and fed to the producer through a chute or by other mechanical device, six men can ordinarily operate eight producers.

HEAVY EMBOSSING PRESS

The press illustrated has been built for very heavy embossing work, including the embossing of paper labels. It has a very massive steel frame, the section of the uprights being 12" front and back by 8" right and left. The design results in a very compact machine. The shaft is of hammered steel, of the eccentric type and has a 2" stroke. The distance between the uprights is 20½" and the face of the slide is 13½" x 19¼".

An important feature of the press is the automatic die slide on which the work is placed. This slide will accomodate a single die 12" front and back by 13" right and left, or several dies of smaller dimensions. After the treadle has been depressed, the slide automatically carries the work under the plunger. With the upward stroke of the plunger the slide recedes and takes the position as shown in the illustration. By detaching the automatic device and operating the die slide by hand, work as large as 18" front and back by 13" right and left can be accommodated. The adjustment is effected by means of a wedge in the bed. This wedge is adjusted and held in place by means of a large screw shown in the lower part of the press frame.



Bliss Embossing Press.

The fly wheel of the press weighs about 2,000 pounds. The large gear is shrouded and has a ratio of 7½ to 1. The floor space occupied by the machine is 84" front and back by 86" right and left. The total weight is about 19,000 pounds. The press, which has been designed and built by the E. W. Bliss Co., Brooklyn, N. Y., may also be used for forming and embossing operations in all kinds of sheet metal, and for this kind of work the automatic die slide is usually omitted.

BOOK REVIEWS.

Watson's Drawing-Down and Staving Scales.—Messrs. Longmans, Green and Co., 39 Paternoster Row, London, are now placing on the market a very simple and handy little instrument for the use of blacksmiths and forgemen. It consists of a number of scales drawn on celluloid, and mounted on cardboard, folding up like a book, and measuring when closed about 10 in. by 2 in. The scales being on the inside of the cardboard when folded, are protected from dirt and injury. They are for reckoning the allowance required for drawing down a bar to smaller dimensions, or for reckoning the allowance necessary for staving to larger dimensions. There are four scales; one for round to round and square to square; and one for square to round; one for round to square, and one for flats, with a table on the reverse side to be used in conjunction with this scale. The instrument is sold at 2s. 6d.

Practical Smithing and Forging.—By Thomas Moore, foreman and practical smith. London: E. and F. N. Spon, Limited, 57 Haymarket, pp. 248, 401 illustrations and numerous tables; 7½" x 5¼", 5s. net.

This excellent manual supplies a long-felt want. Like the sacred Vedas of India, the art of blacksmithing, from the days of Vulcan until now, has been largely a matter of memory-secrets handed down from one generation to another. What, hitherto, has been a tradition is now a science. This effort of Mr. Moore to systematize the operations of the smithy and forge is undoubtedly the most successful popular attempt yet made. He is to be congratulated on having furnished to the works manager, draughtsman, estimater, and even the rank and file blacksmith, a practical treatise simply invaluable.

Tables for the Use of Blacksmiths and Forgers.—By John Watson, lecturer in engineering, for Ayr County Committee, Scotland. London: Longmans, Green & Co., 39 Paternoster Row, E.C., 6¼ x 4¾, 2s. 6d. net.

This unpretentious, but exceedingly useful little handbook, ought to find a place on every draughtsman's desk; for in a clear, and easily understood manner, it shows the necessary allowances to be made in ordering iron and steel for the forging of shafts, spindles, hoops, etc. The author says,—"I have frequently been asked by young smiths for assistance in connection with calculations relating to their work, and have observed that the information required is generally about allowances for staving and drawing down, lengths of material to form hoops, and estimation of weights." To meet a general want, therefore, he has prepared on a unique plan, the tables, fully worked out calculations, and detailed instructions contained in this pocket-book of 88 pages.

Batter Tables.—By C. G. Wrentmore, C.E., Assistant Professor Civil Engineering, University of Michigan. New York: Engineering News Publishing Company, 10" x 8½", $5 net.

Seeing that structural steel work is coming into more extensive use, and competition among manufacturers becoming keener with every change of the moon, the survivors in the struggle will be those who effect the greatest economy in the production of work. The drawing office is the last place where cutting down of staff, and scrimping of wages should begin. But anything which will facilitate calculations in the designing of structures, and reduce to a minimum the chances of error in the draughting room, should be eagerly welcomed. A bridgework draughtsman ignorant of the use of Vega's seven decimal, logarithmic tables, would be as much a laughing-stock as a geographer ignorant of the use of the globes. We predict that the time is not far-distant when the knowledge and use of Wrentmore's Batter Tables will be just as essential. As the author states in the preface, his book is not intended to take the place of the standard tables of squares and logs; but to supplement them. The tables are arranged for 192 batters, from 1-16", 1-8", 3-16", to 12" per foot. Giving altitude and hypotenuse in feet and decimals of feet, for any base measured in feet, inches and sixteenths. An illustrative example showing the application of the tables is given, in the form of a knee brace from a column to a truss; accompanied by a lucid explanation. The book is printed on good paper, in large type, and is strongly bound in buckram. It is a credit to both author and publisher.

Technical Education in Evening Schools.—By Clarence H. Creasey, London: Swan Sonnenschein & Co., Limited, 25 High Street, Bloomsbury, W.C., pp. 309, 7½" x 5¼", 3s. 6d. net.

A thorough and efficient system of technical education is one of Canada's greatest needs. The country is crossing the threshold of a great industrial movement; due to the development of abundant mineral, water-power, and agricultural resources. The chances are, however, that unless a great and quick change takes place, the executive prizes will not fall to the lot of our Canadian youth; they will go to the better equipped United Statesonian, and British mechanics and artizans. Why? Because they have had better opportunities for getting a sound technical education than the average Canadian. In 1902, the writer held as part of his temporary duties the post of chief of the Employment Bureau to the British-Westinghouse Co., Manchester, England—a plant covering 130 acres, and now employing some 6,000 men. Every applicant had to submit his record on a form provided by the company. One of the astonishing things was, the number of mechanics, who had on their credentials, first-class applied mechanics; first-class machine drawing and construction; first-class electricity and magnetism; first-class steam; first-class chemistry, etc., etc. When asked for proof, straightway produced certificates from the British Government Science and Art Department, gained in the annual examinations in connection with evening science and art classes! In 1902-3, there were 657,000 students attending these evening classes in England. This is one of the secrets of the phenomenal progress in the iron and steel industries of the United States during the last twenty years—they got the cream of this intelligent artizan class of England. It is a fact, susceptible of abundant proof, that in all the great workshops in Philadelphia, Pittsburg, Cleveland, and Chicago, the responsible positions were largely held by Britishers, attracted by higher wages; many of whom gained their superior technical training in evening science classes under Governmental auspices.

The book before us, is an admirable exposition of the British system of evening technical classes, showing its advantages on the one hand, and shortcomings on the other, at the same time offering wise suggestions for improvements in the system. To everyone interested in the technical education of the youth of the Dominion, this book will be a revelation of remarkable educational work, which the Government of Great Britain has been fostering for years.

The Derry-Collard Company, New York. American Stationary Engineering.—By. W. E. Crane; pp. 285, 107 illustrations; 8" x 6"; $2.

Practical Papers:—

I. **Turning and Boring Tapers.**—By Fred. H. Calvin, 2nd edition, pp. 25, 8" x 5½", 25 cents.

VI. **Wiring a House.**—By Herbert Pratt, pp. 21, 8" x 5½, 25 cents.

The recent legislation in Ontario making it compulsory for stationary engineers to hold a license secured by examination before taking charge of steam plants over 50-H.P., renders a comprehensive knowledge of modern power-house installations absolutely necessary. Mr. Crane's book has been written to supply this very need. It contains "facts, rules, and general information gathered from thirty years' practical experience as running, erecting, and designing engineer." The book is written with a simplicity of style, lucidity of exposition, and absence of academic affectation, which always characterises work done by men who have a mastery of the subject upon which they discourse. The stationary engineer who reads, marks, learns. and inwardly digests the reasoning and data contained in this eminently practical volume, need have no fear of facing any competent board of examiners in Canada.

The same publishers send us two of their practical papers. The one on "Turning and Boring Tapers," ought to be in the hands of every tool-room man in our machine shops; for, on a few pages, the author has set forth invaluable data, which a few years ago, was the carefully guarded secret of experts. The other, on "Wiring a House," is the best popular, yet exhaustive account of the latest methods of scientifically equipping a middle class house for incandescent lighting that we have seen. From an assumed 110 voltage, the author takes us step by step, through the methods of scientifically equipping a middle-class house for ing wireage, making joints, etc. If there is one thing we miss it is a chapter on illumination; indicating the precise number of lights required for a given-sized room, and specifying where and how they should be placed to give the most effective service. This, however, is perhaps asking for too much in a 25 cent pamphlet which, sticks closely to the text of "wiring," and is a valuable contribution to the literature of electric lighting.

Elementary Principles of Continuous-Current Dynamo Design.—By H. M. Hobart, B.Sc., M.I.E.E., Mem. A.I.E.E. Toronto: The Macmillan Company of Canada, Limited, 27 Richmond Street West; 6¼" x 9¼", pp. 220 ($2 net).

As an addition to electrical literature for the student this work may be placed in the front rank. As indicated by the title, it is intended for the beginner, the author concluding that the reader understands the underlying principles of electricity and magnetism, and that he has some little knowledge of dynamo-electric machinery. It is not assumed, however, that he would be able to make calculations for even the simplest dynamo-electric machines.

From a careful survey of the book we find that it familiarizes one with the calculations which are part of a dynamo designer's daily practice. These calculations are set forth by graphic diagrams and formulæ, which the author has himself used. Illustrative calculations are shown, and the use of the diagrams and formulæ is comprehensively dealt with. The book contains seven valuable tables, and is profusely illustrated throughout. It would make a valuable addition to the library of any student in Electrical Engineering.

A Guide to Electric Lighting, for the use of householders and amateurs:—By S. R. Bottone. London: Whittaker and company, 2 White Hart Street, Paternoster Square. Canadian representatives, the Macmillan Company of Canada, Limited, 27 Richmond Street West, Toronto. Sixth edition, 1906. Size 7¼" x 5", pp. 226. 122 illustrations. (Price 1s. net).

This is perhaps, the best popular guide to electric lighting extant. The fact that it is in the 35th thousand is evidence that it has met a want. The data in chapter eight on the amount of illumination necessary for a given space, is new and valuable. The author says that "to light a room brilliantly there should be a 16 candle-power lamp to every 33 cubic yards of space, or a 20 candle-power lamp to every 40 cubic yards." An excellent table is given for the use of 10 candle-power lamps in rooms ranging from 15 to 72 feet square. It is also stated that "an arc lamp of 1,000 candle-power absorbing 10 amperes at 50 volts) is sufficient for 750 to 1,000 square yards in cotton mills, weaving mills, printing and bookbinding works;" and that "in engineering shops a similar lamp will afford sufficient light for 1,500 to 2,000 square yards, while in open spaces 1,000 candle-power will suffice for from twenty to thirty thousand square yards." The addition of a chapter on the diseases of electrical machinery would make this guide about perfection for its purpose. That the book is attaining wide popularity is not surprising, for although cheap it is thorough.

The Practical Engineer Pocket Book for 1907.—The Technical Publishing Company, Limited, 287 Deansgate, Manchester, England. 1s. 6d.

The 1907 edition of this valuable pocket book is very much superior to any previous issue, chiefly owing to the fact that the demand for the 1906 edition led to an enlargement to over 600 pages of comprehensive engineering data, which places it in the forefront of engineering pocket books.

The revision is extensive. Pages of doubtful interest to the general user have been omitted. The additions include notes on air pumps, suction gas plants, marine condensers, boiler setting, steam traps, engine governors, etc. Steam turbines are more fully dealt with, and the notes on engine-room accessories, cotton belting, and emery wheels have been added to.

Ice Formation, with special reference to Anchor Ice and Frazil.—By Howard T. Barnes, M.A.Sc., D.Sc., F.R.S.C., Associate Professor of Physics, McGill University, Montreal. New York: John Wiley & Sons; 9¼" x 6", pp. 250; 40 illustrations, $3 net.

In view of the phenomenal eagerness just now to utilize the abundant water-power resources of the Dominion; and the important part ice plays in the problems involved in the designing and construction of hydro-electric plants, the publication of an authoritative and reliable work on the nature of ice formation, and of the precautions necessary to avoid the troubles and dangers caused thereby, in connection with mill-races, dams, intakes, and hydraulic works generally, can only be described as an important event.

There was a time when engineers in charge of river works dreaded the advent of winter frost and snows; for it meant a season of constant anxiety and care, lest some morning they should awake to find their hydraulic plant rendered idle by the mysterious action of anchor-ice, or frazil in the unseen river depths; or their engineering works damaged by erosion caused by massive ice flows, or even swept away by the bursting of some tremendous gorge.

Only recently Mr. F. W. Harbord, a famous British Mechanical Engineer, pronounced against the economic production of "White Coal" in Canada, on account of "change of seasons." The book will do very much to enlarge the knowledge of ice phenomena of Canadian engineers.

Dr. Barnes' work contains the most philosophical discussion, and at the same time the most practical data on frazil and anchor-ice yet presented to the scientific world. The importance of the problems dealt with may be gathered from the following extracts:—"The worst effects which are met with in engineering works are from frazil-crystals formed during extreme weather," and again—"The accumulated mass of frazil, though porus and saturated with water, is as effective an obstruction to the flow of a river, with respect to the area occupied by it, as so much rock. The obstruction it creates may be inferred from the fact that it compels so great a river as the St. Lawrence to back up in winter fifteen feet."

The brief, but luminous chapter on "Methods of overcoming the ice problem in engineering work," is worth the price of the book. The comprehensive scope of the work may be gleaned from the titles of the chapters: (1) Physical laws governing the transfer of heat. (2) Physical constants of ice. (3) Formation and Structure of ice. (4) Sheet, frazil and anchor-ice. (5) Precise temperature measurements. (6) River temperatures. (7) Theories to account for frazil and anchor-ice. (8) Methods of overcoming the ice problem in engineering work.

This timely and opportune work ought to have a wide circulation among Canadian engineers; especially among our younger men, for great engineering projects in the form of canals and hydraulic works are in contemplation. With the author, we believe that "a thorough understanding of the laws underlying the formation of ice will lead to methods . . . . . which will so temper the effects of ice in our northern rivers, as to render them no longer a bar to the full development and utilization of our vast water-powers."

SAFEGUARD FOR INK BOTTLES.

A very cheap and effective way of preventing ink bottles from being upset on the drawing table is to simply cut a piece of card-board about 3" or 4" round or square, spread a thin coat of any good mucilage or liquid glue on the bottom of the bottle and set it in the centre of the card-board.

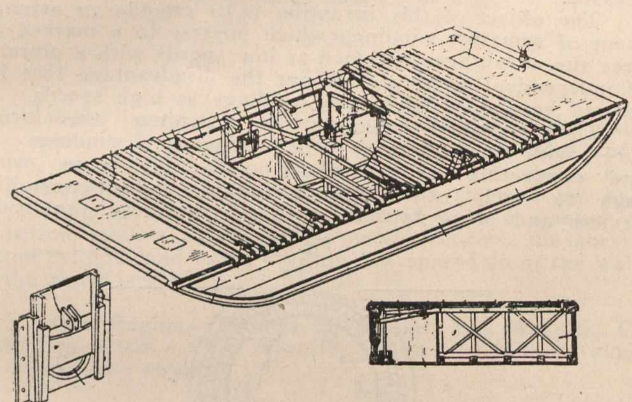
INTERNATIONAL PATENT RECORD

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.

Scows.—M. J. Haney.—98,949.—The invention consists in arranging a longitudinal bulkhead in a scow extending from end to end thereof and to one side of the centre, forming a water-tight compartment. The said compartment is preferably divided off into a plurality of compartments by transverse bulkheads, and each compartment is provided with a sluice gate opening through the outer side of the

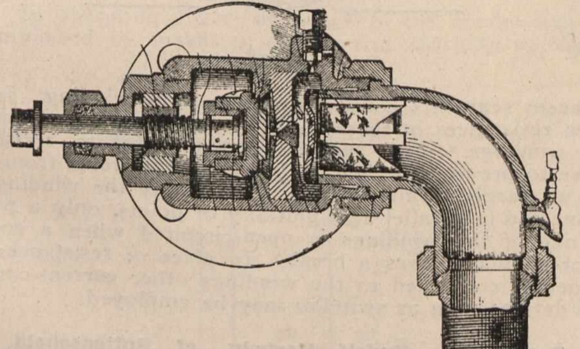


98,949.

scow. The sluice gates are operated from the opposite side of the scow through suitable levers, and sluice gates are also provided between the various compartments.

The dumping of the scow is accomplished by raising the sluice gates in the outer wall of the scow and allowing the water to pour into the water-tight compartment, thus overloading one side of the scow and causing it to tip to that side until the load which is supported upon the deck slides free and clear from the said scow.

Improvements in Valves.—The United Injector Co.—98,856.—A valve body having an inlet and an outlet, a stop valve ensconsed within said valve body, and having an annular knife-edged lip for co-operating with the valve



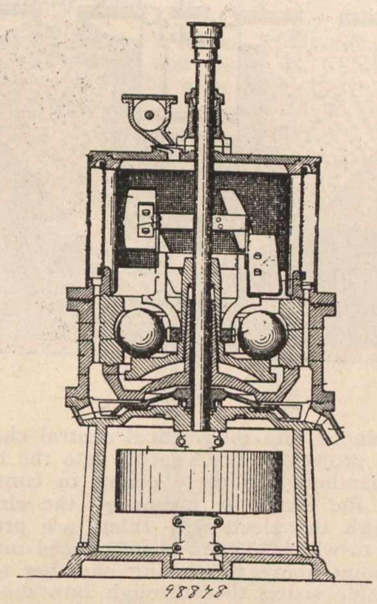
98,856.

seat, and a central tongue portion fitting closely within the aperture of the valve seat.

A check valve is arranged in said casing below the stop valve having on its top side a central boss and raised annular rim at the periphery projecting beyond said central boss, a spider having a central portion adapted to stop the said check valve in its upward travel secured within the casing between the said valves, said central stop and arm being adapted to engage with the boss and the raised annular rim of the check valve, whereby any tipping of the valve and consequent uneven wearing is prevented.

A nominally closed vent is provided in the wall of the casing and a screw valve arranged therein to allow for releasing the pressure within said valve.

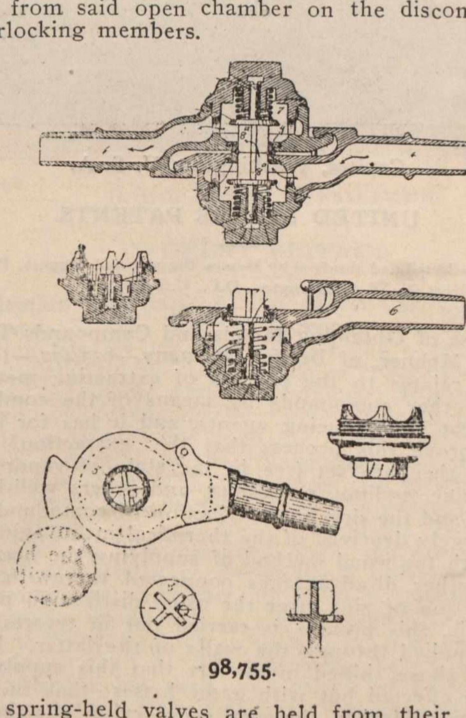
Pulverizing Mill.—James W. Fuller.—98,878.—The invention consists of a vertical casing through the centre of of which extends a vertical rotatable shaft. A grinding wheel or mill is secured to the said rotatable shaft and operates in conjunction with a portion of the said casing to grind the material placed therein. A cylindrical screen is



98,878.

supported in said casing to the outer side thereof and between said screen and the said central shaft are arranged a plurality of rotatable wings having plates obliquely arranged thereon and forming the means for elevating the ground substance and bringing the same into contact with the said screen thus allowing all coarser particles to drop back freely to the grinding mechanism.

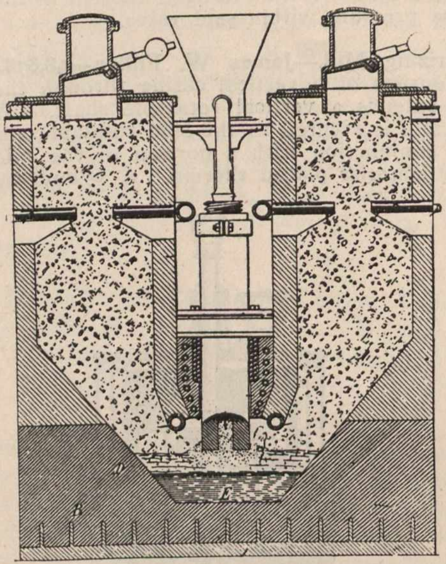
Air Hose Coupler.—E. B. Wilhoit & C. L. Snook.—98,755.—The invention consists in having an open chamber in the end of the interlocking members, and a spring-held valve supported within said open chamber and closing the opening from said open chamber on the disconnecting of the interlocking members.



98,755.

The spring-held valves are held from their seats by their inner faces abutting each other when the interlocking portions are secured together and have a small orifice through the valve portion allowing the air to escape gradually instead of rushing out of the larger opening on the disconnection of members.

Apparatus for Smelting Ores.—99,232.—The smelting furnace is provided with a number of vertical shafts for carrying the ore, and the said shafts are connected at the base to form a common smelting chamber. A central vertical chamber is arranged in the furnace projecting upwardly from the lateral connected chamber at the bottom, and the wall of said chamber is protected at the bottom edge by a water-cooled chamber or channel, which prevents the breaking down of the edge of the central chamber. An elec-



99,232.

trode is introduced into the vertical central chamber having the lower end projecting downwardly into the lateral portion of the ore chamber, and there comes in contact with the ore, smelting the same by means of the electric current passing through the electrode. Inlets are provided in the ore chambers to which oxygen is introduced into the column of ore at a point above the fusing chamber to convert the carbon monoxide rising therethrough into dioxide.

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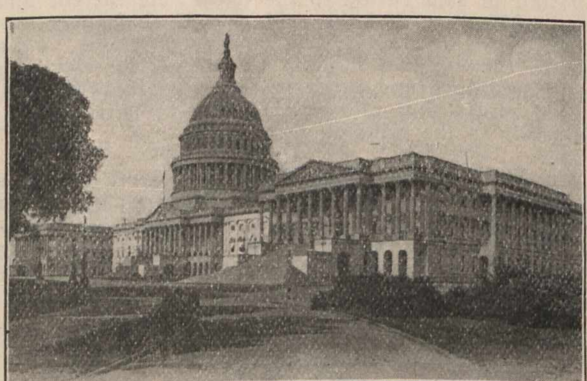
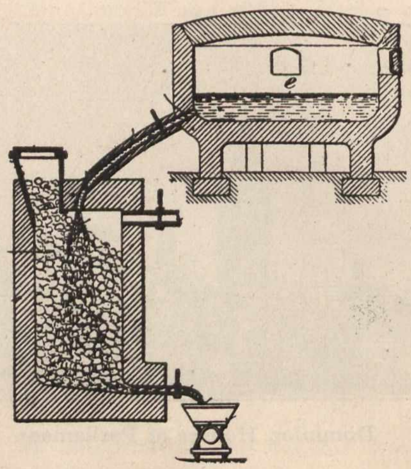


Capitol, Washington, U. S. A.

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.

Process of Obtaining Metals and Compounds Thereof.—Hermann Mehner, of Berlin, Germany.—833,472.—1906. This invention relates to the process of extracting metals from ores and other compounds by means of the combined action of heat and reducing agents, and it has for its object to so improve this process that the extraction of such metals as then are set free in the state of vapors—as, for instance, zinc, sodium, potassium, and others well-known to chemists—and the dry hot production of compounds thereof will be largely deprived of the thermical inconveniences connected with the usual method of supplying the heat, as well as from other disadvantages connected therewith. Taking the extraction of zinc after the usual distillation process as an example, this process is carried out in retorts, and the heat is supplied through the walls of the latter. It is well known to those skilled in the art that this supply of heat cannot be effected but with great losses; that those losses gave to metallurgists the idea of carrying out the process in shaft furnaces, and that the attempts to do this have failed because of the incapability of the known heating methods to supply the furnace with the large amount of heat at all, or at a tolerable cost. It is found that those difficulties can be overcome with ease and great advantage by bringing the ores or compounds while under the action of the reducing agent in contact with an incandescent fluid heat carrier incapable of absorbing or otherwise injuring the



833,472.

metallic vapors—for instance, such as molten silicates (including slag, scoria, cinders and the like) or a molten metal, as iron—the heat carrier being heated above its melting point up to incandescence.

Alternating-Current Motor.—Marius C. A. Latour, of Paris, France.—836,978.—1906. This invention relates to alternating-current motors of the commutator type and its object is to provide an arrangement of armature windings whereby commutation is improved and the efficiency increased.

The object of this invention is to provide an arrangement of armature-windings which possess to a marked degree the advantages obtained at low speeds with a plurality of independent windings without the disadvantage that has existed heretofore with such windings at high speeds.

The invention consists in providing the armature with a plurality of separate windings to and connecting equipotential points on these windings to each other through suitable current-controlling devices and using brushes of width insufficient to bridge

Fig. 1.

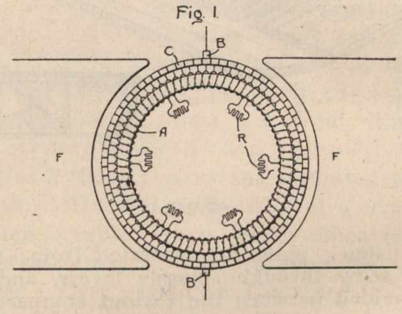
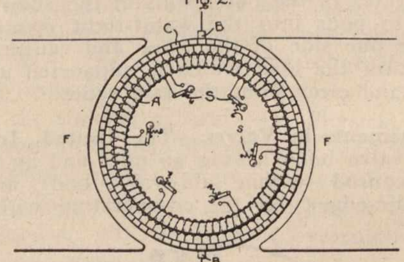


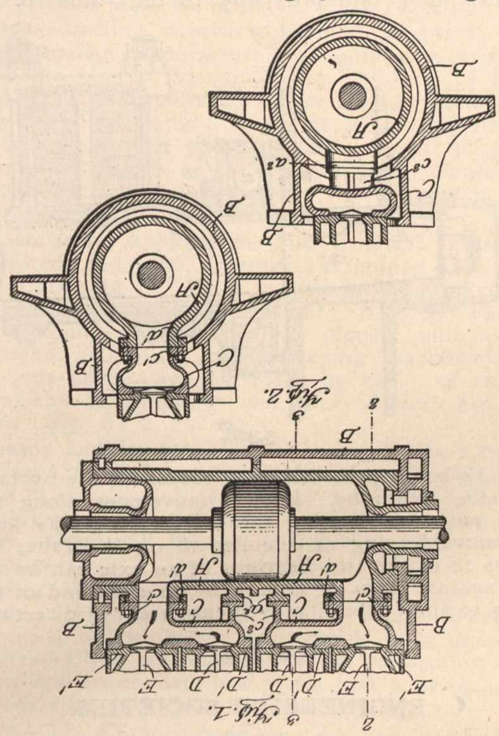
Fig. 2.



836,978.

adjacent segments connected to the same winding. In one form resistances in these connections are employed between the windings. With such an arrangement the resistances serve to prevent any heavy short-circuit currents from flowing at starting, while at high speeds, since the windings are connected in parallel at a plurality of points, only a portion of one of the windings is open-circuited when a commutator-segment leaves a brush. In place of resistances permanently connected to the windings other current-controlling devices such as switches may be employed.

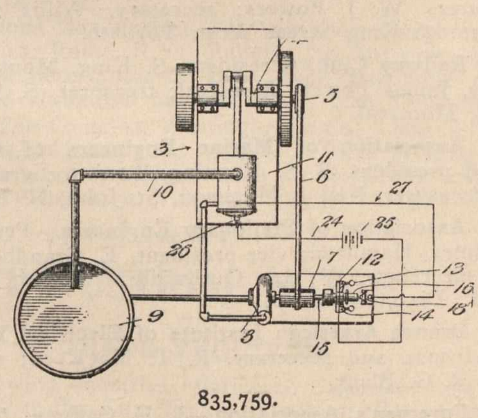
Gas-Engine.—Rudolf Hartwig, of Ruttenscheid, near Essen-on-the-Ruhr, Germany.—832,668; 1906.—This invention particularly relates to the arrangement of the inlet and outlet valves for gas-engines. Hitherto it has been usual to apply the inlet and outlet valves to the cylinder-covers or to the ends of the cylinders, putting the inlet-valve on top and the outlet-valve underneath. The disadvantage of this arrangement, however, is that the outlet-valves are with difficulty accessible, and in addition difficulties arise in the uniform cooling of the cylinder-covers or ends, and it not infrequently happens that they split, owing to unequal expansion. Now, this invention, therefore, is designed to provide a valve-gear which shall not possess the disadvantages above cited. The desired end is attained substantially by placing all the inlet and exhaust valves upon the back of the cylinder. It consists of a working cylinder having a rib and



832,668.

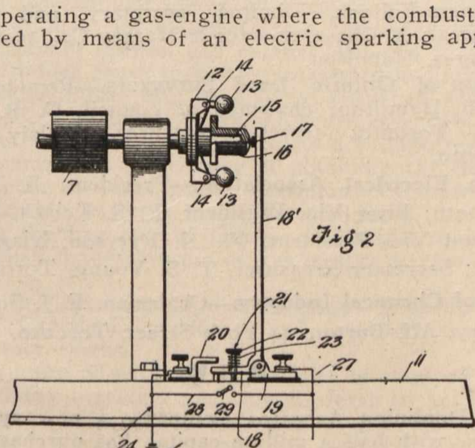
a flanged junction, a water-jacket surrounding the working cylinder a d extending above the flanged junction and the rib, and a valve-chest provided with a rib and a flanged junction supported respectively on the rib and the flanged junction of the working cylinder in such a manner as to permit relative expansion movement between the chest and the cylinder and located within but spaced from the walls of the water-jacket.

Gas Engine.—Thomas N. Kellett, Los Angeles, Cal.—835,759.—1906. This invention relates to the sparking-circuit of the engine.



835,759.

In operating a gas-engine where the combustion is accomplished by means of an electric sparking apparatus it

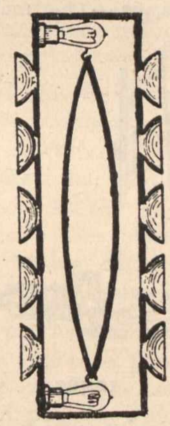


835,759.

often happens that the circulating-pump which controls the flow of water to the engine-jacket and which derives its power from the engine sometimes stops—for instance, when the belt from the engine-pulley slips off or is broken. When such an accident occurs, the flow of cool water to the engine-jacket is cut off and the water in the jacket stops circulating, the engine continues to work and becomes so hot that it often sustains a great injury.

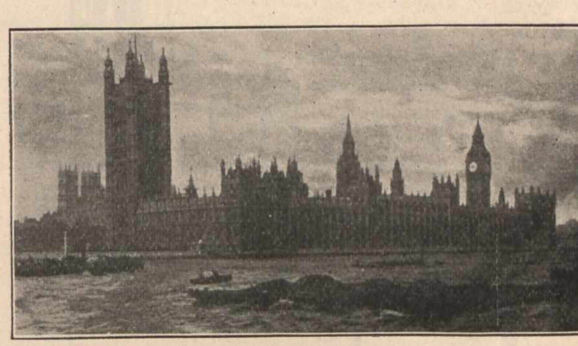
It is the object of this invention to obviate such accidents, and to this end there is provided mechanical means whereby when the circulating-pump is thrown out of action from any cause whatever the supply of current to the sparking apparatus is instantly cut out and the engine is brought to a stop, thereby preventing any injurious effects. It comprises a circulating-pump; a normally open sparking-circuit connected to a spark-plug in the cylinder of the engine; a switch in said sparking-circuit; a spring secured to said switch to hold the same normally open; and means secured to the circulating-pump to close the switch and keep the same closed during the operation of the circulating-pump.

Illuminated Sign.—William T. Bradshaw, Oakland, and Charles H. Townsend and Oscar E. Erickson, Berkeley, Cal.—836,915.—1906.—The sign body has sides apertured in the form of the letters to be displayed, inner surfaces of



836,915

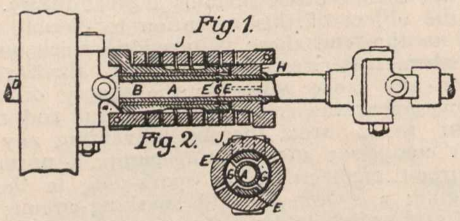
the walls of the sign body being suitably faced to reflect the light. Lamps are placed in the sign body, and concave apertured reflectors are secured on the outside of the sign body, each around one of the apertures in the sides thereof.



British Houses of Parliament.

GREAT BRITAIN.

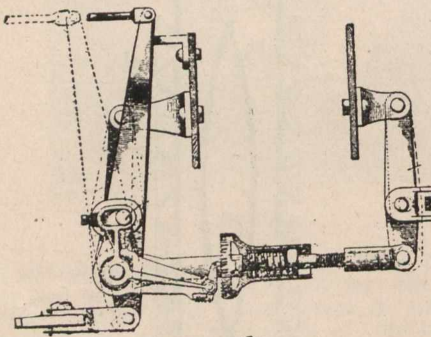
Flexible Coupling.—Albion Motor-Car Company, Limited, and T. B. Murray, Scotstoun.—23,469.—1905.—This invention has for its object to provide a flexible coupling more particularly adapted for use in connection with motor vehicles, and which, while very compact, is simple, effective, and not readily damageable. According to the invention, there is provided loose upon the driven shaft a sleeve operatively connected to the driving shaft and carrying at its end remote from this connection one member of a jaw-clutch. The other member of this jaw-clutch is formed upon a sleeve keyed to the driven shaft. In the example shown there is provided, loose upon the driven shaft A, a sleeve B operatively connected by a universal coupling to the driving shaft, and carrying at its end remote from this coupling one member E of a jaw-clutch. The other member G of this jaw-clutch is formed upon a sleeve H keyed to the driven shaft A. The clutch members E, G are always in engagement, but their jaws permit of a small definite relative rotation of the two parts. Within this amount of rotation a spring J acts in the manner to be described, and the jaws E, G of the clutch have such clearance as not to encounter each other when the spring is free, so that the spring acts to some extent as a cushion even if the direction of drive is reversed. The spring J is of helical form and rectangular section in the present example. It is of a diameter to encircle closely part of the loose sleeve B and part of the fixed sleeve H. The sleeves may, however, be so formed that the spring closely embraces more of the sleeve if it be found desirable. The effect of the close en-



23,469.

circling parts of the sleeves B, H by the spring J is that upon the spring J being subjected to torque, and becoming reduced in diameter, its ends engage the parts of the sleeves after the manner of a coil clutch, and thus take a proportion of the driving effort, so relieving the anchors of the spring.

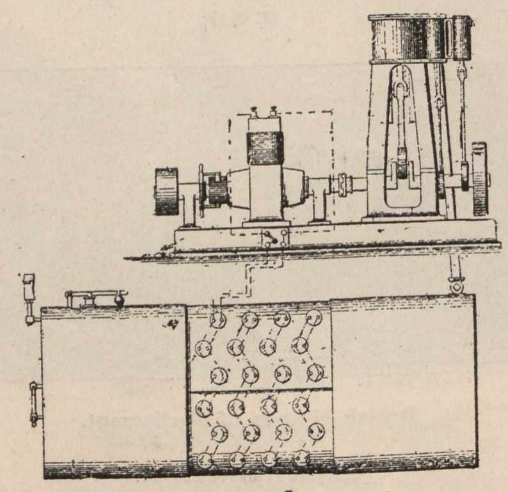
Slack Adjuster for Railway and Vehicle Brakes.—Anderson and Austin.—12,462.—The main brake lever is piv-



12,462.

oted to an adjusting device, which is pivoted at its other end to a lever connected with one of the brake beams, being a third brake lever connected to the main brake lever by a pivot pin.

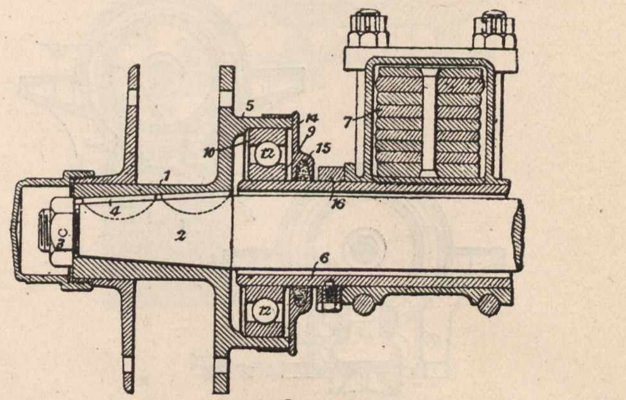
Self-Driving Power Plant.—Dahl.—24,518.—A steam generator supplies a prime mover which drives a dynamo,



24,518

the current from the latter heating resistance coils, which heat the contents of the steam generator.

Axle Bearings.—T. Thornycroft and John I. Thornycroft and Co., Limited, Chiswick.—3,328.—1906.—This inventon relates to bearings for the live axles of motor-cars and like vehicles, and has for its object to provide for the strain being taken partly by the revolving axle and partly on the tube carried by the vehicle body. For this purpose a projection from a part rigidly fixed to the revolving axle is provided internally with ball races and balls, through which the weight of the vehicle is transmitted to the wheels. In some cases provision may also be made for taking up the lateral thrust by means of ball bearings arranged in conjunction with the main ball bearings. The hub 1 of the wheel is rigidly secured to the tapered part of the live axle 2 by a nut 3 and keys 4, and is provided with a hollow cylindrical part 5 which projects from the hub and surrounds the axle 2 for a certain distance. The tube 6, through which the body of the car or other vehicle is supported as by springs 7, surrounds the live axle 2, but does not touch it, and projects into the cylindrical projection 5 on the hub. In the space between the tube 6 and the projection 5 are fitted concentric ball races 9 and 10. The inner race 9, which comprises a ring with a groove in its external surface for the balls 12 to run in, is made to fit upon the tube 6, while the outer race 10, which comprises a ring, having in its inner surface a groove for the balls, fits inside the projection 5. The ball-races are protected from dust by an end cover 14 fitted on the projection 5, and extending into proximity to the tube 6, suitable



3,328.

packing 15 being provided in a recess in the surface adjacent to the said tube. Lateral movement along the tube 6 of the parts constituting the ball bearing may be limited by a removable ring or a collar 16 on the tube; the caps or covers 14 of the two bearings of an axle can be arranged to bear against rings or collars 16 on each end of the tube, and thus to limit lateral movement in either direction.

ENGINEERING SOCIETIES.

Canadian Society of Civil Engineers.—President, H. D. Lumsden, Ottawa; treasurer, H. Irwin; secretary, C. H. McLeod, room 877, Dorchester Street, Montreal.

Canadian Mining Institute.—President, George R. Smith, Thetford Mines, Quebec; secretary, H. Mortimer-Lamb, Montreal, Que.; treasurer, J. Stevenson Brown, Montreal.

Engineers' Society: School of Practical Science.—President, T. R. Loudon, recording secretary, F. A. McGiverin; treasurer, B. W. Marrs; corresponding secretary, C. S. Shirriff.

Engineers' Club of Toronto.—President, F. L. Somerville; treasurer, W. J. Bowers; secretary, Willis Chipman. Rooms: 96 King Street West, Toronto.

Canadian Railway Club.—President, S. King, Montreal; secretary, James Powell, Montreal; treasurer, S. S. Underwood, Montreal.

National Association of Marine Engineers of Canada.—Grand president, F. S. Henning, Toronto; grand secretary-treasurer, Neil J. Morrison, St. John, N. B.

Canadian Association of Stationary Engineers.—President, J. Ironsides, Hamilton; vice-president, E. Grandbois, Chatham; secretary, W. L. Outhwaite, Toronto; treasurer, A. M. Dixon, Toronto.

Toronto Branch American Institute of Electrical Engineers.—Chairman and secretary, R. T. MacKeen; vice-chairman, R. G. Black.

Foundry Foremen's Association.—J. F. Gaffney, The Allis-Chalmers-Bullock, Limited, secretary and treasurer, Montreal; A. Chase, Sawyer & Massey Co., secretary and treasurer, Hamilton.

Association of Ontario Land Surveyors.—President, J. W. Tyrell, Hamilton; chairman of council, G. B. Kirkpatrick, Toronto; secretary-treasurer, Killaly Gamble, Toronto.

Canadian Electrical Association.—President, R. G. Black, Toronto; First Vice-President, R. S. Kelsch, Montreal; Second Vice-President, W. N. Ryerson, Niagara Falls, Ont.; Secretary-Treasurer, T. S. Young, Toronto.

Society of Chemical Industry.—Chairman, F. J. Smale; Secretary, Alf. Burton, 44 York Street, Toronto.

The Dominion Asbestos Company, a new syndicate of Americans with half a million capital, has purchased a large section of the asbestos mines at Black Lake and Thetford. These mines supply 85 per cent. of the world's asbestos. H. H. Robertson, of Boston, is president, and R. T. Hooper, of Montreal, managing director.

CATALOGUES AND CIRCULARS.

Electrical Specialties.—The R. E. T. Pringle Company, Limited, 172 Dalhousie Street, Montreal. A catalogue of special porcelain fittings used in electrical work. Cleats, tubes, bushings, knobs, sockets, etc. The catalogue is well illustrated and all the fittings are described in detail, the various sizes being listed. Size 7 x 4, pp. 102.

Steam Pumps.—Darling Brothers, Limited, Montreal, who are the Canadian manufacturers of pumps as manufactured by the Union Steam Pump Company of Battle Creek, Mich., have published a neat 48-page booklet describing and illustrating the various styles and sizes of "Burnham" steam and power pumps, for all purposes. It is composed mainly of illustrations, just enough reading matter being included to make it explanatory. Size 4 x 5.

Power Transmission Appliances.—The Canadian Fairbanks Co., Limited, Montreal, Toronto, Winnipeg, and Vancouver. Catalogue "F" deals exclusively with appliances used in the transmission of power. Belting, shafting, collars, couplings, hangers, pulley blocks, pulleys, friction clutches, elevating and conveying machinery, etc. The various devices are set forth by half-tone engravings, and the descriptions and lists of sizes are very complete. Size 6 x 9, pp. 111.

Air Compressor Lubrication.—The Joseph Dixon Crucible Co., Jersey City, N.J. A wealth of interesting data and information on the subject of air compressor and air drill lubrication is presented in a twenty-four page pamphlet, which will be sent to all who are interested in this subject.

Turbine Water Wheels.—Charles Barber and Sons, Meaford, Ont. The Canadian Turbine Water Wheel as manufactured by the above company is fully described and illustrated in a catalogue of recent publication. The results of numerous tests are given, and a price list of the various sizes is included. Size 6 x 9, pp. 32.

Cling-Surface.—The Cling-Surface Co., N.Y., are sending out a circular letter containing the names of companies in Canada where Cling-Surface is being used. The letter is accompanied by a circular containing illustrations and letters of recommendation from companies where Cling-Surface has met with great success.

Integrating Wattmeters.—The Canadian Westinghouse Co., Limited, Hamilton, Ont. Folder No. 4065 is an excellent booklet on type "C" integrating wattmeters for house and switchboard service, two and three wire, single-phase and polyphase. Size 3½ x 6, pp. 30.

Motor Hoists.—The Canadian Rand Drill Co., Montreal, Que. An illustrated folder of the "Imperial" Motor Hoist for use in foundries and machine shops. Size 6 x 9, pp. 4.

Hand Telephone Equipment.—The Wire and Telephone Co., of America, Rome, N.Y. Bulletin No. 101 gives a well illustrated description of their hand telephone equipment, and Houghton binding posts. Size 8 x 11, pp. 14.

Rheostats.—The Canadian Westinghouse Co., Limited, Hamilton, Ont. Circular No. 1139 sets forth starting and field rheostats. It also contains a numerically arranged list of circulars now in force. Size 7 x 10, pp. 16.

INDUSTRIAL NOTES

TRADE ENQUIRIES.

The following enquiries relating to Canadian trade have been received at the City Trade Branch, 73 Basinghall St., and Canadian Government Office, 17 Victoria St, London.

An English firm of engineers and boilermakers, who make a speciality of suction gas engines and gas plants, is anxious to introduce these to parties interested in Canada.

A Spanish (Malaga) firm asks to be furnished with the names of Canadian exporters of timber, more especially pitch pine and other cheap varieties, such as are imported into Spain. The same firm is desirous of obtaining the general agency for Spain of some good Canadian exporters, for whom considerable business could be introduced.

A firm in the Province of Quebec has asked to be referred to English manufacturers of gas motors to work machinery.

A Hamburg firm with good connections is desirous of hearing from Canadian producers and exporters of ores, minerals and rare earths.

The proprietors of patented specialities in stamped steel fittings for railway carriages and wagons, wish to be placed in correspondence with a Canadian firm prepared to manufacture the goods upon royalty, or some similar basis.

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TORONTO.

The Standard Inspection Bureau has moved its head office from 23 Jordan Street to the Traders Bank Building.

K. L. Aitkin, consulting electrical engineer, has moved from 164 Bay Street, into more commodious quarters, 1003 Traders Bank Building.

The new fire engine, the "J. J. Ward," has been tested, and proves itself to be the best the city has yet had, so far as mechanical excellence is concerned. The new engine has a capacity of 800 gallons per minute.

Andrew F. Macallum has resigned his position on the Trans-Continental Railway at Quebec, and has opened an office in Toronto as a consulting engineer. Mr. Macallum has had a wide experience in railway, mining, and hydraulic engineering.

Consulting Engineer Sothman, of the Hydro-electric Power Commission, says that the figures in the report are calculated upon the highest tenders for the machinery necessary to serve the municipalities, and there is sufficient difference between the lowest and the highest of these to leave a margin for unforeseen contingencies.

Regarding the letter from the committee of June 30th last, in connection with the proposal to change the form of the tunnel and substitute concrete for brickwork in its construction, City Engineer Rust has recommended that the contractors be allowed to make the waterworks tunnel circular instead of horseshoe. This change is now possible owing to the contractors having constructed a boring machine which can only be used in a circular tunnel.

One of the features of the new depot will be a drive down to the tracks. The approach from Front Street will be by a bridge. The station will be 600'-0" long and considerably higher than the present Union Station building. Pathways will lead down to the main waiting room and the bridge will give access to an upstairs rotunda. The floor of this rotunda will be 60'-0" above the concourse. The arrangement of the tracks will be semi-terminal, the main line trains running on the tracks nearer the bay. These trains will be reached through a subway.

The semi-annual convention of the Canadian Street Railway Association was held at the King Edward Hotel, Toronto, Friday and Saturday, December 7th and 8th. There was a large number of representatives present from companies throughout the Dominion, the only company of importance not represented being the Hamilton Radial Railway, whose employees were on strike. Among the papers presented was one entitled "Some of the Methods in Vogue in Modern Railway Shops," by W. B. McRae, master mechanic of the Toronto Railway. This paper treated generally of shop methods.

GENERAL.

The Philip Carey Manufacturing Co., of Cincinnati, have decided to erect a branch factory in Hamilton.

The Galt Malleable Iron Works have placed an order for a 3½-ton travelling crane with the Smart-Turner Machine Co., Limited, Hamilton.

The experimental smelter at Hamilton for the treatment of Cobalt ores has proved a success, and in all probability a large smelter will be erected at that place.

The Smart-Turner Machine Company, Limited, are supplying the Collingwood Shipbuilding Company with one of their Duplex pumps for boiler feeding; also a Duplex sanitary pump.

The Pacific Coast Pipe Company, of Vancouver, has just completed a large contract in supplying the Canadian Pacific Railway Company with ten miles and a half of 8-inch high-pressure wood-pipe.

The Standard Asbestos Co., of which R. F. Hopper is president and managing director, have sold a portion of their property at Black Lake to a syndicate of Americans, who have organized the Dominion Asbestos Co., with a capital of $500,000. A large modern plant will be erected on the property.

The route map of the International Railway from Moncton, N.B., to Chipman, and then from two and a half miles west of Grand Falls to the Quebec bridge and a portion west of La Tuque, and a section north of Abitibi, have been approved by the Cabinet, and tenders for construction will be called for at an early date.

The Penman Manufacturing Co., Paris, Ont., have ordered a 350 H.P. Corliss engine from the Robb Engineering Company.

One of the big C. P. R. elevators at Fort William was dstroyed by fire on the morning of December 7th. The loss is $350,000.

The Allis-Chalmers Company have supplied the Prendergast Lumber and Coal Co., Saskatchewan, with a 14" x 24" Reynolds Corliss engine.

The Atikokan Iron Company's blast furnace at Port Arthur is nearing completion, and, it is stated, will be in operation in about six weeks.

The Owen Sound Bridge ½ Terminal Co., who are seeking incorporation from the Dominion Government, will construct a bridge over Owen Sound Bay.

Messrs. Jenkins Bros., of New York, have ordered a 150 H.P. engine from the Robb Engineering Company for the new factory they are building in Montreal.

The Ontario Iron and Steel Company have placed an order for a No. 4 Centrifugal pump, direct connected to an electric motor, with the Smart-Turner Machine Co., Limited.

N. S. Hoffar, architect, Vancouver, will prepare plans for the erection of several large warehouses, a school, two churches and a number of large dwellings for Prince Rupert, B. C.

Its product is flexible and cement roofings, asbestos pipe and boiler coverings, magnesia steam pipe and boiler coverings, and all products in which asbestos and asphalt materials are used.

The Canadian Refining Company, recently organized at Ottawa with $2,000,000 capital, will supply the Dominion mint with gold and silver for coinage purposes. The company is looking for a suitable site in Hull, Quebec.

The H. W. Johns-Manville Co. have moved their Boston office to 55-57-59 High Street. They occupy the whole building, consisting of seven floors, which will enable them to meet the increasing demands for their products.

The building permits issued in Toronto during November last were 402, making the total number for the eleven months 3,288. The value of the buildings for November was $1,087,692, and for the eleven months $12,190,615.

Mr. Graham Fraser, late of the Nova Scotia Steel & Coal Co., New Glasgow, N. S., has purchased a site near Longue Point, Que., for the sum of $65,000, and will erect a new establishment for the manufacture of car wheels.

Messrs. Barnhill & McLennan, of Amherst, N. S., have purchased a large lumber property at Etiomani, Sask., on which they intend building a 100 H.P. rotary saw mill. The machinery for the mill has been ordered from the Robb Engineering Co.

Work has been started on the Harkshaw bridge, across the St. John River, between Fredericton and Woodstock, N.B. The Canada Foundry Company has received the contract for the superstructure. The bridge is to be ready for crossing by April 1st, 1908.

The Fernie strike has cost nearly a million dollars, the Crow's Nest Coal Company has lost $500,000 in profits, and it will cost $50,000 to place the mines in good condition again. The men lost $300,000 in wages and the government lost $20,000 in royalties.

Wood-paving blocks of red pine are used by the Bristol corporation, England, and the city engineer is open to receive particulars and tenders from Canadian firms. The timber is usually supplied in planks, 9" by 3"; the most convenient lengths are from 9'-0" to 5'-0".

The firm of John F. Allen, 370-372 Gerard Avenue, New York City, are in receipt of an order from the American Car and Foundry Company for six Allen compression lever riveters to be used in their new plant in St. Louis, Mo. This is part of an equipment of fifteen riveters for the same plant.

The large main car barn and the rolling stock of the G. H. & P. and the P. & B. Street Railway Companies at Preston were completely gutted by fire on December 4th. The total loss is estimated at $60,000, and the insurance on the sheds and cars that were destroyed will amount to $41,000.

The Wm. Hamilton Manufacturing Co., of Peterboro', has assigned. The company's nominal capital stock was $200,000. There was preference stock to the amount of $80,000 and common stock amounting to $100,000. The company was organized in 1883 to manufacture saw mills, mining machinery and water wheels.

Among the recent orders received by the Allis-Chalmers-Bullock, Limited, is one from the Laprairie Brock Company for a 500 H.P. induction motor, and two of 15 and 30 H.P. respectively. From the Cleveland Cobalt Mining Company for a mining plant, including 3-belt driven compound "Ingersoll" air compressors, rock drills, plunger sinking pump, hoisting engine and necessary fittings. From the Canadian Mine and Smelting Company, of Vancouver, B. C., for a standard Dodge crusher.

The boiler shops of the Canadian Northern Railway were destroyed by fire on December 7th.

The Farmers' Association of Ontario are circulating a petition throughout the Province for signature, asking the Government to do away with the bounties on iron and steel.

The Colonial Portland Cement Co., whose construction work at Wiarton has been at a standstill for want of funds, has now floated $80,000 worth of bonds, which it is expected will be enough to put the factory in operation. The board has been reorganized.

Peterboro' is to get a branch of one of the largest carpet manufacturing concerns in the world. A representative of the Crossley Carpet Company, who has been in Canada some weeks seeking a location for a branch, has practically decided to locate works here, through the intervention of Hon. Senator Cox, who has influenced the decision in favor of Peterboro'. The works will employ between 500 and 600 hands.

Damage to the extent of almost $80,000 was done to the rolling stock and car barns of the Galt, Preston and Hespeler Street Railway by a fire which totally destroyed the barns in Preston, recently. Five passenger cars, worth in all $34,000, two of them worth $10,000 each, were totally destroyed. Two freight motors, one worth $10,000 and the other $2,000, and a sweeper worth $3,000, were burned. The barns and equipment were valued at $26,000.

The rumor is again afloat that iron rolling mills are to be established on Vancouver Island. Whatever truth there is in that, it is a fact that large iron deposits on the west coast have been bonded by a syndicate, of which James A. Moore, of Seattle, and Alfred Merritt, the well-known iron mine owner of Duluth, are members. A steel plant is to be built at Seattle, announcement of which has been made, and supplies of raw material drawn from British Columbia.

Every contract to which the Government of Canada is a party which may involve the employment of laborers, workmen or mechanics, is to contain a stipulation that no laborer, workman or mechanic in the employ of the contrator or subcontractor, or other persons doing or contracting to do the whole or a part of the work contemplated by the contract, shall be permitted or required to work more than eight hours in any one calendar day, except in cases of extraordinary emergency caused by fire, flood or danger to life or property.

TELEGRAPH AND TELEPHONE

The Nova Scotia Telephone Company has purchased an automatic branch switchboard for the Sydney mines office. It will be the only one of the kind in Canada, and will cost in the neighborhood of $5,000.

The Independent Telephone Company made a new offer for the city franchise. The rates are clearly lower than the Bell Company, and it is the opinion of the company that the council will grant it a competitive franchise.

The Manitoba Government will proceed with the construction of public-owned telephones as soon as the frost is out of the ground, as a result of the overwhelming vote of Winnipeg in favor of the Government's policy.

After a long controversy, the Port Hope Town Council has granted a telephone franchise to G. W. Jones and W. H. Burley, of Newtonville, representing the Rural Farmers' Telephone Association, which has lines throughout Clarke and Hope townships.

Byron Douglass has been appointed manager for the Bell Telephone Company of the district of Northern Ontario. His territory extends from Peterboro' north as far as telephone lines go, from the Ottawa on the east to the Manitoba line on the west, and includes Manitoulin Island, Wiarton and Owen Sound. This territory will be under Mr. Douglass' supervision as general superintendent. He has been with the Bell Company for 24 years.

MARINE NEWS

A third lock will be built by the United States Government at Sault Ste. Marie, costing probably $10,000,000. And Congress has voted $500,000 to connect Lake Erie at Buffalo with the Tonawanda barge canal. While $2,000,000 is voted to complete the improvement of the Detroit River, chiefly at the Lime-Kiln Crossing, at Amherstburg, Ont., the deepening of the waterways between the lakes must wait on account of the great expense involved.

The Government traffic report shows the movement of freight for the season to date to be 50,192,835 tons through the canal, or nearly 6,000,000 greater than for the corresponding period last year. November tonnage was slightly under 6,000,000.

The keel plates of another "Dreadnought" have been laid at Portsmouth by Admiral Sir Archibald Douglas, the Commander-in-charge in Portsmouth. The new battleship will be larger and more powerful than the first "Dreadnought" and as much of the preliminary work has already been done it is expected that her construction will progress rapidly.

The British Navy is to have a repair ship. It will be practically a floating dockyard intended to furnish the necessary repairs to vessels when at sea. It is equipped with the latest implements required, and all the machines and cranes used on it are to be operated by electrical power. The new vessel's tonnage is about eleven thousand tons, and it is to carry a crew of three hundred men, the majority of them experienced mechanics.

Foreign contractors are to be barred from competition for the completion of the Panama Canal. Many changes have been agreed to in the form of contract to be entered into for the construction of the canal, but the most important is the limiting of the proposals to American firms. January 12th is the date set for the opening of proposals.

A bill has been passed by the Dominion Government as follows:—"Every navigation company whose vessels ply on the inland waters of Canada, and which receives a subsidy from the Government of Canada, shall furnish free transportation upon any of its vessels for members of the Senate and House of Commons of Canada, with their baggage."

Plans have been presented to the United States Congress for what is to be the largest battle ship afloat. She will be 510'-0" long, 85'-2⅝" beam, 20,000 tons displacement, 27'-0" draft, 2,300 tons coal capacity and 21 knots speed, and will have ten twelve-inch rifles and fourteen five-inch rapid fire guns, together with some small machine guns to repel torpedo attacks. The cost limit is $6,000,000.

Three steamers of the "Chr. Knudsen" type now under construction in the yards of Sir Raylton Dixon, Middlesborough, England, have been chartered by the Dominion Iron and Steel Company for a period of four years. Two of the boats have a carrying capacity of seven thousand tons and will run in the Wabana ore trade. The other steamer will only take thirty-six hundred tons. She will be used in carrying limestone from Marble Mountain.

It is reported that the earnings of the Richelieu and Ontario Navigation Company will exceed those of last year by over $100,000. The net return will probably be about $350,000. It will be surprising to even the friends of Richelieu that the company has earned over 10% on the capital stock of $3,132,000 outstanding. In 1905 the profits represented 7.60% earned on the stock. These semi-official figures, if borne out later, will entirely justify the directors in declaring the recent dividend rate of 5% per annum.

A deputation of shipbuilders, consisting of Frederic Nicholls (president), and A. Angstrom (manager), of the Canadian Shipbuilding Company; Thomas Lang and Capt. McDougall, of the Collingwood Shipbuilding Company; and F. B. Polson, of the Polson Iron Works, waited upon the Dominion Government on December 10th, and urged the granting of a bounty of $6 a ton towards the encouragement of the Canadian shipbuilding industry.

Col. Hughes proposed a motion recently for the construction of a branch canal from the main waters of the Trent Canal at the village of Coboconk, on the height of land, Balsam Lake, northward up the Gull River for about 60 miles. He took it for granted that the main Trent Canal would be pressed to a speedy completion. He suggested that there should be a lock and dam at Coboconk, thence through Mud Turtle Lakes to Norland. A lock there and at Elliott's Falls would lead into Moor's Lake, thence via a small lift at Moor's Falls or Leary's. There would be a clear stretch through the beautiful waters of Gull Lake to Minden; thence by a slide lock operated by water-power access could be had to Mountain Lake; thence with a dam between Horseshoe and Mountain Lakes navigation would be open for 30 or 40 miles further on.

The inland vessels visiting Montreal this season were larger in number and tonnage than ever before, being 12,557, with a tonnage of 3,905,174, against 11,088, with a tonnage of 2,781,191, the previous year.

Not since 1900 has there been such a long season of navigation as that just closed. The first ocean steamship arrived on April 29th, and the last left on December 2nd; in 1900 the first arrived on April 26th, and the last left on December 3rd. The season of 1905 lasted from May 2nd to November 30th. During the season just closed, the number of ocean-going steamships visiting the port was 783, having a combined tonnage of 1,957,615, against 786 tons with a tonnage of 1,918,002 last year. Including sailing vessels, the total vessels during this season was 816, with a total tonnage of 1,968,979, against 833 with a tonnage of 1,940,056, the previous season.

RAILWAY NOTES

The Canadian Pacific Railway will construct a bridge over the Seguin River, at a cost of $300,000.

Electrical operation of trains in the New York Central tunnel, leading to the Grand Central Station, became an accomplished fact on December 11th.

The Canadian Pacific Railway is appealing against the assessment of $32,000 on their property in Galt. The matter will come before the Railway Commission.

It is said that the G. T. R. will build another new line to connect with the G. T. R. running from North Bay through the Cobalt and Lake Temagami districts.

An Eastern syndicate with a capital of half a million dollars will apply to the Calgary Council for a street railway franchise and charter to supply electric power to the city and private consumers.

The Canadian Pacific has ordered from the Angus shops five hundred 30-ton flat cars, all equipped, in accordance with the provisions of the Railway Act, with air brake equipment and automatic couplers.

The Canadian Northern Railway is applying to Parliament to increase its bonding powers from $35,000 to $40,000 a mile on its lines other than those from Edmonton to the Pacific Coast and in British Columbia.

Preparations are being made by the C. P. R. to clear up 150,000 acres of land on Vancouver Island, though the details of the scheme are not yet completed. It costs from $80 to $100 an acre to clear this ground.

It is stated that the purchase of rolling stock to the value of $13,500,000 is now under the consideration of the C. P. R. This includes 150 engines, 50 sleeping and other cars, and 200 passengers and baggage cars.

A charter has been secured to build a ten mile tunnel under Belle Isle straits to connect Newfoundland with Canada. The franchise allows 20 years for its construction and the Newfoundland Government will contribute $75,000 annually for the work.

The G. T. P. has submitted to the Railway Commission detailed plans of its line through the Yellowhead Pass, which show that the line over the Rocky Mountain range at that point can be accomplished on a maximum grade of four-tenths of one per cent.

The rumour that the Canadian Northern has secured control of the Quebec and Lake St. John Railway is now confirmed, and it is stated that Mackenzie and Mann have purchased 51,000 parts of the stock of the company at $34 a share, the capital being $6,000,000.

The two sections of the tunnel under the East River, which were started simultaneously in New York and Brooklyn, were brought together under the bed of the river on December 14th. The two shields came together almost directly under the centre of the river.

It is maintained that the Hudson's Bay route to Europe will bring Canada a thousand miles nearer Europe and give the farmers of the West practical control of the world's grain markets. Eight railroad companies have already applied to the Government for charters for lines to Hudson's Bay.

It has been given out that the C. P. R. intends to begin electrifying its entire system at once. The initial start will be made on the Pontiac and Pacific division which runs from Pontiac to Ottawa. The recent purchase by the company of water- power from Deschene's Falls, owned by the Capital Power Company, for $240,000, is the best evidence of the company's intention.

Some idea of the growth of the business handled by the Canadian Pacific Railway at the docks in Fort William can be gained by the increased tonnage of flour and package freight. In October, 1905, the amount was 72,000 tons. In October, 1906, it was 133,000 tons, an increase of practically 100%, as during four days when the strike was on work was at a standstill.

With the completion of the Toronto to James Bay section of the Canadian Northern Railway, 149 miles is added to the mileage of the Canadian Northern Railway system.

The Temiskaming and Northern Ontario Railway returns to the end of September show aggregate earnings since January 1st of $388,300, operating expenses totalling $243,789, leaving a balance to the good of $144,511. The earnings for September were $43,428 and the expenditures $31,816, leaving the net earnings at $11,612.

The French Government has retained Charles M. Jacobs, of New York, who designed the Pennsylvania Railway tunnels under the Hudson and East Rivers, to prepare plans for a tunnel to be built under the River Seine between Rouen and Havre. The tunnel will have two railway tracks, and will be about a mile in length. The cost of construction is estimated at about $10,000,000.

The C. P. R. is applying to Parliament for an increase of its bonding powers from $30,000 to $40,000 a mile, for the line from Rumford on the main line to Bolton on the Toronto-Sudbury branch. The distance is 228 miles and the extra bonds are asked, because of the difficult nature of the construction. The C. P. R. is also asking permission to issue bonds, secured exclusively on any branch line, to the extent of $30,000 a mile.

The drilling operations being carried on in connection with the new C. P. R. bridge over the Belly River are proceeding at a good rate. In the first hole a solid bottom on hard clay was found at a depth of 75'-0". In the second, the same clay bottom was reached at a distance of 81'-0" from the surface. At the third station already a depth of over 80'-0" has been reached, and it is expected that the men will have to go another 30'-0" before reaching the desired bottom.

A bill has been passed by the Dominion Government limiting the speed of trains in cities. It says that no train shall pass over any highway crossing at rail-level in any thickly-peopled portion of any city, town or village at a greater speed than ten miles an hour, unless such crossing is properly protected, or unless such crossing is constructed and threafter duly maintained in accordance with the orders, regulations and directions of the Railway Committee of the Privy Council and of the Board in force with respect thereto.

At the annual session of the Canadian Ticket Agent's Convention at Mobile, Ala., the following officers were chosen for the ensuing year: W. McIlroy, Peterborough, president; C. R. Coleman, first vice-president, Truro, N.S.; R. J. Craigh, second vice-president, Cobourg; J. P. Honley, third vice-president, Kingston; E. de la Hook, secretary-treasurer, London; F. R. Hodges, auditor, Clinton. The following executive committee was elected: W. Jackson, Clinton; J. F. Dillon, Montreal; W. Bunton, Peterborough; C. G. Horning, Toronto; E. G. Picke, Joliette, Quebec.

W. G. Ross, managing director of the Montreal Street Railway, of Montreal, is quoted as saying that the company will soon take over the property of the Montreal Terminal Railway Company, operating 26 miles of road and handling a large amount of freight. The line will be extended to St. Genevieve and to St. Vincent de Paul. Surveys for the extensions have been made and practically all of the right-of-way secured. They will open up thriving districts tributary to Montreal. The new lines will be laid with heavy rails and high speed cars will be installed. A number of other improvements will be made to the city system.

The Grand Trunk Pacific Company has submitted detailed plans to the Railway Commission of the route its line will take through the Yellowhead Pass. This shows that the line over the Rocky Mountain range at this point can be accomplished on a maximum grade of four-tenths of 1% which will be far and away the easiest grade on any road leading to the Pacific slope. The company confidently believes that it will be able to carry its line through to Prince Rupert without having to tackle anything heavier than the four-tenths of a foot rise in a hundred, with which its engineers have surmounted the Yellowhead Pass.

The Grand Trunk has just placed orders for new freight and switch engines aggregating an expenditure of over $800,000. They have ordered from the Locomotive and Machine Works here 30 freight engines of the compound consolidation Richmond type. These are exceptionally powerful engines of the most modern design and will weigh 211,200 pounds, with 63-inch driving wheels, with a working boiler pressure of 210 pounds to the square inch, and will have a capacity for 7,000 gallons of water and 10 tons of coal. They will cost approximately $20,000 each, and will be delivered early next year. Besides these, the Grand Trunk has ordered from the American Locomotive Company, at Schenectady, N.Y., 14 six-wheel coupled switching engines. These being for yard use, are of a much lighter type of engine, weighing 139,000 pounds each, with 56-inch driving wheels, with tank capacity of 8,000 gallons, and will carry eight tons of coal.

MINING

Coal has been discovered in North Antrim, Ireland.

It is stated that one, Mr. Gerhant, has discovered tin on Desolation Sound, B. C., within 100 miles of Vancouver.

It is said that a vein of gas exists outside the city of Chatham, and drilling has been commenced. Considerable local capital has been invested in the enterprise.

In the White Bear mine, Rossland, on the 350 foot level an ore body of large dimensions and of good grade, has been located by means of a diamond drill. While the management is reticent as to the details of the find, still it admits that it is of considerable importance.

Asbestos in payable quantity and quality has been discovered in the Transvaal. An expert who has examined the deposit states that it is of abnormal width and equal to the finest in Canada or Italy. An offer of $193.60 per ton has been received from Germany for the best quality.

Gold, in what appears to be huge quantities, has been discovered at Birling, 42 miles west of Battleford. The discovery was made by an old prospector named Hughes, who sent samples, taken at random over a square mile of territory, to the assaying office at Ottawa. The report came back that his dirt had assayed $55 to a ton, a vein of great richness.

On the Bankshead, near Banff, the Pacific Coal Company is mining anthracite. Its preparation is attended with the production of a large proportion of coal dust, and the company is now erecting a briquetting plant from which within a few months an excellent fuel, new to Canada, will be placed on the market in the form of anthracite coal dust briquettes.

About two months ago the property of James Curren, at Lingan, which includes about 178 acres was purchased by the Dominion Coal Company through the Sydney Real Estate Company, who were acting for the Coal Company in the transfer. This property will be the centre of the operations of a new colliery. A shaft will be sunk there and a line of railway will be constructed to connect the colliery with Lingan Bay, where excellent shipping facilities will be obtained.

The discovery of one of the most remarkable hematite deposits in the North-West, containing, according to conservative estimates, two hundred million tons of high-grade iron ore, is announced from Port Arthur. This deposit lies about 20 miles to the eastward of Port Arthur, the area averaging about three miles in width and six miles in length, and comes within 1,000 ft. of the shore of the lake. It lies in sheet formation, much of it being without covering. There are many places on the property, it is said, where a high-grade bessemer blue hematite is exposed for acres. This is believed to be the largest body of accessible ore outside of the holdings of the United States Steel Corporation, and is the only body of high-grade bessemer hematite in Canada.

PERSONAL

Sir Edward J. Reed, formerly chief constructor of the British Navy died on November 30th, 1906. He was born in 1830.

Mr. Charles W. Cooper, who is well-known in Montreal railway circles, has been appointed assistant general passenger agent of the Canadian Northern at Winnipeg.

W. J. Bowers, C.E., died last month at his home, Macdonell Avenue, Toronto. Mr. Bowers was associated with John Galt, civil engineer, of Toronto. He was also treasurer of the Engineers' Club.

J. C. Blais, engineer, connected with the Public Works Department, died on December 6th. He was 54 years of age, and was a native of St. Francis, Quebec, and lived for some years at Quebec City.

William McGillis, of Kankakee, Ill., and a former resident of Glengarry, has passed away. Mr. McGillis was born in Lancaster township, Glengarry County, on April 29th, 1838. His first experience in railroad work was during the building of the G. T. R. He had a wide experience in the construction of railroads and Government and State contracts, and was the pioneer in the use of the steam dredge for draining swamp lands, and redeemed millions of acres in this way.

After spending about 15 months investigating mining conditions in this country, Nanabhai D. Daru, is about to return to his native land, India. Mr. Daru, whose portrait appeared in the September issue of "The Canadian Engineer," as well as having graduated from one of the leading universities in India, is a graduate of the University of London, and of the Royal School of Mines. He visited nearly all of the important mining camps in the West, and upon his return to India will report to the Government upon mining, milling, and smelting in the Dominion.

Classified Advertiser's Directory.

Abattoir Machinery
Perrin & Co., Limited, Wm. R., Toronto, Ont.

Air Compressors
Allis-Chalmers-Bullock, Ltd., Montreal, Que.
Canada Foundry Co., Toronto, Ont.
Canadian Fairbanks Co., Ltd., Montreal, Que.
Canadian Rand Drill Co., Montreal, Que.
Canadian Westinghouse Co. Ltd., Hamilton, Ont.
Mussen & Co., W. H. C., Montreal, Que.
Peacock Bros., Montreal, Que.
Petrie, H. W., Toronto, Ont.
Smart-Turner Machine Co., Ltd., Hamilton, Ont.
Smith Foundry Supply Co., J. D., Cleveland, Ohio, U.S.A.

Air Receivers
Allis-Chalmers-Bullock, Ltd., Montreal, Que.
Canada Foundry Co., Toronto, Ont.

Anvils
Jack & Co., Watson, Montreal, Que.
Leslie & Co., A. C., Montreal, Que.

Automatic Labor-Saving Machinery.
Hamilton Facing Mill Co., Hamilton, Ont.
Waterous Engine Works Co., Ltd., Brantford, Ont.

Automatic Turret Lathes
Potter & Johnston Machine Co., Pawtucket, R.I., U.S.A.

Bars, Grate
Cramp & Sons, S. & E., Bldg. Co., Wm., Phila., Pa., U.S.A.

Batteries, Storage
Canadian General Electric Co., Toronto, Ont.
Canadian Westinghouse Co., Ltd., Hamilton, Ont.

Bearings, Ball and Roller
Canadian Bearings, Limited, Hamilton, Ont.
Canadian Fairbanks Co., Ltd., Montreal, Que.
Wilson & Co., J. C., Glenora, Ont.

Belt Dressing
Cling-Surface Co., Buffalo, N.Y., U.S.A.
Dixon Crucible Co., Joseph, Jersey City, U.S.A.
Dominion Belting Co., Ltd., Hamilton, Ont.

Belt Preservative
Cling-Surface Co., Buffalo, N.Y., U.S.A.

Belting, Canvas
Canadian Rubber Co., Ltd., Montreal, Que.

Belting, Rubber and Leather
Canadian Fairbanks Co., Ltd., Montreal, Que.
Canadian Rubber Co., Ltd., Montreal, Que.
Dominion Belting Co., Ltd., Hamilton, Ont.
Gutta Percha & Rubber Mfg. Co., Ltd., Toronto,
Jeffrey Mfg. Co., Columbus, Ohio, U.S.A.
Petrie, H. W., Toronto, Ont.
Williams & Dadson, Wayland, Montreal, Que.

Blast Furnace Equipment
Canada Foundry Co., Toronto, Ont.
Cramp & Sons, S. & E., Bldg. Co., Wm., Phila., Pa., U.S.A.

Blowers (See Ventilating Apparatus)

Boiler Coverings
Garlock Packing Co., 7 Mary St., Hamilton, Ont.

Boiler Fittings
Canada Foundry Co., Toronto, Ont.
Michigan Lubricator Co., Detroit, Mich., U.S.A.
Penberthy Injector Co., Limited, Windsor, Ont.

Boilers
Canada Foundry Co., Toronto, Ont.
Canadian Rand Drill Co., Montreal, Que.
Cramp & Sons, S. & E., Bldg. Co., Wm., Phila., Pa., U.S.A.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Morris Co., I. P., Beach & Ball Sts., Phila., Pa., U.S.A.
Mussen & Co., W. H. C., Montreal, Que.
Petrie, H. W., Toronto, Ont.
Robb Engineering Co., Amherst, N. S.
Smart-Turner Machine Co., Ltd., Hamilton, Ont.
Smith Co., S. Morgan, York, Pa., U.S.A.
Waterous Engine Works Co., Ltd., Brantford, Ont.

Boilers, Marine, Stationary and Water Tube
Canada Foundry Co., Toronto, Ont.
Canadian Rand Drill Co., Montreal, Que.
Goldie & McCulloch Co, Ltd., Galt, Ont.
Jack & Co., Watson, Montreal, Que.
McDougall Caledonian Iron Works Co., Ltd., John, Montreal, Que.
Polson Iron Works, Ltd., Toronto, Ont.
Robb Engineering Co., Ltd., Amherst, N.S.
Williams & Dadson, Wayland, Board of Trade Bldg., Montreal, Que.
Waterous Engine Works Co., Ltd., Brantford, Ont.

Bolt Drivers
Armstrong Bros. Tool Co., Chicago, Ill., U.S.A.

Books, Technical
Smith Foundry & Supply Co., J. D., Cleveland, Ohio, U.S.A.
Spon & Chamberlain, New York, N.Y., U.S.A.

Boring Tools
Armstrong Bros. Tool Co., Chicago, Ill., U.S.A.

Brake, Air Storage Systems
Canadian Westinghouse Co., Ltd., Hamilton, Ont.

Brakes, Automatic Air
Canada Foundry Co., Toronto, Ont.
Canadian Westinghouse Co., Ltd., Hamilton, Ont.

Brass Goods
Penberthy Injector Co., Ltd., Windsor, Ont.

Brick, Coke Oven
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Co., Francis, Montreal, Que.

Brick, Fire
Dartnell, E. F., 157 St. James St., Montreal, Que.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Co., Francis, Montreal, Que.

Bridges
Canada Foundry Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Montreal, Que.

Buckets (Clam Shell, Coal and Concrete)
Beatty & Sons, M., Welland, Ont.
Mussen & Co., W. H. C., Montreal, Que.

Burners.
Waterous Engine Works Co., Ltd., Brantford, Ont.

Cableways
Dartnell, E. F., 157 St. James St., Montreal, Que.
Mussen & Co., W. H. C., Montreal, Que.

Canners Machinery
Wilson & Co., J. C., Glenora, Ont.

Castings
Allis-Chalmers-Bullock, Ltd., Montreal, Que.
Cramp & Sons, S. & E., Bldg. Co., Wm., Phila., Pa., U.S.A.
Lunkenheimer Co., Cincinnati, Ohio, U.S.A.
Morris Co., I. P., Beach & Ball Sts., Phila., Pa., U.S.A.
Wilson & Co., J. C., Glenora, Ont.

Castings, Iron, Steel and Malleable
Bliss Co., E. W., Brooklyn, N.Y., U.S.A.
Jack & Co., Watson, Montreal, Que.
Laurie Eng. & Mach. Co., Ltd., Montreal, Que.
McDougall Caledonian Iron Works Co., Ltd., John, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Montreal Steel Works, Montreal, Que.
Morris Co., I. P., Beach & Ball Sts., Phila., Pa., U.S.A.
Niagara Falls Mach. & Foundry Co., Niagara Falls, Ont.
Peacock Bros., Montreal, Que.
Robb Engineering Co., Amherst, N.S.
Smart-Turner Machine Co., Ltd., Hamilton, Ont.
Wilson & Co., J. C., Glenora, Ont.
Waterous Engine Works Co., Ltd., Brantford, Ont.

Cement, Portland
Hanover Portland Cement Co. Ltd. Hanover, Ont.
Hyde & Co., Francis, 31 Wellington St., Montreal, Que.
Leslie & Co., A. C., Montreal, Que.
Munderloh & Co., Montreal, Que.
Owen Sound Portland Cement Co., Ltd., Owen Sound, Ont.

Cement, Iron and Steel
Hamilton Facing Mill Co., Hamilton, Ont.
Smooth-On Mfg. Co., Jersey City, N.J., U.S.A.

Cement, Machinery
Allis-Chalmers-Bullock, Ltd., Montreal, Que.
Dartnell, E. F., 157 St. James St., Montreal, Que.
McDougall Caledonian Iron Works Co., Ltd., John, Montreal, Que.
Peacock Bros., Montreal, Que.

Cement, Rubber
Canadian Rubber Co., Ltd., Montreal, Que.

Chains.
Leslie & Co., A. C., Montreal, Que.
Waterous Engine Works Co., Ltd., Brantford, Ont.

Chain Blocks
Mussen & Co., W. H. C., Montreal, Que.
Yale & Towne Mfg. Co., New York, N.Y., U. S. A.

Chain, Conveyor Drive
Link-Belt Eng. Co., Philadelphia, Pa., U.S.A.
Waterous Engine Works Co., Ltd., Brantford, Ont.

Check Valves
Lunkenheimer Co., Cincinnati, Ohio, U.S.A.

Chemicals
Leslie & Co., A. C., Montreal, Que.

Chimneys, Steel and Concrete
Weber Steel-Concrete Chimney Co., Marquette Bldg., Chicago, Ill., U.S.A.

Chucks
Morse Twist Drill & Mach. Co., New Bedford, Mass., U.S.A.

Chucks, Automatic
Potter & Johnston Mach. Co., Pawtucket, U.S.A.

Coal Cutters
Allis-Chalmers-Bullock, Ltd., Montreal, Que.
Canadian Rand Drill Co., Sovereign Bank Bldg., Montreal, Que.

Coal Handling Machinery
Beatty & Sons, Ltd., M., Welland, Ont.
Canadian Fairbanks Co., Ltd., Montreal, Que.
Dominion Bridge Co., Ltd., Montreal, Que.
Hayward Co., 97 Cedar St., New York, N.Y., U.S.A.
Jeffrey Mfg. Co., Columbus, Ohio, U.S.A.
Laurie Engine & Machine Co., Ltd., Montreal, Que.
McDougall Caledonian Iron Works Co., Ltd., John, Montreal, Que.
Peacock Bros., Montreal, Que.
Petrie, H. W., Toronto, Ont.

Cocks, Gage and Air
Penberthy Injector Co., Ltd., Windsor, Ont.

Concentrators
Allis-Chalmers-Bullock, Ltd., Montreal, Que.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Mussen & Co., W. H. C., Montreal, Que.

Concrete Bonding
Greening Wire Co., Ltd., B., Hamilton, Ont.

Concrete Machinery (Mixers and Crushers)
Canadian Fairbanks Co., Ltd., Montreal, Que.
Dartnell, E. F., 157 St. James St., Montreal, Que.
Hyde & Co., Francis, 31 Wellington St., Montreal, Que.
Jeffrey Mfg. Co., Columbus, Ohio, U.S.A.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
McDougall Caledonian Iron Works Co., Ltd., John, Montreal, Que.
Mussen & Co., W. H. C., Montreal, Que.
Peacock Bros., Montreal, Que.
Petrie, H. W., Toronto, Ont.
Waterous Engine Works Co., Ltd., Brantford, Ont.

Condensers
Canada Foundry Co., Toronto, Ont.
Cramp & Sons, S. & E., Bldg. Co., Wm., Phila., Pa., U.S.A.
Goldie & McCulloch Co, Ltd., Galt, Ont.
McDougall Caledonian Iron Works Co., Ltd., John, Montreal, Que.
Morris Co., I. P., Beach & Ball Sts., Phila., Pa., U.S.A.
Peacock Bros., Montreal, Que.
Smart-Turner Machine Co., Ltd., Hamilton, Ont.
Waterous Engine Works Co., Ltd., Brantford, Ont.

Contractors
Canadian White Co., Ltd., Sovereign Bank Bldg., Montreal, Que.
Haney & Miller, Home Bank Bldg., Toronto. Ont

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F. H. Taylor, formerly vice-president of the Westinghouse Electric and Manufacturing Co., has been appointed vice-president of the Yale and Towne Manufacturing Company. Mr. Taylor's duties will relate equally to the manufacturing and commercial sides of the business, and ultimately will include many of the matters, which heretofore have been attended to by the president, H. R. Towne.

MUNICIPAL WORKS

The Provincial Government of Nicola, B. C., will construct a bridge across the river at a cost of $2,500.

The Manitoba Government has granted the request of the municipalities of Winnipeg and St. Boniface for a grant of $125,000 for the building and acquiring of bridge communications between the two cities. The bridge will cost in the neighborhood of $800,000.

The special committee of the City Council of Galt, Ont., has recommended that an agreement be entered into with the electric light company of the city, to extend over five years, giving the city power of nullification at the end of three years, on six months' notice. The cost is to be 25 cents per lamp per night, on moonlight schedule.

Charles H. Mitchell, C.E., who was one of the hydraulic engineers engaged in developing the Niagara Falls water-power has been making a preliminary examination of the various water-power propositions at Prince Albert. Mr. Mitchell is very sanguine over the power supply, feeling sure that a comparatively small outlay will give ample supply for not only the street railways but all the electric lighting and machinery necessary for a population of 5,000 or more.

LIGHT, HEAT, POWER

The Capital Power Company, whose plant and power at Deschenes was in liquidation, has been sold by Mr. W. L. Scott, master-in-chambers, to the Canadian Pacific Railway Company for $240,000.

The Kakabeka Falls water-power plant was started on Monday night, December 10th, by the Kaministiquia Power and Light Company. Connection has been made with the Ogilivie Company's new mill, one of the largest and most modern in the country.

The dam at the Natural Steps, Montmorency River, has now been built above the water, consequently the work will proceed with greater speed and with comparative ease. Owing to the dry weather and frost, the water is low, which assists matters. Very little water is going over the falls now.

The long-discussed scheme of harnessing the Victoria Falls of the Zambesi River will be begun immediately with united British and German capital. When the works are completed, electric power will be supplied to the industries of Rhodesia and the Transvaal, including the Rand. Probably afterwards, many railways will be electrified, getting their power from the same source.

St. John, N. B., has received a proposal from the Grand Falls Power Company to supply electrical power to the city for thirty years at named maximum figures. The company's calculation is that there would be an annual saving of $250,000 to users of the power in St. John. The company expects to develop 60,000 H.P. at the falls, with storage facility to increase the H.P. by 25%. The cost of equipment to the company will be $2,500,000.

A company is being formed for the purpose of developing 40,000 H.P. on the Quinze River at the head of Lake Temiskaming. The power will be used for mining purposes in the Cobalt silver-mining region, which is only 18 miles distant, and also for lighting purposes, as well as for an electric railway to run from New Liskeard to the source of the power. There will also be ample power to operate a large pulp and sawmill industry, to be established on the Quinze River. A number of prominent Canadian financial and business men are interested in the project, P. J. Loughrin, of Toronto, for the present acting as secretary for the proposed company.

NEW INCORPORATIONS.

Manitoba.—Canada Lighting Fixtures, Winnipeg, $100,000. R. H. Mainer, R. G. Mainer, R. J. Cole, E. C. White, Winipeg.

The Western Rubber and Apparatus Co., Winnipeg, $25,000. A. A. Andrews, J. H. Anderson, G. D. Minty, Winnipeg; W. P. Kearney, Montreal.

The Neva Development Co., Winnipeg, $100,000. J. Mattson, A. Anderson, M. S. Linnell, T. H. Johnson, Winnipeg; C. North, Whitemouth.

Ontario.—The Exploration Company, of Canada, Limited, Toronto, $100,000. A. O. Beardmore, W. R. Johnston, Jr., A. T. K. Evans, A. C. Macdonell, Toronto.

North Cobalt Mining Company, Limited, Cobalt, $50,000. H. Von Hagen, W. G. Kennedy, J. E. Judge, New York, N. Y.; E. O. Seeley, R. M. Holden, Cobalt, Ont.

Cobalt Native Silver Mining Co., Limited Haileybury, $500,000. A. T. Budd, Haileybury; W. S. Mitchell, Boston, Mass.; J. W. Kay, Detroit, Mich; W. A. Sadler, D. H. Glanville, Cobalt, Ont.

Consolidated Hardware Manufacturing Company, Limited, Hamilton, Ont., $40,000. T. H. Wynn, F. Forsyth, C. H. Brigger, S. B. Cunningham, G. L. Forsyth, Hamilton, Ont.

Ruby Silver Mining and Development Company, Limited, Hamilton, Ont., $500,000. S. J. Lloyd, W. S. Hutchinson, Montreal, Que.; J. M. Peregrine, G. R. Lees, Hamilton. Ont.

The Hunter Cobalt Silver Mining Company, Limited, Ottawa, Ont., $1,000,000. F. R. Latchford, W. L. Marler, J. Heney, M. J. Whelan, J. J. Heney, Ottawa, Ont

Nova Scotia Silver Cobalt Mining Company, Limited, Toronto, Ont., $2,000,000. B. E. Bull, J. Montgomery, J. G. Strong, W. R. Williams, G. F. Thompson, Toronto, Ont.

Cobalt Union Mines, Limited, Toronto, $1,000,000. J. A. Ferguson, J. A. Milne, A. C. Armstrong, W. B. Newsome, J. S. Back, Toronto.

Dominion.—H. R. Richey Co., Montreal, $20,000. H. R. Richey, C. H. Richey, A. L. Richey, G. W. Elliott, T. P. Butler, Montreal.

The Canadian Electrical Exhibition Co., Montreal, $20,000. W. M. Walbank, R. S. Kelsch, H. B. Bayne, J. A. Milne, J. W. Pilcher, Montreal.

The General Metal Foundry and Machinery Co., Montreal, $199,900. M. E. Lymburner, Ste. Agathe; L. M. Lymburner, J. E. Mathews, J. B. Mathieu, Montreal; A. St. Georges, St. Paul Que.

The Canadian Chrome Co., St. Hyacinthe, $145,000. H. St. Germain, J. H. E. Brodeur, J. M. Palardy, J. Blanchard, J. A. Cadotte, St. Hyacinthe.

The Valleyfield-Cobalt Mining Co., Valleyfield, Que., $1,000,000. T. Belanger, O. P. Prieur, L. Cossette, A. Cossette, J. N. Napoleon Bourasa, Valleyfield.

Northern Coal and Coke Co., Winnipeg, $1,000,000. J. S. Hough, A. C. Ferguson, C. Williams, E. B. Lindsay, W. M. Graham, Winnipeg.

Dominion Marble Co., Montreal, $50,000. F. A. Johnson, R. T. Hopper, F. H. Markey, W. W. Skinner, R. C. Grant, Montreal.

Shedrick, Rigby Co., Montreal, $20,000. C. E. Shedrick, J. S. Rigby, J. Rigby, P. C. Ryan, F. A. C. Bickerdike, Quebec.

D. Rattray, and Sons, Montreal, $500,000. D. Rattray, Quebec; D. J. Rattray, Montreal; E. E. B. Rattray, Quebec; C. W. Tofield, W. J. Lafavre, Montreal.

Western Canada Development Co., Winnipeg, $2,000,000. J. S. Hough, A. C. Ferguson, C. Williams, E. B. Lindsay, W. M. Graham, Winnipeg.

The Primier Asbestos Company, Limited, Montreal, Que., $50,000. E. Languedoc, W. J. Henderson, A. C. Calder, C. T. Jette, J. Jenkins, Montreal, Que.

Dominion Chrome Company, Limited, Montreal, Que., $20,000. H. W. Beauclerk, A. C. Calder, J. Jenkins, A. Savard, E. Languedoc, Montreal, Que.

Mussens, Limited, Montreal, Que., $500,000. W. H. C. Mussen, G. Boulter, G. G. Foster, C. G. McKinnon, W. R. Staveley, Montreal.

Dominion Asbestos Co., Montreal, $500,000. H. H. Robertson, Boston, Mass., R. T. Hopper, F. H. Markey, W. W. Skinner, R. G. Grant, Montreal.

The German Development Co., Ottawa, $1,000,000. G. W. Buxinstein, H. Dansiger, H. Kraemer, Berlin, Germany; O. E. Talott, H. B. McGiverin, A. E. Barlow, M. Cohen, Ottawa.

New Brunswick.—The Saint Martins Railway Co., St. John, $99,000. G. W. Vaughan, St. Martins; W. E. Foster, H. A. McKeown, W. G. Scovil, St. John; F. M. Anderson, Campbellton.

The Perth Electric Co, Perth, $9,000. W. Amies, S. J. Brown, J. W. McPhail, C. L. Olmstead, G. E. Armstrong, Perth.