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The Canadian Engineer

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CONTENTS OF THIS NUMBER:

THE MECHANICAL ACTION AND RESULTANT EFFECTS OF MOTIVE POWER AT HIGH SPEEDS ON BRIDGES.

The following report was presented to the Association of Railway Superintendents of Bridges and Buildings at its recent session in Chicago, by Geo. W. Andrews, J. E. Grenier, and Walter G. Berg.

"The subject which your committee has been called upon to investigate is one which has been before the engineering profession for years, but up to the present time no one has been able to definitely formulate any positive law of action, or even to indicate in an approximate manner just what injurious effects quickly-moving loads have upon bridges.

"We all know that trains rushing over a bridge will cause shocks, tremors, and vibrations. We can feel these effects by standing on the structure, and we realize that the heavier structure is less shaken than the lighter. But if called upon to state in accurate terms the amount of increased strain due to those moving loads, your committee must plead ignorance. The effects are there, they can be measured, and instruments can be made which will register them. These measurements, however, must necessarily cover such a broad field that in all probability no one committee will even be able to arrive at any conclusions worth speaking about. Your committee must ask to be excused if they have found it beyond their power to present to the association any original matter, but have resorted to the old trick of embracing in this report a resumé of the facts presented and the experience gained by others, and compiling this information so as to represent our present knowledge on the extremely erratic action of motive power on bridges.

"The attempted determination of impacts can be divided into three classes:—

"1. Those which are purely theoretical and which are of no interest to this association.

"2. Those which had for their object the measurement of the stretch of the various members of a bridge during the passage of trains. These tests are practically limited to those made by European investigations on riveted bridges, the results of which indicated that impacts decreased as the length of the span increased, and in a rather uncertain and erratic manner, that impacts in the various members of the same span are a vague function of the length of moving load required to cause the maximum strain in the member considered. Members of your committee made about one hundred tests of this character, but results were not sufficiently positive to justify their presentation in this report.

"3. Those which had for their object the measurement of the deflection of the structure as a whole.

"Among investigators who have endeavored to measure centre deflections by mechanical means, perhaps no one has gone further into the question than Prof. S. W. Robinson, M. Am. Soc. C.E., who invented an instrument which accurately measured the deflection of bridges. The results of Professor Robinson's experiments were presented before the American Society at the June meeting, 1895, and show that the increase of strain due to vibrations caused by unbalanced locomotive drivers is 28 per cent. of the maximum strain caused by the passing train when statically considered. He observed also that the increased strains due to vibrations caused by the body of the train were 50 per cent. greater than the corresponding part of the train statically considered. Moreover, since he found certain cases in which the dynamic strains produced by the train load itself were greater than those caused by the engine, he was of the opinion that in designing bridges 50 per cent. should be allowed for impacts, instead of the 28 per cent. which he found in his diagram. He also found that the cumulative vibrations, depending upon certain relations between the load and bridge, were particularly prejudicial. Among these are the relation between the circumference of the driver and the panel length, and the relation between the wheel spacing and the panel length.

"In actual practice it is the custom of different engineers to make variable allowance for the effects of impact. For example, some roads will assume that bridges under 100-feet span are subjected to impacts of varying amounts, while spans of greater length are subjected to no impact. Others assume that the strains caused by live loads are twice as great as those caused by the dead load only, regardless of the length of span. Some specifications allow a certain impact varying from 100 per cent. for very short spans to nothing for spans of 500 feet and over. Others, again, will allow for varying impacts, depending upon the ratio of the minimum stress to the maximum.

"All these attempts to establish a law of impact, and the assumption of such laws as given in the various bridge specifications, while undoubtedly indicating the unsettled knowledge of the subject, are nevertheless more or less valuable, and tend toward safe construction. It is to be hoped that in the near future a sufficient number of tests will be made to indicate in some definite manner which, if any, of the numerous assumptions are approximately correct."

GRAND TRUNK SIGNALING SYSTEM AT TORONTO.

There are several kinds of interlocking in use in the States and Europe, viz.: the Manual, the Electric, the Auto-Pneumatic, the Electro-Pneumatic, the Automatic-Electric, and the Hydraulic.

In Toronto, the Grand Trunk Railway has adopted the Manual system for working the switches and signals from Berkeley street to Queen's wharf, there being in that distance four cabins, comprising 187 levers in all. Illustrations are here given showing several features which have been introduced for the first time on any Canadian railway. The accompanying diagram represents the yard at the east entrance of the Union station. This cabin contains 66 levers, and is worked by three men during the twenty-four hours, in eight-hour shifts each.

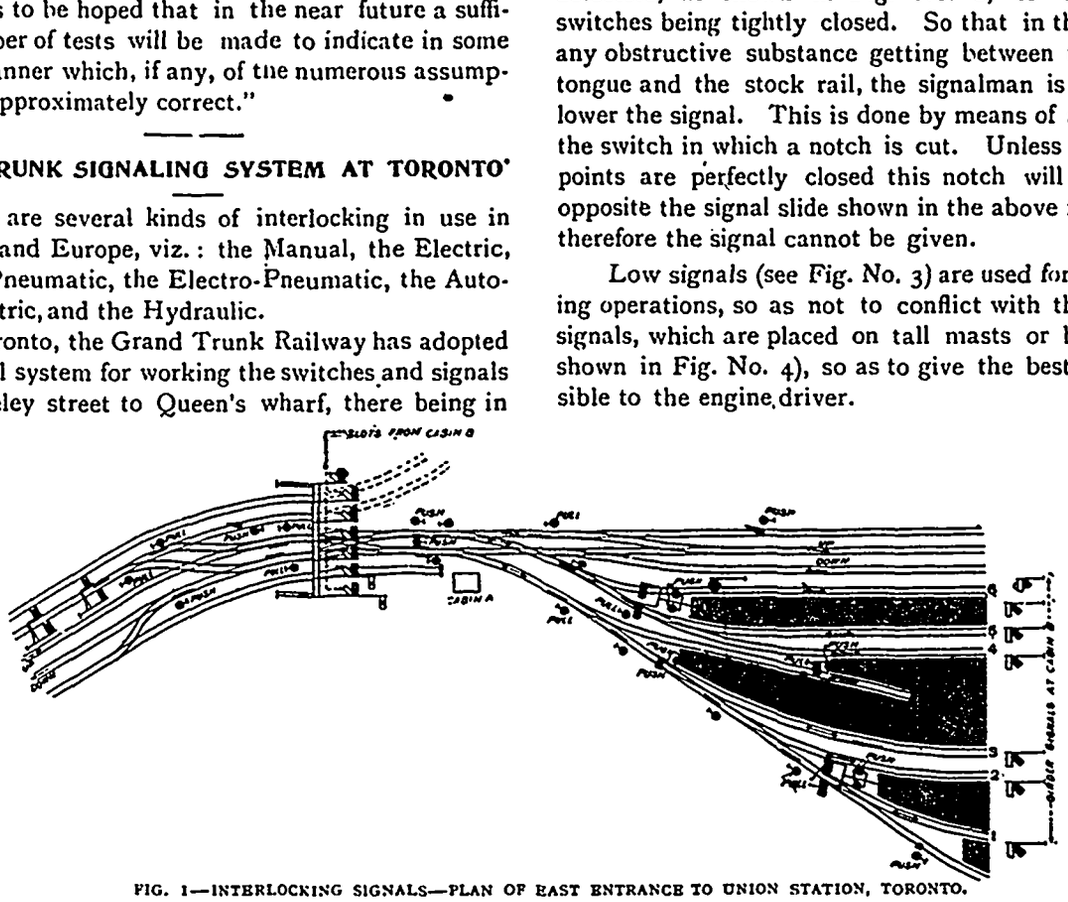


FIG. 1—INTERLOCKING SIGNALS—PLAN OF EAST ENTRANCE TO UNION STATION, TORONTO.

The signals and switches are so interlocked one with the other, as to prevent the signals being given for any other route than that for which the switches are set. The action of setting the switches itself locks the signals for conflicting routes at danger, and the signal for any route cannot be lowered until all the switches for that route are set right, and when the signal is pulled for that route all the switches are locked and cannot be moved until the signal has been put to danger.

To prevent the signalman throwing up the signal and moving the switches before the train is clear of them, the switches themselves are provided with bars which must rise above the top of rail before the switch can be thrown, this bar being of sufficient length to cover the longest wheel base.

In addition to this, the switches are provided with detectors, as shown in Fig. No. 8, to ensure the switches being tightly closed. So that in the event of any obstructive substance getting between the switch tongue and the stock rail, the signalman is unable to lower the signal. This is done by means of a rod from the switch in which a notch is cut. Unless the switch points are perfectly closed this notch will not come opposite the signal slide shown in the above figure, and therefore the signal cannot be given.

Low signals (see Fig. No. 3) are used for all shunting operations, so as not to conflict with the running signals, which are placed on tall masts or bridges (as shown in Fig. No. 4), so as to give the best view possible to the engine driver.

All signals are worked by wires, and the signal arms are so constructed that in the event of a breakage of the wire they will at once fly to danger. The switches are worked by gas-pipe run on anti-friction rollers (Fig. No. 5), and attached to the levers in the cabin by means of cranks.

The long-distance signals are supplied with wire regulators (Fig. No. 6), so that the signalman may adjust the length of the wires no matter how much they vary through difference in temperature, without having to leave his cabin.

As a means of communication between the signalmen in the various cabins train indicators are used (Fig. No. 7), on the dials of which are marked the various kinds of trains run on that section of the line. In this way the announcement of the trains is indicated from cabin to cabin.

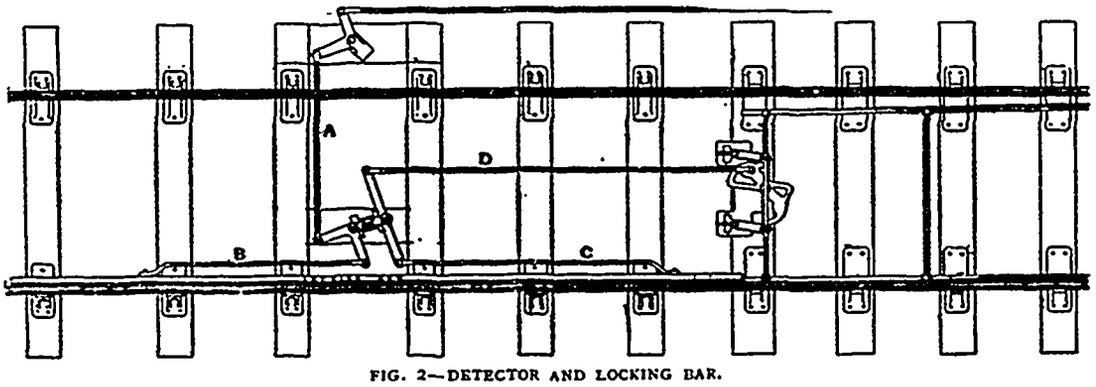


FIG. 2—DETECTOR AND LOCKING BAR.

At the crossing of one railway by another on the level, derails are placed in the track 50 feet from the home signal, and 500 feet from point of crossing, so that in case of a driver over running his signal, the engine

will be dropped out of the ties. These derails are interlocked with the signal, so that it cannot be given unless the derail is closed and the signals on the opposing line are set to danger and the derails open.

The Fig. No. 8 illustrates a new form of locking gear for switch points, which is being tried here for the

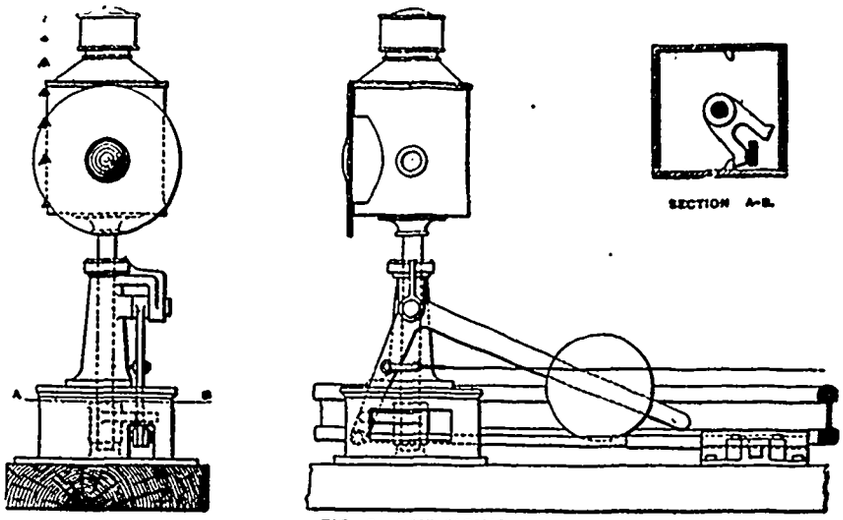


FIG. 3—LOW SIGNAL.

first time in America. Whilst the switch is perfectly locked for a train to pass over it in the facing direction, it can nevertheless be trailed through by a train moving

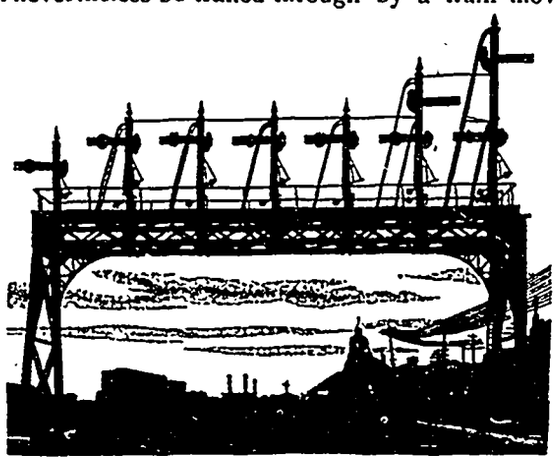


FIG. 4.—MAST SIGNALS.

in the opposite way without damaging the switch; at the same time, however, a pin connecting the switch with the lever is sheared through, and must be replaced before the switch can be again shifted. There is no strain placed on this brass pin while the lever is being moved, as the spring catch clamps the curved arm to the lever; but when the spring catch is released the brass pin is the only connection with the lever.

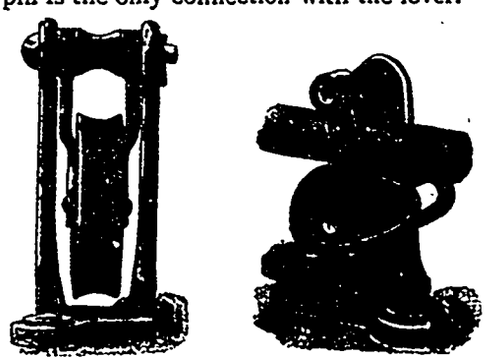


FIG. 5.—CHARRINGTON'S SUSPENDED ROLLER

P. F. Hodgson, the engineer under whose supervision the admirable system above described has been developed, was born in London, England, in 1868. He was educated at Christ's College, Finchley. After serving three years in the shops and two years in the offices of Messrs. Saxby & Farmers, signal engineers, of London, England, he took charge of the fixing of their appliances on the various railway lines in the United Kingdom. In May, 1893, he was appointed signal engineer of the Grand Trunk Railway. (For other diagrams and portrait of Mr. Hodgson, see next page).

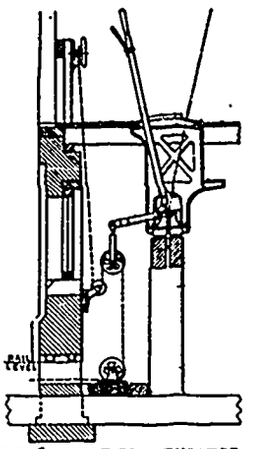


FIG. 6—WIRE COMPENSATOR.

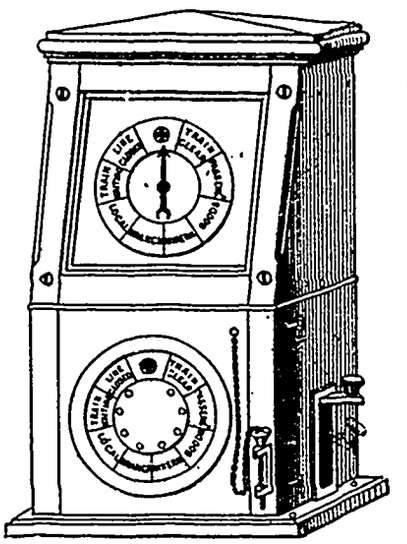


FIG. 7—TRAIN INDICATOR.

EXPERIMENTS ON CONCRETE MADE AT M'GILL UNIVERSITY.

At a meeting of the Canadian Society of Civil Engineers, held on 19th November, a report of some experiments on concrete, made at McGill University by Messrs. Theo. Denis, G. G. Hare and Carl Reinhardt, was presented by Theo. Denis. These experiments were suggested by the specification for the Chicago Drainage Canal, and are interesting as they tend to remove some errors in general opinion on the effect of water on cement. Discussion was sustained by Prof. C. B. Smith and Messrs. Marceau and McPherson and Theo. Denis. The report is as follows:

Of late monolithic works of great importance have been carried out, and every day concrete, as building material, is creeping to a foremost place.

Although cement testing proper has been subjected to elaborate, scientific and practical investigations, very few researches, and especially normally conducted researches, have been made on the strength and behavior of concretes and betons. This probably is due to the fact that for such experiments heavy and costly apparatus is needed. Investigations on small specimens would be useless, and conditions approaching as nearly as possible to practice have to be followed.

The following are the results obtained from a series of experiments made by students of McGill University, 1895-96:

The object of this first series of experiments is to determine the effect of different per cents of water on the strength of the concrete. The limits were 16 and 30 per cent. of water, by weight of cement and sand, which are beyond the extremes of practice on both sides.

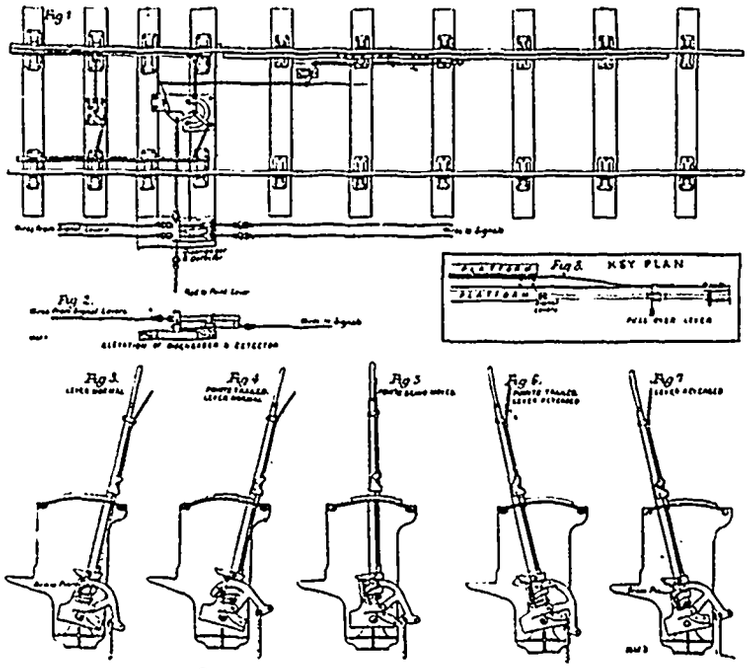


FIG. 8—TRAILABLE FACING POINT LOCKING GEAR.

CEMENT.

The cement used was, of course, the same brand throughout the series. It was a German Portland of good quality, slow setting, on which separate sand tests were made in connection with this series. The results are tabulated below.

SAND.

This was clean, coarse, angular, dry sand of good quality, of slightly higher grade than usual practice.

STONE.

This was broken limestone of such size that the pieces would have passed through a ring 1¼-inches diameter. They were unscreened and just as they came out of the breaker. Consequently a slight amount of dust was mixed with them. They had to be broken a little smaller than in actual practice. The blocks of concrete being only one cubic foot, it was thought that more accurate results would be obtained in this way.

MOULDS.

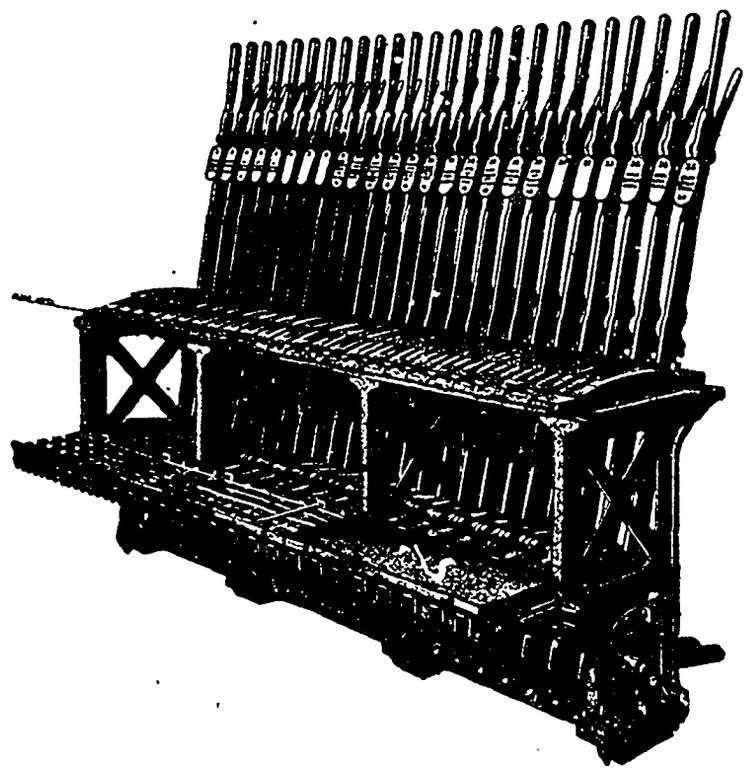
The moulds were made of ¾-inch plank, lined with sheet zinc. They were 5 feet long, 1 foot high and 1 foot wide, divided into four compartments, which would mould four cubes at once, of dimensions 1 x 1 x 1 feet, forming specimens large enough to investigate seriously upon. These were removed by unscrewing one side of the box and sliding them out. Care had to be taken to oil the sides of the moulds slightly before ramming the mixture in them, to avoid trouble in getting them out.

CONDITIONS OF MIXTURE AND PROPORTIONS.

The proportions adopted for this series were one of cement, two of sand, and four of stones, by weight, the proportion of water being based on the weight of sand and cement.

The cement and the sand were first thoroughly mixed dry, then the water added gradually. The stones were then thrown on this mortar, spread out, and the whole vigorously and very thoroughly mixed. The fresh concrete was then placed into the moulds and rammed in 1½ to 2-inch layers.

P. P HODGSON.



LOCKING APPARATUS, UNION STATION.

RAMMING.

The rammer was a block of hard wood 2 feet long by 2x2 inches, with a lathe turned handle. It was not very easy with this to ram uniformly, even throughout one block, and this is one of the main sources of discrepancies in this series of experiments.

It was thought that a reduction of the breaking loads to a standard weight of the blocks would be only fair, and would slightly improve the results.

GROUPING OF TESTS.

The tests were made at one week, four weeks, and

two months, and the results grouped accordingly, that is to say, the one week tests, with different per cent. of water, compare between themselves, four weeks and two months likewise. Parallels between the results, at different ages, cannot be drawn on account of some specimens having been prepared under widely different conditions. For instance, the results at two months are exceedingly low as compared with those obtained at one and four weeks. This is due to the fact that these two months specimens were the first prepared of all, and this before the cemented trough in which they were to be immersed was completed. Consequently, they were kept 8 to 10 days longer than the others in the dry air of the laboratory, which seems to have had a disastrous effect on them. But in spite of these slight drawbacks, the annexed table shows that up to 24 per cent., the percentage of water has not a very great effect on the strength. This is an important point, for below 20 per cent. the mortar obtained is rather dry and very difficult to handle.

But beyond this limit of 24 per cent. a greater proportion of water seems to weaken the concrete considerably.

This limit is very sharply defined in the adjoining table, where an additional 2 per cent. of water, from 24 to 26 per cent., weakens the concrete by almost one-half for the one-week tests. It is, however, interesting to notice that strength is almost completely recovered with time, the four-week tests showing the weakening limit to be between 26 and 28 per cent., and the two months' between 28 and 30 per cent. So that if immediate strength be not required of the concrete structure, 28 per cent. of water will not affect the ultimate resistance if allowed to stand two months.

In the parallel sand and cement tests the weak line is not so sharply defined, but yet it is sufficiently so to show that the same statement applies. The tests in this case show a marked weakening between 14 and 16 per cent. of water for the one week, which strength is ultimately recovered, as is shown by the four weeks' and two months' tests.

The low limit of 14 per cent., as compared with 24 for the concrete, is probably due to the fact that the stones of the concrete, on account of their porosity, absorb a part of the water.

The table shows that the greatest density is obtained with 16 and 18 per cent. The weights of the cubes beyond this decrease up to 24 and 26 per cent., where they are again nearly equal in density to the 16 and 18 per cent. of water. Therefore this 24 and 26 per cent. seems to be the point where the best practical results are obtained, because 16 and 18 per cent. make up too dry a concrete to allow of easy handling.

Another point incidentally comes up. Attention has been drawn to the poor results obtained by the same tests and reason of long exposure to dry air given. This shows up a very important point, namely, the necessity of covering up carefully all concrete and cement works exposed for any length of time to dry air and sun. The bad effect of these agents is plainly demonstrated, and it is doubtful whether much strength would ultimately have been recovered.

It is also interesting to notice the results obtained by the concretes made of 1 part of cement, 2 of sand and 5 of stones and 1 cement, 2 sand and 6 of stones. The specimens of these compositions gave results equal to concretes 1, 2, 4, showing that for strength they are as good as the ones containing a less proportion of stones, while being much more economical.

These experiments are as yet very incomplete. But it is hoped that the researches in this subject will be continued and that valuable information for the engineer in practice derived from them.

CONCRETE TESTS—COMPRESSION.

Proportions by weight: 1 part cement, 2 sand, 4 stone.

Per cent. of water by weight of cement and sand.	Crushing strength per square inch. 1 week, comp. tests.	4 weeks.	2 mos.	Average weight of sp. per c.f.
16	792	677	382	141.5
18	653	679	507	143.0
20	746	626	507	139.5
22	620	615	670	139.5
24	679	542	559	141.5
*26	362	545	500	141.2
28	326	340	823	138.0
30	245	331	361	135.5

Proportion by weight. 1 cement, 2 sand, 5 stone.

20 703

1 cement, 2 sand, 6 stone.

20 728

CEMENT AND SAND TESTS.

Proportions: 1 cement, 2 sand.

10	825	800	1822
12	800	1311	1666
14	750	1000	1100
*16	475	1389	1777
18	395	1110	1266
20	400	913	1633
22	330	844	1233
24	388	—	1230
26	—	—	1000

*Line of weakness due to excess of water.

THEO. DENIS.
CARL REINHARDT.
G. G. HARE.

McGill University, April, 1896.

DR. JAMES P. KIMBALL, of New York, mining engineer and ex-director of the United States mint, has been making a personal inspection of the Trail Creek mines in British Columbia.

POWER FROM THE TIDES.

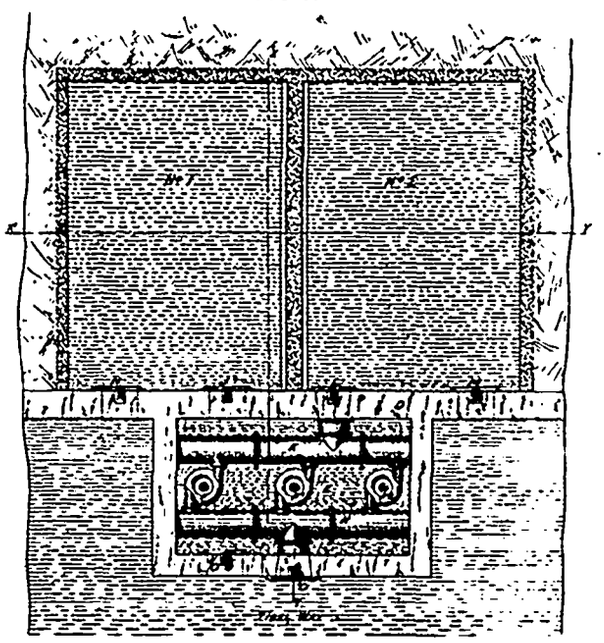
Dr. Babbage, the well known mathematician, was so struck with the vastness of the power represented in the ocean tides, that he made a calculation of the energy which the tides of the Atlantic could exert in a day. His estimate is that if the tides of this ocean alone were stored up for 24 hours, and converted into mechanical force, the power would be sufficient to drive all the machinery then existing in the world for 175,000,000 years. What a "pull" the moon must have on "this distracted globe!" And if this estimate is exaggerated by one half, still the mechanical force of the tides must be almost beyond comprehension, for this power is in constant exertion. To give one a more concrete notion of this power it may be stated that Professor Sylvanus P. Thompson made the startling assertion that at one English port (Bristol) the displacement of the volume of water up and down each tide was represented by a force of twenty billion foot-pounds of energy each year, or fifty billion foot-pounds at the mouth of the river, which is five miles distant. A tenth part of the tidal energy in the gorge of the Avon, the professor states, would light the city of Bristol, and a tenth part of the tidal energy in the channel of the Severn would light every city in Great Britain, and, in addition, turn every loom, spindle and axle which English manufacturers possess.

If this can be obtained out of the low tides of the British coast, it would be interesting to know what power could be got out of the Bay of Fundy, where, between the two coasts of Nova Scotia and New Brunswick, the tide rises and falls at some points over 60 feet.

On pages 124 and 180 of our last volume, reference was made to a tidal motor invented by Edward Davies, an English inventor of extended experience, who put in a small experimental plant in a tidal inlet in England, and operated a dynamo for three months in lighting a house. The experiment was quite successful, and Mr. Davies claims that the cost of running a tidal motor would be only one-fifth that of steam, while the wear and tear would be next to nothing.

Mr. Davies favors THE CANADIAN ENGINEER with the following description of the tidal motor with the accompanying diagrams, showing the method of its operation :

FIG. 1.



DAVIES' TIDAL MOTOR.

"According to this invention I employ two reservoirs of dimensions suitable to the power required, and which I call No. 1 and No. 2 reservoirs. By the aid of the two reservoirs, and working from the tide direct, I can keep turbines or other suitable water motors going continuously during the 24 hours, and if necessary throughout the year. The bottom of No. 1 reservoir will be about on a level with low tide, but may be higher; and the bottom of No. 2 reservoir may be about level with the tide when about half high, more or less. A turbine race is arranged in front of the reservoirs next to the tidal way. In this race are fixed, as a rule, two turbines; but there may be more or only one to suit circumstances. The turbines will be fixed 3 feet, more or less, above the bottom of the turbine race, which will be on a level with the bottom of No. 1 reservoir, or may be higher. There is a water supply pipe on each side of the turbines to work them. One pipe receives the water direct from the tidal way through a sluice valve. When the turbines are a considerable distance away from low tide the water can be brought up the trough or pipes that take away the used water from the turbines to low tide, and so to the feed pipe above mentioned. The other feed pipe on the other side of the turbines receives its water through a sluice valve from No. 2 reservoir. The turbines discharge their water on to the bottom of the turbine race, from whence it runs through a sluice gate into No. 1 reservoir for a given time, and for the rest of the time through a sluice gate into the tidal way through troughs or pipes or other means.

FIG. 2

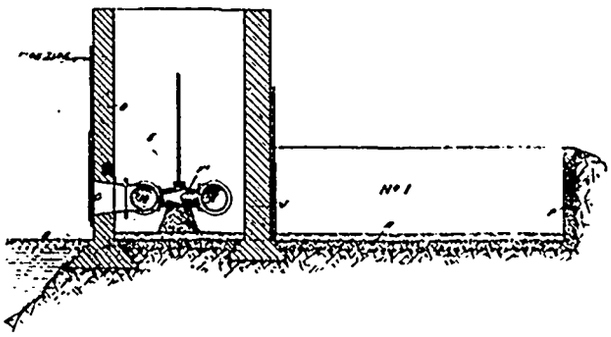
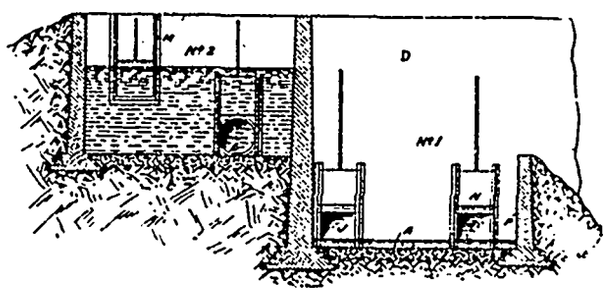
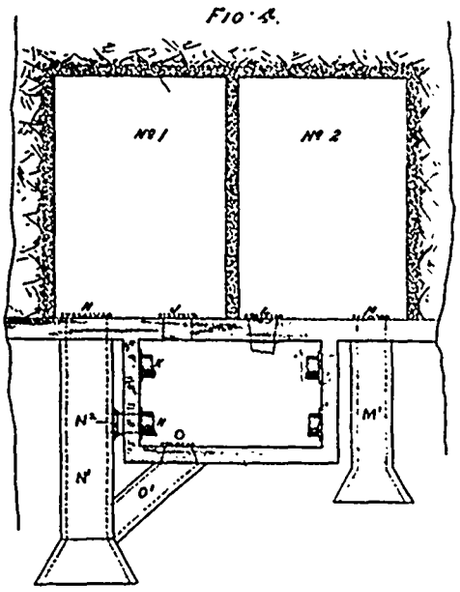


FIG. 3.



DAVIES' TIDAL MOTOR.

"The above arrangement in practice works as follows: Dealing with a tidal rise and fall of 21 feet: assuming the turbines to be 3 feet above the bottom of their race, this will give at high tide an eighteen feet head of water. At high tide No. 2 reservoir is full of water and No. 1 reservoir is empty. The tide will rise and fall 3 feet 6 inches per hour. To commence work the tidal water is admitted to the turbines, which are kept going for 1¾ hours, the water being delivered from them into No. 1 reservoir, which must be of a suitable size for the purpose; the tide will have lowered in the 1¾ hours 6 feet 1½ inches, leaving 11 feet 10½ inches clear head of water: I now stop the water from the tidal way and work the turbines from the water in No. 2 reservoir for 3 hours, still delivering the water from the turbines into No. 1 reservoir. The tide has lowered in the 4¾ hours 16 feet 7½ inches; I keep on working from No. 2 reservoir for 1¼ hours longer, the turbines delivering the water into the tidal way. The turbine has now been working 6 hours and it is low tide (and No. 1 reservoir is emptied into the tidal way). I still keep on working the turbine from No. 2 reservoir for 1¼ hours, the water being delivered into the tidal way. The tide has risen in the 1¼ hours 4 feet 4½ inches. I still keep on working from No. 2 reservoir, delivering the water from the turbine into No. 1 reservoir for 3 hours, making 4¼ hours from low tide. The tide has risen in the 4¼ hours, 14 feet 10½ inches. I now shut the water off from No. 2 reservoir and commence to work the turbines from the tidal way for 1¾ hours, delivering the water into No. 1 reservoir; this makes 6 hours, and it is again high tide (as when I started at first) and No. 2 reservoir is again filled; so that I go on with the same cycle of working continuously every hour, day and night (if required) throughout the year. The turbines can be started to work at any time, day or night, and at any height of the tide, and even at low tide.



This invention will be best understood by describing the same with aid of the accompanying drawings.

Figure 1, plan of the entire means according to this invention.

Figure 2, sectional view on line X, Y.

Figure 3, sectional view on line X^1,Y^1, looking towards the tidal way.

Figure 4, partial view of Fig. 1 with modification.

According to this invention I employ one or two reservoirs of dimensions suitable to the power required, numbered for convenience of reference 1 and 2; the bottoms of these are placed at different levels to enable the rise and fall of the tides to be utilized during every twelve hours to drive turbines as hereafter described. I will proceed to describe the invention with reference to two reservoirs.

The bottom A of No. 1 reservoir may be on a level with the top of the water B, of the tidal way at low water; and the bottom C of No. 2 reservoir about the top of the water at half tide high. I propose to explain the invention dealing with a tidal rise and fall of twenty one feet.

The wall D of the reservoirs facing the tidal way is provided with a turbine race E, which shuts out the tidal water. In this race are arranged the turbines F, F^1,F^2. The drawings show three turbines, but more or less may be employed. These turbines are held to be about three feet above the level of the bottom A, of No. 1 reservoir. At this level there is a sluice valve G, opening into the tide water. This valve communicates with a feed tube H, for the turbines when the latter are being worked by an inlet of water from the tidal way. The turbines empty into the bottom of the race E, from which there is a communication into No. 1 reservoir. This communication is closed by a sluice valve J. The capacity of this reservoir should be such that the water running in from the race E, should never rise above the level of the turbines. On the other side of the turbines is another feed pipe K, to receive the water from No. 2 reservoir. The communication from the latter reservoir to the feed pipe is controlled by a sluice valve L. The working is as follows: As the turbines are placed three feet above low water level, a tidal rise of 21 feet will give the turbines at high tide a head of water of 18 feet. At high tide No. 2 reservoir is full of water which has come in through the sluice M, then the latter is closed. At this time No. 1 reservoir is empty. The tide will rise 3 feet 6 inches per hour. Working begins at high tide by letting the water in from the tidal way for one hour and three-quarters, which, after passing through the turbines, empties into bottom of race E, and runs into reservoir No. 1, through the sluice way J. During this hour and three-quarters working the tide will have lowered 6 feet 1½ inches, leaving 11 feet 10½ inches of water head. The tide water will now be shut off by closing valve G; and the sluice L of No. 2 reservoir opened and the water taken from this reservoir for three hours, which runs into feed pipe K, and from thence through the turbines as described into No. 1 reservoir. The tide will have lowered in 4¾ hours 16 feet 7½ inches. For the next 1¼ hours the water is continued to be drawn from No. 2 reservoir, but empties out into the tidal way. It will now be low tide when the sluice N, of reservoir No. 1, is opened and the reservoir emptied of its water into the tidal way, and any water in the turbine race can be also run out though the sluice O. The turbines continue working with water from No. 2 reservoir for a further 1¼ hours, the water running into the tidal way, when the tide will have risen 4 feet 4½ inches. Working is still continued from No. 2 reservoir for another three hours, the water running into No. 1 reservoir, making 4¼ hours since low tide. During this 4¼ hours the tide will have risen 14 feet 10½ inches. No. 2 reservoir is now shut off, and the turbines worked by water from the tidal way for 1¾ hours, the water being delivered into reservoir No. 1. It is now high tide again and No. 2 reservoir is once more filled for working.

By the above described means turbines can be worked day and night continuously by tidal water throughout the whole year, the capacity of the reservoirs being such as will receive and supply the requisite quantity of water necessary to work the turbines. To obtain nearly even power in working, I find it advisable to vary the size of the turbines, taking the smallest one with the highest head, and the largest with the lowest head. When the reservoirs are placed a distance inland I use pipes M^1 and N^1, from the reservoirs to the tidal way. The feed pipe H can be connected to the side of the pipe N^1, as shown at Fig. 4, and the outlet from turbine race by branch pipe O^1. When working with one reservoir only (No. 1), the working begins at half tide, the reservoir being then empty, and goes on for six hours from the tidal way, the water running into the reservoir. When the tide has fallen half way the working ceases, and at low tide the reservoir is emptied, and working recommences when the tide has risen half tide high."

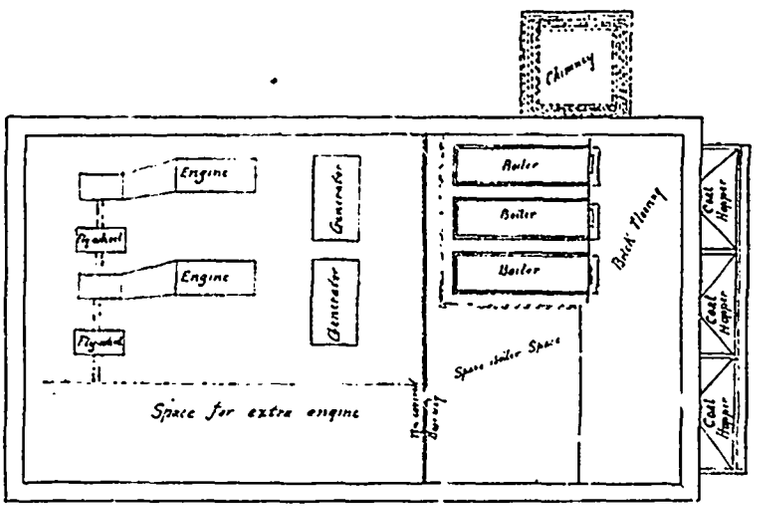
For THE CANADIAN ENGINEER.

THE HAMILTON RADIAL ELECTRIC RAILWAY.

BY F. C. ARMSTRONG.

Of the various electric railway projects which have in Ontario during the past year advanced from the preliminary and paper stage into that of a completed or partially completed and operating system, the Hamilton Radial Electric Railway is easily the most important. The scope and nature of the undertaking is clearly indicated in the name of the company. The situation of Hamilton, thrust forward by its position at the head of Burlington Bay into the most fertile and populous part of Western Ontario, is especially favorable to the success of such a system of light electric railways, radiating from it as a centre towards the south-east through Beamsville, Grimsby and St.

Catharines to Niagara Falls; to the west, reaching out to connect with the Brantford, the Galt, Preston and Hespeler, the Guelph and the Berlin systems, and to the north-east through Burlington and Oakville to a point of connection with the Toronto system, if not into the city itself. The original and more comprehensive scheme of the Hamilton Radial Railway Company, as first incorporated, embraced the construction of a road in each of the three directions named, and complete surveys have been made of the proposed route in each case. The field in the direction of St. Catharines and Niagara Falls, however, has already an occupant in the Hamilton, Beamsville and Grimsby Company, whose road recently extended as far as Beamsville, and now covering a distance of twenty-two miles, has during the past two years built up a large and exceedingly profitable business. It was, therefore, in the direction of Toronto that the present strong and active management of the Radial Company, upon assuming control of the undertaking early last spring, decided to commence operations. The section of the road at present completed reaches from the Hamilton terminus to the village of Burlington, a distance of 11¼ miles. The second section to be built next spring, extending a further distance of twelve miles, will carry the line into Oakville. The construction of a final link, ten miles



HAMILTON RADIAL ELECTRIC RAILWAY, PLAN OF POWER HOUSE.

in length only, will then be sufficient to connect the line at Long Branch with the Municipal extension of the Toronto Railway Company's system. It is, therefore, easily possible that before next autumn the steam lines will have to face in their new electric rival a formidable competitor for passenger and light freight traffic, between the two important cities of Hamilton and Toronto. A valuable feature of the Radial Company's route may be pointed out in this connection. As will be noted, it controls the only practicable entrance remaining into Hamilton from the east or north, while the terminus at the corner of Gore and James streets is in the very heart of the city, within a stone's throw from the City Hall.

The officers of the company are Messrs. A. Turner, President; W. A. Wood (of the firm of Wood Vallance & Co.), Treasurer, and T. E. Leather, of Leather & Watson, Vice-President and Manager, and the directorate comprises as well T. H. Watson, Col. A. Zimmerman, and other gentlemen well known in business and financial circles in the Ambitious City. The actual and laborious work of carrying the enterprise through its initial and constructive stages has devolved upon Messrs. Wood and Leather, and to their unremitting efforts is due the rapid and successful completion of the most difficult portion of the undertaking.

The line, as at present constructed, covers, as has been stated, a distance of 11¼ miles, and is especially well adapted for economical operation at high rates of speed, the maximum gradient being less than two per cent., while the curves, except for a short section within the city limits, are practically negligible. The position of the power-house at Burlington is such as to facilitate the ready handling of coal, either from vessels or by rail, while affording an abundant supply of water for condensing. The placing of the power-house at the end of the line, as at present constructed, is, of course, in view of the extension to Oakville next year. The extreme distance of transmission to the end of the line in Hamilton is 9¼ miles, entailing of course a heavy expenditure for copper at the standard railway pressure of 550 volts. It may be mentioned in passing that the whole question of transmission was thoroughly gone into before a decision was arrived at, on the lines finally adopted, of using one power house, located at Burlington, to supply the two sections of the line, and of putting the necessary money into feeders to carry the current at standard voltage. The alternatives of an additional power-house, of using polyphase transmission apparatus with rotary converters, of employing boosters, or a higher voltage than the standard, were all, however, for the conditions stated, found less advisable, on the paramount grounds of simplicity and economy, than the method adopted.

The equipment of the road is excellent throughout, no effort having been spared to make it up to date in every particular. The track consists of 65-lb. steel T-rails, laid on cedar ties, fastened with angle plates and Goldie patent spikes. All turnouts are provided with automatic safety switches, and are placed one mile apart. The over-head construction work, done under the supervision of Walter Scott for the contractors, McCartney, McIlroy & Co., New York, is of the most modern and substantial description. The trolley lines of No. 00 hard-drawn round copper wire, are suspended, except where cross suspension work is required, from flexible brackets, soldered clips being used throughout. The use of double trolley wires, unusual on a single track road, has the great advantage of dispensing with the switches and frogs which are a continuous source of trouble in high speed service. In this case, of course, the extra trolley wire is as well, supplying the place of its equivalent capacity in an additional feeder. Where the road crosses the Beach Canal, upon the new steel bridge, conveniently erected during the past summer by the Dominion Government, the feeders are carried under the canal in armoured cables. The bridge itself, it may be added, is operated by an electric motor, for which current is supplied from the railway company's circuit at a reasonable rental.

The rolling stock, up to the present, consists of four fifty-foot closed motor cars, built by Patterson & Corbin, mounted on Blackwell trucks. The cars are of the cross-seat type with centre aisle, and are equipped with standard air brakes operated by an axle driven compressor. The electrical equipment of each car consists of two C. G. E. 1,200 motors with K. 21 controllers, manufactured by the Canadian General Electric Co. These motors have given excellent service, being found amply sufficient in power to handle one, or if necessary two loaded cars at full speed.

The power-house is a handsome and well laid out

structure of pressed brick. In the boiler-room, separated by a brick fire wall from the rest of the building, are three Goldie & McCulloch boilers 66 inches by 14 feet, of their standard horizontal type, space being provided for additions to be made as required. The engines at present installed consist of two Wheelock tandem compound, 15 x 26 x 34, each capable of working condensing up to 300 h.p. The generators, one of which is belted direct to the fly-wheel of each engine, are of the Canadian General Electric Company's multipolar type, having a capacity of 200 kilowatts each. The switchboard, built up of white marble panels, contains the standard equipment of station apparatus, the ammeters and voltmeter being of the Weston round pattern.

Altogether the Hamilton Radial Electric Railway, as embodying the most recent features which bear the stamp of approved practice in work of this class, is well worthy of a visit of inspection by those interested in electric railway development.

THE CLOSE CORPORATION QUESTION.

If the Canadian Society of Civil Engineers takes the advice of the New York *Engineering Magazine*, regarding the plan of "close corporation" initiated in Manitoba, they will "pause and take a big think," to use the words of the American humorist. One can understand, of course, why American engineers would not look with favor on an Act, the rigid application of which would restrict their practice in Canada; but without reference to the effect of such an Act on the American profession, it is a question in which the Canadian Society of Civil Engineers can well afford to tread slowly. It is true that the Ontario Association of Land Surveyors have been successful as a close corporation, but the relations of the civil engineers to the public are not on the same lines. Indeed, the general question as to whether the C. S. of C. E. should be converted into a close corporation at all is one on which we find a great diversity of opinion in the society itself, and a more thorough enquiry into all its bearings would be advisable.

The following are the observations of the *Engineering Magazine*:—

"Her Majesty, by and with the advice and consent of the Legislative Assembly of the Province of Manitoba," has enacted a bill "which may be cited as the Manitoba Civil Engineers' Act," by which the profession is closed in the Province of Manitoba.

This is in line with the tendencies which have recently been so strong marked, both in public and private expression, throughout the Dominion, and the passage of the Act seems to have been directly secured by the influence of the Canadian Society of Civil Engineers, working through their committee. It will be generally regarded in the country as a step backward; but an examination of the text of the bill shows the step to be almost amazingly short and hesitating. Sixteen of the eighteen sections are devoted entirely to the organization, constitution, and administration of the Canadian Society of Civil Engineers, the remaining two sections are as follows:—

17. On and after the 1st day of July, 1896, no person shall be entitled within this Province to take or use the name and title of "civil engineer" or any abbreviation thereof, either alone or in combination with any other word or words, or any name, title, or description implying that he is a member of the said Society of Civil Engineers, or act as engineer in laying out, advising on, constructing, or superintending the construction of any railway or public work, or any work upon which public money is expended, the cost of which shall exceed $500, unless such person is a member of the Society hereby incorporated and registered as such, under the provisions of the Act, or unless he is a duly qualified engineer, and entitled to use the title of civil engineer by virtue of some statute in force in this province, or by the authority of some institution of learning in this province, having authority to confer degrees in civil engineering, or unless he has been practising as a civil engineer in this province at the time of the passing of this Act, or unless he is a member in good standing of some institution of civil engineers in Great Britain and Ireland, or of some national society of civil engineers of good standing in any foreign country.

18. This Act shall be deemed a public Act.

As remarked by the *Engineering News*, "the breadth of the exceptions is praiseworthy, but it is also to be noted that the law provides no pains or penalties for those who disregard its provisions." It is rather severe on the registrar of the society, who shall "make, or cause to be made, any falsification in the matter relating to the register," but a violation of the Act itself is not even declared to be a misdemeanor. To commend an Act for its omissions and exceptions is decidedly to damn it with faint praise, but it is the only ground on which the condemnation could be extended to a measure which, in principle, has no justification in public policy, and can scarcely fail to result in formalism and stagnation within the profession.

For THE CANADIAN ENGINEER.

THE KIND AND CHAUDRON PROCESS OF SINKING AND TUBING THROUGH WATERY STRATA.

BY E. ANDREWES.

Over a considerable area in France and Germany a loose stratum, consisting of watery marls, is encountered at a moderate depth. The attempts of engineers to sink shafts through this by ordinary methods for some time proved failures. Pebbles and fine rock interfered with operations, and the water completely drowned out the shafts.

To overcome these difficulties Herr Kind, in 1850 originated a scheme for mechanically sinking shafts. His machine was practically a percussion drill or borer on a large scale. He also introduced a variation in the mode of lowering the tubing and a device for regulating the influx of water. To this M. Chaudron added the sliding bottom piece, to form a perfectly water-tight joint at the bottom of the tubing.

A hole is first drilled about 4.5 feet wide, in which the debris may accumulate. A larger tool, working 50 feet behind, widens the shaft to the required diameter. The drill tool is called a trepan, and is suspended by rods from the walking beam of an engine.

The smaller trepan (Fig. 1) is a blade of forged iron, on which are keyed a number of steel teeth. A stem connects the blade to the suspension rods by means of a sliding box, which prevents the jar from being communicated to the rods. The trepans are raised six inches or so, turned slightly and dropped. They are of massive construction, weighing from 8 tons up, for hard rock. Their concussion disintegrates the rock along a diameter of the circle. A progress is made of from 3 inches in flint per day to 3 feet in chalk, 1 foot in sandstone, 16 inches in coal

measures. The larger trepan (Fig. 2) is of the same construction as the smaller one, but the blade is deeper towards the centre. The central part is toothless, and a U-shaped guide which fits the smaller hole, is fastened to it. This tool often weighs as much as 15 tons. It may cut the shaft to its full width, or it may be followed by another similar reamer. The broken material, most of which is quite fine, is hoisted from the smaller hole in a sludger (Fig. 3 and 4). The operations of drilling and widening the hole take place alternately, the tubing being simultaneously lowered by a separate engine.

A record of the preliminary shaft 4.5 feet in diameter, showed for 508 feet an average progress of 3.3 feet per 24 hours; 51 per cent. of the time was spent in drilling, 19 per cent. in raising and lowering the tools, 20 per cent. in dredging, and 10 per cent. in repairs and delays. Widening the shaft to 14 feet, and sinking to a depth of 460 feet took ten months, reaming 46 per cent. of the time; altering and operating the tools, etc., 14 per cent.; dredging 22 per cent.; repairs and delays 18 per cent. A tall derrick is necessary at the surface for lowering the tubing, and from which extra lengths of rods may be attached as required. Three skilled laborers and six ordinary hands are employed about the works. The cost of installation of machines, tools, etc., all of which are portable, is from $13,000 to $20,000.

The tubing consists of iron sheeting, built on in 6 feet sections with leaded joints, suspended by rods (Fig. 5.) The flanges come on the inside of the tubing *bb*, leaving a perfectly smooth exterior. The joints are bolted together. An example of tubing is one 12 feet 7 inches internal diameter, 280 feet high, one inch thick at the top, 1⅛ inch at the bottom, and weighing 400 tons. The sections were 5 feet high; the flanges 3½ inches wide, 2 inches thick, having leaden wedges between them 4⅛ inches wide and ⅛ inch thick, and 20 bolts 3 16th inch diameter. At the bottom of the iron cylinder are the before mentioned appliances for controlling the linking of the tubing and hermetically sealing the bottom. The latter is a moss box, *a*, and the form consists in a false bottom, *f*, which is attached to the tubing, with the lower section of which it forms a diving sill that floats the whole system. The greater the head of the water coming from the strata, the more complete is the balance and the greater the relief of the rods *dd*, which support the tubing. The safety pipe *g* is an equilibrium column, operated from above by cocks and plugs, which regulate the speed of the sinking. If the cocks are opened and water allowed to escape, sinking proceeds rapidly, and when closed the mass of iron is upheld by the pressure of the water on *f*. When the plugs are opened, water is discharged into the tubing, thus weighting it, and at the same time relieving the pressure below. By these means a complete control of the lowering of the tubing is maintained. The lower flange of the bottom section *bb* turns outward, and forms an annular piston to a lower section *aa*, whose upper flange turns inward and lower one outward. Between these flanges is packed moss, in the annular space between the rock and the moss box.

When the water-bearing strata has been traversed, a seat having been scraped for the moss box, the pipe *g* is opened at the surface and the entire weight allowed to fall on *bb*. The rods *ss* slide in their bearings. The moss is pressed to a compact hard mass, forming a perfectly water-tight joint.

There is now a certain amount of water in the shaft which may be pumped. Often, however, a cement backing is first inserted by means of a closed spoon, holding a barrel or so of cement and curved to fit the annular space. Three sets of six men do this work, burying 400 cubic feet per day, at a cost of about forty cents per square foot area of lining. Subsequently a solid foundation of wrought iron curbing is built on a stout ledge to receive the weight of the iron mass. Where this method of sinking has been employed, it has never yet met with failure, and it is considered surprising that American engineers, usually so progressive, have not adopted it in cases where attempts to sink by other means have proved futile. Objections to it are that the diameter of the shaft is limited to 14 feet or thereabouts, and also that there is no means of knowing when the watery stratum has been sunk through, except by preliminary geological observation. A short while ago a pair of shafts were sunk in Samlund, Prussia, for amber, by a variation of this method, through 147 feet of clay and sand. The drill tools, weighing 1,700 lbs., cut a 4 foot 6 inch space. No moss was necessary, as the ground was not wet. Four feet lengths of tubing were forced down by jack screws. The total weight of tubing was 45 tons, and the cost $17,500.

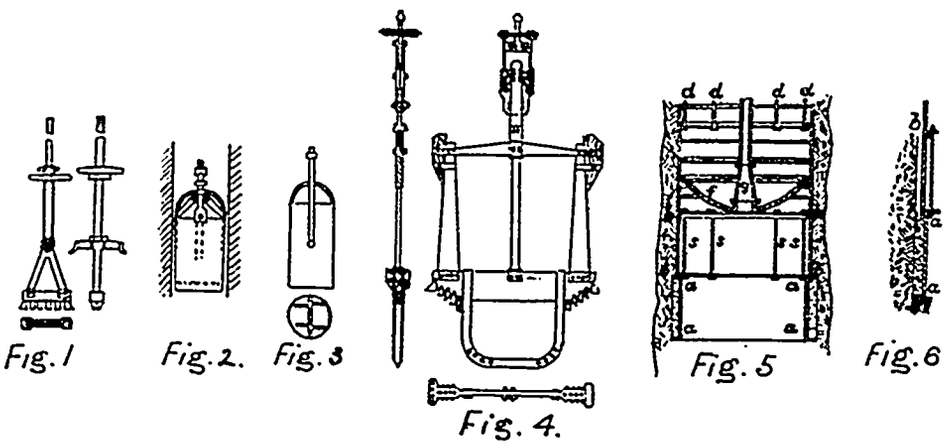


Fig. 1 Fig. 2. Fig. 3 Fig. 4. Fig. 5 Fig. 6

BURLINGTON CHANNEL SWING BRIDGE.

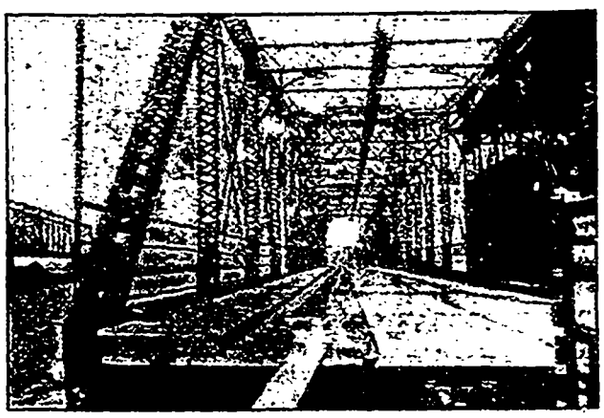
Burlington channel, or canal, is simply a cutting through a piece of low land, about 700 feet wide, first formed as a sand-bar, which separates Lake Ontario from a large sheet of deep water called Burlington Bay. It enables vessels to reach the city of Hamilton and the Desjardins Canal, the latter being a private work and leading to the town of Dundas. The canal is protected on both sides with crib-work extending out into the lake at one end and into the Burlington Bay at the other.

After the cutting was made in 1825, a ferry was

established to enable vehicles and passengers to cross the canal. This ferry consisted of an ordinary scow, worked by hand, and the process of crossing was necessarily slow. Owing to the fact that of recent years Burlington Beach has become a fashionable summer resort, the traffic has increased to a very large extent, and during the past year over 6,000 vehicles were taken over on the scow during the season. No record has been kept for the passenger traffic, but it was found that this old-fashioned ferry accommodation was quite inadequate for the public wants, and petitions to erect a highway bridge were forwarded to the Government at Ottawa, and in 1892 Major Henry A. Gray, engineer in charge of the Public Works of Canada in Western Ontario, was directed by his Department to make a survey, and to report, with plans, to the Chief Engineer, on the advisability and necessity of building a bridge at this place.

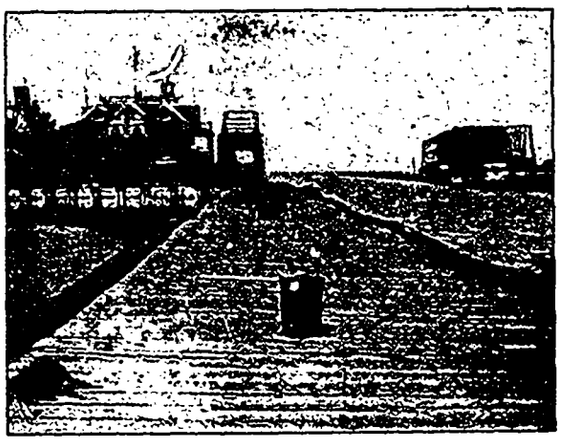
BURLINGTON CANAL BRIDGE, FROM NORTH PIER.

The report and plans were duly submitted, and in 1894 a sum of money was voted towards building the structure, and early in the following year a contract was let to Mr. George F. Webb for building the masonry required, which consisted of a very substantial pivot pier on foundations of piles and concrete with two abutments—the one on the north side for the long span and the one on the south side for the short span or "bobtail" end to rest upon. The masonry was completed in the early part of the present year, and is considered to be a very substantial as well as handsome piece of work. Mr. Webb's contract amounted to $15,799. On the 28th January last a contract was let to the Dominion Bridge Company, limited, Montreal, for the construction of the iron superstructure,



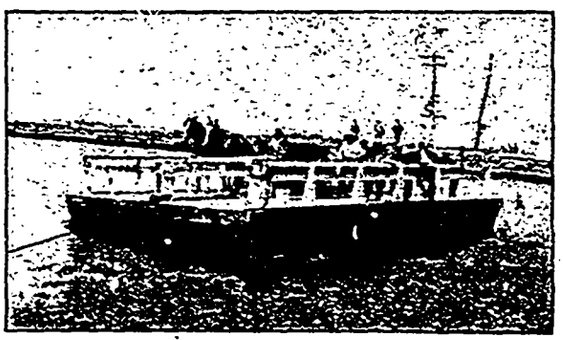
BURLINGTON CANAL BRIDGE LOOKING EAST, WITH G.T.R. BRIDGE ON LEFT.

and during the past summer it has been placed in position and—as will be seen by the two photographs kindly supplied us by the engineer in charge—is a very graceful and substantial structure. It was designed by E. Vautlet, C.E., of Montreal, under the direction and instruction of Louis Coste, Chief Engineer of the Public Works Department, the contract price being $15,290. About the same time that the designs for the bridge were being completed a company was formed in Hamilton, under the name of the Hamilton Radial



BURLINGTON CANAL BRIDGE, ROYAL HAMILTON YACHT CLUB HOUSE IN THE FOREGROUND.

Railway Company, to construct an electric railway, extending from the city of Hamilton to the town of Burlington, and it succeeded in obtaining permission from the Government under certain conditions to use this bridge in connection with the operation of its road. It was originally intended to swing the bridge by hand power, but as the electric power-house for the railway company was so near it was decided to use electricity as the motive power instead. This is the only bridge in Ontario which is operated in this way (except that at the Sault Ste. Marie), and it works with ease and rapidity.



BURLINGTON CANAL, OLD FERRY BOAT.

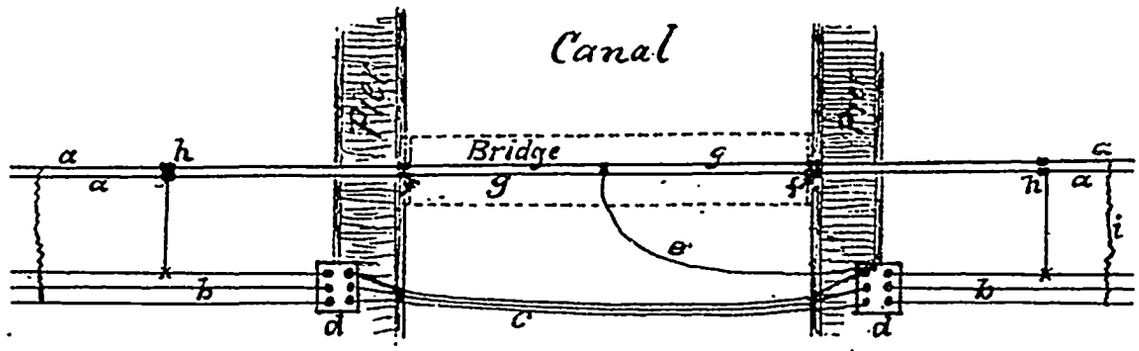
To design a workable bridge at this place was a difficult matter, owing to the narrowness of the neck of land at this point, with a railway swing-bridge built and in position, occupying at least two thirds of the space between the lake and the bay. A drawbridge was an impossibility, as the width of the channel would not permit of the erection of a pier on which to divide the span; again, the main road along the beach could not be diverted towards the lake or east side, as it would have to cross the railway track, and the fact of the land formation being low, it would not permit of any considerable increase in the height of approaches, consequently the only bridge that could be erected was what is known as "a bobtailed swing-bridge." Those works have been carried out under the personal supervision of Major H. A. Gray, Government Engineer, who has kindly given us a photograph, reproduced here, taken sometime ago, to show the obsolete method of carrying

traffic and passengers across the canal by ferry scow.

The electrical apparatus of the bridge contains a safety device, which has been used for the first time, we believe, in the history of electrically swung bridges. In the accompanying explanatory diagram, the curves at the approaches to the bridge are omitted for the sake of clearness.

The road passes over the draw-bridge crossing, so as to reduce the chance of a car going over the draw when the bridge is moving. There is a 500-foot section on each side of the bridge which is fed from the trolley wire on the drawbridge, and this in turn is fed by a cable brought up through the centre of the bridge. Just as soon as the bridge is moved six inches or more the contact is broken, the feed sections are dead, and the car coming into the section can receive no power. The approaches to the bridge are sharp curves, which would prevent the car getting over the draw with its own momentum. The bridge is also moved with the power received from the wire, a very neat arrangement being designed for the connection of those wires to the bridge by W. R Scott, superintendent of construction for McCartney, McElroy & Co.

Instead of using a ridged bracket the company has put up a flexible one which permits the trolley wire to be supported on a wire which does away with the pound of the wheel on the bracket when the car is running fast. There is about 95,000 lbs. of copper in the feeder, which is placed to the best advantage along the line. When the feeder comes to the canal it passes it by three submarine cables, which are protected at the junction houses with circuit breakers. There are 45 pole lightning arresters placed on the poles and ground to a separate ground (not the track). All the overhead work, fitting and connecting, were built and designed by McCartney, McElroy & Co, of New York, contracting engineers.



PLAN OF ELECTRICAL SWINGING APPARATUS, BURLINGTON BEACH BRIDGE.

(a) Working Trolley Wires (two 00 Copper Wire). (b) Feed Wires from Power House (three 0000 Copper Wires). (c) Feed Wires, Submarine Cables (three 0000 Copper Wires). (d) Terminal Houses with three circuit Breakers and Switcher to protect Cables. (e) Cable from Terminal House Feeding Wire on Bridge. (f) Contact Plates on Bridge and Shore Trolley Wires. (g) Trolley Wire on Bridge and 500' on each end, fed from e. When Bridge is moved 6' or more, g receives no current. (h) Trolley Wire Insulators making an Electrical Break between a and g.

For THE CANADIAN ENGINEER.

CREOSOTING TIMBERS.

BY WILLIAM B. M'KENZIE, MEM. CAN. SOC. C.E., MEM. AM. SOC. C.E., ASST. ENG. INTERCOLONIAL RAILWAY.

(*Concluded from last issue.*)

Filling the Cylinders with Oil.—While the vacuum is still on, the creosote heated by steam-pipes to about 125° Fah., is allowed to run by gravitation from the gauge tank, until the cylinders are completely filled. The creosote should be maintained at a temperature of about 125° Fah. during the treatment. It is important that no water from condensed steam or otherwise should be allowed to mix with the creosote as it rises to the top of the cylinders, and in this case the wood at the top only receives an injection of dirty water. The cylinders will run about 3 5ths full by gravitation, then, with the aid of the force pump, they are completely filled with creosote. The valves are now closed and the reading of the gauge-tank noted; the pressure is applied by the force-pump and the creosote is forced into the empty cells of the wood under a pressure of from 110 to 135 lbs. per square inch, which pressure is kept up until the specified number of pounds of oil has been forced into the timber as indicated by the gauge-tank; the usual time required being from three to six hours for piles of short-leaf or Loblolly pine. The pressure is then released, the unabsorbed creosote in the cylinders forced by the air-pump back into the gauge-tank, the cylinder doors opened and the timber removed. From the taking out of one charge of 10 to 20 piles to the putting in of another, the time consumed is usually about 20 to 27 hours. The quantity of oil absorbed by the timber is measured by determining the difference in volume of the oil in the gauge-tank before and after the operation, and as 2¼ or 2½ lbs. of creosote is absorbed per cubic foot of timber, while the cylinders are filling, this amount should be deducted from the specified quantity.

Creosote.—The production of the dead oil of coal tar in the United States is insufficient for the needs of the country, and a considerable quantity is imported from England. What is commercially known as "London oil," a thick and heavy oil, is considered to be the best produced in England for marine work. Creosote at 65° Fah., weighs about 8 to 9 lbs. per U. S. gallon, and boils from 380° to 760° Fah. Analysis of American and English oils used in 1895 for treating piles are as follows:

AMERICAN OIL.	
The sample as received, well mixed, contains water	0.18 per cent
Oils (lighter than water distilling over between 350° and 410° Fah., carbolic acid, creosote, etc.)	1.13 "
Oils (heavier than water distilling between 410° and 540° Fah., naphthaline, etc., crystalline..	73.10 "
Higher phenoloid bodies, distilling between 540° and 610° Fah..	14.67 "
Heavy crystalline substance and a little red oil distilling between 610° and 680° Fah.....	6.79 "
Soft pitch, not volatile at 680° Fah.....	4.13 "
	100.00 "
ENGLISH OIL.	
The sample, as received, well mixed, contains water.....	0 25 per cent.
Oils (lighter than water, distilling over between 392° and 450° Fah., phenol).....	9.50 "
Oils (heavier than water, distilling over between	

450° and 482° Fah., naphthaline, crystalline when cold)..	24.00	per cent.
Oils (heavier than water, distilling over between 482° and 540° Fah., naphthaline, crystalline when cold)..	28.50	"
Higher phenoloid bodies, distilling over between 540° and 610° Fah.....	10.25	"
Heavy crystalline substance and a little red oil, distilling over between 610° and 680° Fah...	12 00	"
Soft pitch, non-volatile at 680° Fah...	15.50	"
	100.00	"

No two lots of oil will give precisely the same analysis, so that only general qualities should be called for in specifications. The phenols, which include crude carbolic acid, cresylic acid, and other tar-acids, are the germ-destroyers, and some of the heavier constituents, principally naphthaline and acridine, which crystallize in the cells and render the wood water and air-proof, are the germ-excluders.

About 10 lbs. per cubic foot is sufficient to prevent decay above water, and 15 or 16 lbs. per cubic foot to protect the piles against the ravages of marine insects for at least thirty and perhaps fifty years, in Canadian waters. Creosoted piles at Sydney, Cape Breton, in use 24 years, are still in perfect condition.

The following quantities of creosote per cubic foot are considered a sufficient protection against sea-worms at the places mentioned below:

In English harbors.....	10 to 12	lbs. per cubic foot.
Northern harbors in the United States	10 to 12	"
Holland and Belgium.....	10 to 12	"
France.....	19	"
Gulf of Mexico.....	20	"
Canada.....	15 to 16	"

The square timber should be handled carefully after creosoting, to avoid chafing or brooming the edges and thus spoiling its appearance.

Economy in creosoting.—Piles can be treated most economically at a shipping port near the forest in which they grow, because the following items of loss are thereby avoided:

1. The handling and the freight on the bark, which is about 10 per cent. or 15 per cent. of the total cubic contents.

2. The cost, handling, freight and duty on the small and crooked ends which will be cut off before creosoting.

3. The cost, handling, freight and duty on the waste pieces occasioned by cutting piles to special lengths.

4. The cost, handling, freight and duty on piles which may be condemned by the Inspector as being unsound, small, or crooked.

5. One extra loading into the vessel, and one extra unloading from the vessel.

Purpose of creosoting.—The purpose of creosoting is to so fill up the cells of the wood that neither air, moisture, nor life can get inside. In order that this may obtain to the fullest possible extent, it is necessary that as little cutting as possible be done, and all cuts or broken surfaces be covered over with three or four coats of thick hot creosote, and where such surfaces are exposed above water they should be coated over once a year.

If two or three months elapse between the time of treatment and the using of the timber in actual construction, inject 1 to 1½ lbs. of creosote extra per cubic foot of timber, to allow for evaporation.

Inspection.—Close inspection during the treatment by a reliable engineer, experienced in the work, is an absolute necessity, and honest contractors always prefer to have such a man at their works.

Economy in Construction.—The saving of labor for renewals and maintenance, and not the first cost, should be the ruling factor, and in a calculation for ultimate economy, it will be found a decided waste of money to expose untreated timber to the insatiable sea-worm. Public works and railroads exposing untreated timber to quick destruction by sea-worms, instead of defying them by using creosoted material, are neglecting an important economy; in the case of Public Works spending the people's money for maintenance and renewals, and in the case of railroads spending money for maintenance which should be paid in dividends to the stockholders. To secure good results, pay a sufficient price, contract with none but reliable persons, and keep an experienced person at the works during the preparation and treatment of the timber.

Price.—Creosoted piles, from 30 to 65 feet long, can be delivered in dock in almost any port in Canada, freight and duty paid, for from 30 to 40c. per lineal foot, according to lengths and sizes of butts and points; square timber for from $35 to $45 per B.M., according to sizes, lengths and quantity of oil. Duty is 20 per cent.

The following is a skeleton specification for the supply and creosoting of piles (short-leaf or Loblolly pine) with dead oil of coal-tar, which may prove useful as a general guide:

SPECIFICATION.

For piles of Virginia or North Carolina short-leaf or Loblolly pine, to be delivered, freight and duty (20 per cent.) paid, at ...., on or before the ..... day of ....., 189..., as per accompanying bill.

The piles to be of the Virginia or North Carolina short-leaf pine, *Pinus mitis*, or Loblolly pine, *Pinus toedas*, sound, free from shakes, bad knots, or other imperfections that would reduce their strength. To be completed, barked and saw-butted, and so nearly straight that when the tape is stretched from the centres at the ends, it will not overhang the most crooked places more than one inch. They shall be not less than nine inches diameter at the small end, and not less than 16 inches diameter at the butt; all measurements after barking. To be of even taper and not button-headed, thus: a pile 16 inches at butt to be not less than 14 inches three feet down. The cubical contents of the round piles shall be determined by the rule used by the United States Government, as follows: Multiply the square of mean circumference by the length and divide by 12.5; if in inches divide again by 144.

Dead Oil of Coal-tar.—The creosote shall consist of dead oil of coal-tar heavier than water—not thin oil, lighter than water, thickened and weighted with coal-tar. The composition shall be as follows: At least two-thirds shall be obtained by distillation at a temperature exceeding 482° Fah., and the remainder at a temperature exceeding 392° Fah. Specific gravity at 60° Fah, between 1.035 and 1.065. Completely liquid at 100° Fah. To solidify between 40° and 45° Fah. Phenols between 5 per cent. and 10 per cent. Naphthaline not less than 50 per cent. Boiling point not below 410° Fah. The storage tanks shall have no water on top of the creosote, nor no muddy nor objectionable matter at the bottom. When a sample for analysis is required, it shall be composed of one-half from the upper 12-inch layer and one-half from the lower 12-inch layer of the storage tank.

Treatment.—The piles shall be treated with not less than 16 pounds best dead oil of coal-tar per cubic foot. Sufficient percentage must be allowed for outside drainage when drawn out of the cylinders. To be subjected to heat by live and superheated steam, not over 250° Fah.; heat to be continued long enough to reach the centre of the timber. Vacuum to range between 22 and 25 inches. Heat above the condensing point shall be maintained in the cylinders during the vacuum and throughout the treatment, so that there shall be no condensation whatever at any stage of the process. Vacuum to be continued until the discharge from the pump shall have no odor or taste of turpentine, and kept up until the cylinders have been filled with oil. The oil in the gauge-tank connected with the force-pump to be measured at a temperature of about 125° Fah., which temperature should be maintained during the treatment. The vacuum in the cylinders must not be so suddenly produced, nor the temperature raised so high as to cause cracking or splitting of the timber. Cylinders to have proper outlets to free them from all gases before the pressure is applied. Pressure to be continued until the requisite quantity of oil has been injected into the timber. Water must not be admitted into the cylinders, nor allowed to accumulate in the upper part of the cylinders over the oil. Proper gauges to determine the amount of oil used, to be furnished. The piles shall be selected, and those having the same amount of seasoning, texture and density placed in the cylinder together, so that the penetration may be uniform. With every charge a test block shall be placed on the top of the load, which block will be afterwards split, and the penetration ascertained by the Inspector. The block should be 3½ feet long by 12 inches in diameter, and as near as possible of the same degree of seasoning and texture as the piles forming the charge. The piles, creosote and treatment shall be subject to close inspection at the works and before shipment, and the whole of the materials and workmanship must be to the entire satisfaction of the Inspector. A chemical analysis of the oil must be furnished if requested.

PUBLICATIONS CONSULTED IN THE PREPARATION OF THIS PAPER.

"American Woods," by R. B. Hough, 1896.
"Forest Wealth of Canada," by Geo. Johnson, 1895.
"Antiseptic Treatment of Timber," by J. S. Boulton, 1884.
"Report of Committee of Am. Soc. C. E.," 1885.

I am also indebted to the following gentlemen for valuable information:

Geo. S. Valentine, manager, Eppinger & Russell, Creosoting Works, New York.

B Comer, superintendent, Lehigh Valley Creosoting Co., New York.

Dr. Henry Froehling, analytical chemist, Richmond, Va.

A. S. Martin, manager, Old Dominion Creosoting Works, Norfolk, Va.

Edmund Christian, engineer and general manager, Norfolk Creosoting Co., Norfolk, Va.

H. S. Haines, of the Plant R. R. and Steamship System.

B. T. Burchardi, chief engineer and general manager, Fernandina Oil and Creosote Works, Fernandina, Fla.

H. J. Mackenzie, C.E., Creosoting Inspector, Moncton, N.B.

THE SIRIUS STEAM TRAP.

Editor CANADIAN ENGINEER.

While in England, I was shown a very ingenious and reliable steam trap, exceedingly small, and which can be fixed in any position. It is a new idea in expansion traps. I believe the principle employed is that of expansion and contraction; the construction is on a new principle avoiding defects common to other expansion steam traps. The requisite movement is obtained by the elongation and contraction of the extremities of a bent metallic tube, filled with a volatile liquid upon which the variations of temperature act, giving the required movement. The bent tube does not commence to move until the temperature of the imprisoned liquid has sufficiently raised to cause it to completely fill the internal vacuum; until then it remains inactive.

THE "SIRUS" TRAP, WITH COVER REMOVED.

T. Is the bent hollow spring tube. *B.* The cast iron case. *E*, Spring. *S.* The valve. *V.* Regulating screw. The spring is used only as a means of holding the expansion tube securely on to its pivot. Each trap is so regulated that at starting the valve remains wide open until the steam actually arrives, and all air and water expelled, the expansion tube acting and closing the valve at a temperature of 212°. The moment that condensation again sets in and the temperature of the tube is below 212°, the tube at once contracts and allows the valve to open and let the condensed water escape. It is a very sensitive trap, sure in its action, and is made use of largely by engineers to govern their drip pipes.

W. M. WATSON, Toronto.

WHAT MAKES BOILERS EXPLODE?

Editor CANADIAN ENGINEER:

SIR,—In thirty-three years' experience with steam boilers and engines, I have never had one collapse or explode under my care. No matter how a boiler gives out, it is generally said to explode, and this, too, by engineers. This is decidedly wrong. A boiler, like a vehicle, horse, or man, can only carry a load in proportion to its strength; anything over that will cause it to give way in its weakest points, or collapse altogether. It is possible, too, to overload the safety-valves and cause the destruction of the boiler, but neither of these is an explosion. There must be some ignitable matter in a boiler before an explosion can occur, I believe. When the water is allowed to get low in a steam boiler, a combustible gas forms within, and on turning on the steam the pulsations of the engine beget a friction which ignites this gas, and an explosion is the result. To avoid sudden expansion or sudden contraction, a boiler should not be blown out while it or the brickwork is hot; the boiler should be allowed to cool down gradually, and the water run out in the same way. When a boiler is blown out empty, the heat leaves so suddenly, and the cold air strikes it so suddenly in return, that some parts stand expanded, while others contract, thus rendering it liable to collapse at any time. No engineer should depend entirely on the water glass of a boiler—the try cocks should be his guide. I believe in the system adopted in Toronto of having every boiler under inspection and under insurance.

Yours truly,

G. W. SPROULE.

65 Berkeley street, Toronto.

[It is of interest to read in connection with our correspondent's letter the following extract from the *Locomotive*: "Chief Engineer Quinlan and Assistant Engineer McCormack were seriously burned on February 17th, by an explosion on the United States Government dredge "General C. B. Comstock," at Galveston, Texas. They removed a hand-hole plate from one of the boilers, and held a light to the opening to examine the interior, when a violent explosion occurred. An inflammable vapor of some sort was evidently present, but whether it was generated from benzine that had been used in getting the boiler ready for the regular Government inspection or not, we cannot say. It is possible it was caused by the use of kerosene as a scale preventive, for it is frequently employed for that purpose. Most oils in use are hydrocarbon oils, which generate a vapor, when mixed with air, which is highly explosive. Every boiler should be thoroughly drenched with a hose before going into it or introducing a naked light."—ED.]

THE Moncton Manufacturing Co., Ltd., applies for a New Brunswick charter to manufacture agricultural implements and machinery. Capital, $60,000. The applicants are: E. C. Cole, J. L. Harris, C. W. Robinson, H. A. Whitney, Moncton; J. E. Riley, of Omaha, Nebraska; C. P. Harris, D. I. Welch, Moncton; J Abrams, Apohaqui, N.B.; R. A. Chapman, Moncton.

TANK CONSTRUCTION.

The accompanying illustrations show a system of tank construction, the invention of Wm. Golding, of New Orleans, La., which is described by him as follows: A circular tank cannot be strengthened by cross-bracing, therefore all of the retaining strength must be put into the periphery. Thus for a circular tank fifty feet in

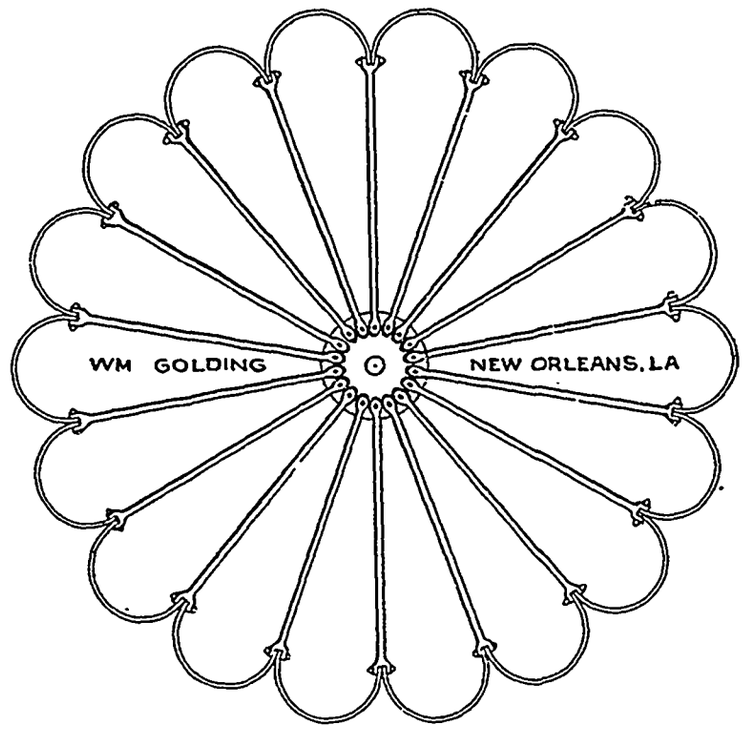


FIG. 1

diameter by thirty-six feet deep, the plates in the lower belt would require to be half an inch thick, each belt diminishing in thickness towards the top.

If the periphery be constructed of half circles, preferably of five feet radius, and cross-braced to a common centre, as shown in Fig. 1, a tank of any diameter and of any depth, either square or round, may be constructed of plates no thicker than would be required for a round tank ten feet in diameter, of usual construction. The cross-braces should divide the height into spaces of five feet, which would subject the braces to a strain due to fifty square feet. The foregoing is based upon the principle that each half of a circle, when subjected to internal pressure, is endeavoring to push the opposite half away, the force of which can only be resisted by the material of the periphery, or by cross-bracing.

There is quite a demand for storage tanks of large capacity in the Mississippi delta, to be used for settling the river water, but the great cost of construction has prevented any attempt to build tanks exceeding fifty feet in diameter. Some twenty years ago a circular tank, 100 feet diameter by 50 feet deep, was constructed and set up in Cincinnati, Ohio, which burst during the first test, when the water had reached the height of 45 feet. It would appear that large storage capacity for settling purposes could be accomplished by aggregating a number of small tanks, yet it has been found that the flow tends to agitate the water, and thus prevents the settlement desired. The city of New Orleans, La., depends entirely upon the Mississippi River for the supply of about 8,000,000 gallons daily, which contains an average of fifty tons of mud to each day's supply. Elevated settling tanks have been suggested, in which to settle the water before admitting it into the distributing pipes. Ten years ago letters were written to the principal tank builders of the United States on this subject, none of whom would undertake the job of building a tank of the required size, namely, 300 feet square by 36 feet deep. More recently, however, a Pittsburg firm has consented to construct tanks of the desired size, to be constructed in accordance with designs and specifications furnished by Wm. Golding. The plan is to place the tanks upon foundations 30 feet above the ground. The weight of the square tank will be 2,660,000 pounds, with a capacity of 24,300,000 gallons. The suggestion is to have three tanks, and to draw one day's supply from the top of each tank every third day.

ANOTHER rotary engine "of novel design" has been evolved by a sanguine inventor, Grant Brambel, who hails from Sleepy Eye, Minn.—the last place from which we would expect the ideal rotary engine. The newspaper despatch tells us that H. F. Allen, president of a London engineering company, has offered Brambel $1,600,000. Mechanical men will be excused for being skeptical till they see diagrams of this engine, with amount of steam consumed, etc.

PROFESSORS NICHOLSON AND CALLENDAR have made interesting experiments at McGill University on steam engines. Their conclusions will be read as a paper before the English Society of Civil Engineers. We hope to publish it shortly.

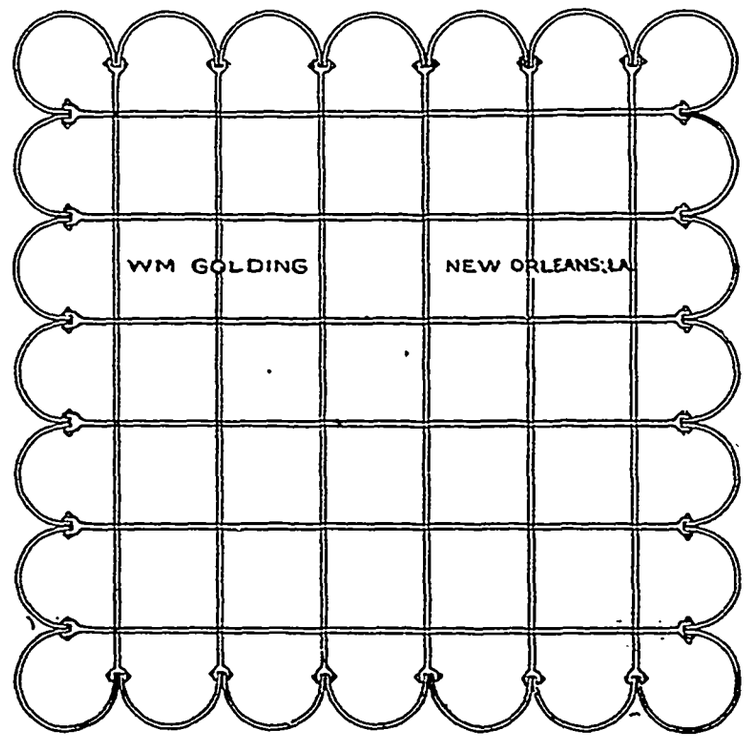


FIG. 2.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

TORONTO'S DINNER

The tenth annual dinner of the Toronto branch of the Canadian Association of Stationary Engineers was held at the Palmer House on Thanksgiving eve, and in point of numbers and enthusiasm was the most successful yet held About 300 tickets were sold and nearly every seat in the capacious dining hall of the Palmer was filled. The dinner was abundant, well served—as was expected from the Palmer—and was eaten with an appetite that is one of the happy peculiarities of engineers The chair was occupied by John Fox, president of the Toronto branch, who, though new to the position, acquitted himself with much credit Among the guests on the right and left of the chairman were E H Keating, city engineer, Prof Galbraith, of the School of Practical Science Dr. Orr, of the Toronto Technical School, and Ald McMurrich, representing the mayor. Letters of regret were read from the mayor; O. B. St. John, president of the Association of Marine Engineers; John Galt, C.E.; J. C. Robb, general manager of the Boiler Inspection and Insurance Co., James Devlin, president of the executive council C A S E, and from others When the cloth was metaphorically cleared, the president made a short address congratulating the association on their large attendance at this happy event, to which they looked forward with more interest every year. As the membership increased he hoped the annual dinner would become a more memorable event, and that the associations that gathered about this reunion would always continue to be pleasant The toasts of the "Queen" and "Canada our Home" were drunk heartily, and a rousing chorus was given to G. W. Grant's song "The Maple Leaf." Bro. A. M. Wickens, who replied, took it for granted that such a toast would be received with enthusiasm. Canada was the finest country the sun ever shone on, and in everything that went to make a great nation we have the materials. (Hear, hear.) Our young men, whether they stay at home, as they should, or whether they go to the United States or the far antipodes, always make their way in the world, always become respected for their industry and integrity, and generally climb higher than those about them. "Toronto, our City" was coupled with the name of Ald. McMurrich, who was greeted with "He'll be Mayor," sung to a familiar refrain He said Toronto was his native city and he was proud of it. As a director in the Boiler Inspection and Insurance Co., he was interested in the progress of the stationary engineers, and he considered their work of the highest importance They were men of whom more intelligence was demanded as time goes on and machinery comes into wider use, for upon their care, thoughtfulness and skill the lives of thousands depended. If they were not sober, honest and intelligent, they would imperil the lives of all around them. Though it was a bad thing for an engineer to tie down the safety-valve of an engine, they might safely do that in driving on Toronto No 1, for nothing could burst this association. (Laughter.) Bro. W. G. Blackgrove was then called on for a song, which was heartily applauded. The toast of the "Manufacturers" was replied to by C. L. Weeks, of the Weeks-Eldred Co., of Toronto, who made a speech bristling with humor and was well received. As a young manufacturing firm who had met with a good reception in Canada, he was proud to be associated with the engineers and wished the organization every success. Ald McMurrich then sang the "Girl I Left Behind," and was encored. John Main also replied, referring to the brightened prospects of trade, and finished with a story of exciting adventure which turned out to be a dream—the denouement of which was much applauded "The Educational Interests" was responded to by Prof. Galbraith, who observed that though he had been at every dinner since the association was formed, he was still able to congratulate them upon their continued improvement. In the early years of the association they appeared to have had many struggles and improvement was slow; but there was no doubt about their advance now. Speaking of the steam engine, he remarked that the ancient Greeks knew more about the steam engine than we gave them credit for, and he thought the great battle of steam had not yet been fought out. In recent years, there had been a contest between the high speed and low speed engine, but it seemed that the electricians were settling this contest by calling for an engine of medium speed In the further development of the engine, there was talk of doing away with steam and getting power with a pole battery, but such a revolution was not yet upon us Meantime if the steam turbine arrives at anything practical, it will do away with engines as they are. We would simply have two wheels—the turbine connected with the dynamo, and that again led us back to the old Greek idea He referred to some experiments he had recently been making in measuring the draught of chimneys At first his investigations seemed to show that the engineering books were out by fifty per cent. in their calculations, but he found on further experiments that the engineering authorities were right Noticing the flags in the room, he was glad to see that the young men had so much pride in their country, and this association, he was pleased to think, was doing its share in Canada's advancement. Charles Palmer, of the Kensington, here sang "Maggie," and was heartily encored. Dr. Orr replied on behalf of the Toronto Technical School, and spoke of the great progress of that institution in the five years since its establishment. In the first year it had 246 pupils, while last year the number was 1,310. Its great success showed that the educational system of the past had not fulfilled the requirements of the community. He pointed out how Germany, England, France, Austria, and even Italy, had made such remarkable progress by specializing their system of education. Germany, for instance, by making a special study of chemistry and applying it to dyeing, had gained almost a monopoly of the manufacture of aniline and other dyes, surpassing England, where the discovery of aniline dyes was first made The School of Practical Science had filled an important blank in our educational system, but the Toronto Technical School had so clearly demonstrated the need of primary education in technical subjects, that the Minister of Education for Ontario was now taking steps to introduce manual training for boys throughout the province. Our educational system must change to meet the requirements of the day, and must become more practical. By the training of both brain and muscle our young men in the future will put Canada in the position of being able to compete with other countries on their own terms In reply to charges in a city paper of the costliness of the Technical School, he said that there were 34,000 pupils attending the public schools of the city, 1,300 at the High School and 1,310 at the Technical School The cost of the public schools was $19 per pupil, of the High School $31, and of the Technical School only $6, and he asserted that the last named would be found to be the most profitable school in Toronto He was happy to acknowledge that the Toronto Technical School was largely the outcome of an agitation started by the Canadian Association of Stationary Engineers Mr. Ferrier then sang the "Sailors' Anchor" very acceptably. The next toast was the "Executive," to which Bro E. J Philip, vice-president, replied, thanking the association for the hearty way in which it had been drunk. The executive were doing a good work for the association, and were trying to extend its influence in the different manufacturing towns of Canada. A couple of new branches had been organized in the past year; but one difficulty of the executive was its small revenue, which hindered its work The chief work before them was to get a law requiring a license for engineers A doctor or a lawyer or a surveyor required a diploma or a certificate to practice his business, but any one could be an engineer, whether he knew anything of his work or not The executive were now going to try the Dominion Government after the delays of the Provincial Government, and he hoped the prominent gentlemen present would work for them when the time came to act. Bro. R. C. Pettigrew, Hamilton, executive treasurer, also replied, giving a humorous turn to the compliments paid to the Ambitious City, from which Toronto had drawn some of its best pillars (hear, hear) The executive were doing their best for the manufacturers and users of steam, and they were evidently finding it more profitable to employ those who had a license from the Ontario Association of Stationary Engineers in preference to those who had not. This was decidedly the case in Hamilton. Bro. Blackgrove then sang "Remember you have Children of your own." The toast of "Sister Societies" was replied to by John Yule, Guelph, for the Canadian Electrical Association; Geo Mills, president of the Toronto branch of the Brotherhood of Locomotive Engineers, and A. E. Edkins, registrar of the Ontario Association of Stationary Engineers Mr Yule said he had seldom been at a gathering where there was more enthusiasm and harmony than was shown here. The occupation of the engineer was increasing in importance, and in many places he was expected to know more than any man in the establishment. He urged the young men to earnest study, and the old members to help the young men all they could Geo Post gave a good recitation describing the career of a hose reel horse Mr Mills gave an interesting sketch of the progress of the Brotherhood of Locomotive Engineers, which since its organization in Rochester 33 years ago, had increased to a membership of 35,000 He had himself been 17 years chief of the branch in Toronto Bro Edkins explained the scope of the Ontario Association of Stationary Engineers, which was an examining board and had power from the Ontario Government to grant certificates to engineers in this province, there being 650 of such certificates granted, the last one having been issued the evening before to a

Hamilton engineer He had special opportunities in his travels of observing what was being done, and he could say that the association had done much to raise the status of engineers during the past three or four years. Those who had had to devote themselves to study in order to get certificates had found their reward in being able to get better wages than before. At the same time the association made it a principle never to interfere with the wages question by strikes or otherwise, but left each man to deal with the employer on his own account He commended the English law relating to the employment of engineers. There a steam user might employ any one he liked to run his engine, but if an explosion or accident occurred the owner of the plant was held responsible for the damage or loss of life. He spoke highly of the example set by the city council of Hamilton, which recently decided that no engineer shall be employed to run engines owned by the corporation unless he has a certificate from the association. Dr. Orr here broke in on the toast programme by proposing "Toronto No. 1," coupled with the names of Bros. A. M. Wickens and James Huggett. Bro. Huggett, in reply, spoke of the advance made by the association, which had grown from the 13 members with which it started to a present membership of 125. It had now a hall of its own and had the beginnings of a library, to which he invited contributions. Bro Wickens, in thanking the friends of Toronto No. 1, referred to the voluntary and educational character of the association. There were young men he could name who were now getting double the salary they were able to obtain before they joined the association. "The Visiting Brethren" was coupled with the names of Bro. Mackie, of Hamilton Branch, and Bro. Hazlett, of Winnipeg Branch. Bro. Robt. Mackie expressed his pleasure at being present, and in the course of his speech spoke of the influence which the Hamilton association had upon the prospects of the engineers in that city. Not only had the city council required that all the engineers in its employ should have certificates, but the school board had ordered that after the 1st September every engineer in the employ of the board must have at least a third-class certificate. The result was a large increase in the applications for membership and certificates. After Mr. Grant had sung "Scots Wha' Hae," Bro. G. M. Hazlett spoke and said that in Manitoba they had a provincial law providing for the inspection of boilers, and they have been trying to get a clause inserted in this Act covering an engineer's license. He failed to see why Ontario should not have a similar law. "The Press" was responded to by E. B. Biggar, of THE CANADIAN ENGINEER, and T. S. Young, of the *Canadian Electrical News*. The programme closed with a volunteer toast, "The President's Health," proposed by Bro. Edkins, who said that if anyone had told Bro. Fox when he first joined that he would be asked to fill the president's chair one day, he would have fainted—(laughter)—but he was actually in that position to-night, and it was not too much to say that his success in his career as an engineer was due to this association. President Fox, in reply, agreed with what Bro. Edkins said, and told how he had studied at the technical school, and had got help from kind friends like Bros. Wickens, Edkins and others, to whom he went at night after work was over. The toast was enthusiastically drunk. The dinner committee was composed of Bros. Thos. Eversfield (chairman), G. C. Mooring (secretary), J. Fox, A. M. Wickens, J. Marr and J. Bain, to whose exertions the success of the annual reunion was largely due.

LONDON BRANCH.

The Canadian Association of Stationary Engineers has reorganized, with a full set of officers, in London, Ont. G. B. Risler has been selected president; T. D Campbell, Pottersburg, vice-president; Wm. Meaden, secretary-treasurer; Duncan McKinley, recording secretary, and Wm. McLean, guard.

HAMILTON BRANCH.

An open meeting of the Canadian Association of Stationary Engineers was held on Nov 20th, at which a paper on "Heat" was given by James Gill, B.A., of the Collegiate Institute.

BERLIN BRANCH.

The secretary of the Berlin Branch writes. "We are few in number, but what there are of us want to do our share in the work before us, both as individuals and as an association. We are having interesting meetings, and are realizing the benefit to be derived from joining the C.A S.E. The members of No. 9 are all a wide-awake and intelligent set of 'boys,' willing to learn and extend a helping hand to all new comers, and we are being visited by our superiors, members of the executive. No. 9 is very much obliged to Bros. John F. Cody, District Deputy of London, and E. J Philip, executive vice-president, of Toronto, for a friendly visit paid No 9, C.A.S E., at their last regular meeting."

WATERLOO BRANCH.

A branch of the Canadian Association of Stationary Engineers was organized in Waterloo recently by District Deputy John F. Cody, of London, assisted by E. J. Philip, of Toronto; W. J. Rhodes, Geo. Steinmetz and W. Tiedt, of Berlin. The officers' names of the C A.S E. No. 17, of Waterloo, are: John Nihill, past president. John Uttley, president; Jos Srosz, vice-president; John Wendel, secretary; Nathan Uttley, treasurer; F. A. Sflug, finance secretary; Peter Hartlieb, conductor; John Teufel, doorkeeper. This branch meets every Tuesday evening, at 7 30, in the Waterloo Woolen Mills engine room.

KINGSTON BRANCH.

At the last meeting of Kingston Branch, No. 10, of C.A.S.E., it was decided by a standing vote of the members present to change the meeting nights from the 1st and 3rd Tuesday of each month, to the 1st and 3rd Thursday of each month. The first meeting under the new arrangement occurs on Thursday evening, December 3rd.

BROCKVILLE BRANCH.

Since the last report, the Brockville Branch has removed to other rooms that are more suitable, and when any of our visiting brethren happen to come to Brockville, they will find our association rooms on the second story in Richards Block, on King street. We still have a good attendance, and hard workers for the good of the order are usual with us. One new member has been admitted since last report, writes Secretary Jas. Aikins.

BOILER PRACTICE IN EUROPE.

The Steam Users' Association of the U.S., of which Edward Atkinson is president, recently sent R. S Hale to Europe to study, and report on European boiler practice. The report now published as circular No. 5, is a very instructive one, as the following extracts will show:

The standard type of boiler in use through Europe, with the exception of France and the Province of Alsace in Germany, was decidedly the internally fired flue boiler known as the Lancashire when it has two flues, and the Cornish when it has one. The Lancashire boiler is generally about 30 ft. long by 7 ft. 6 ins. in diameter. The two internal flues are about 3 ft. diameter, and the grates in them are generally 6 ft. long. Galloway, or cross tubes, about 6 ins. diameter, are often placed in the tubes back of the bridge wall, five to each flue, but this is advised against by some of the best authorities. The gases after leaving the furnace tubes pass underneath the boiler to the front, then back along the sides to the underground flue. Such a boiler would have 36 sq. ft. of grate surface and about 1,000 sq. ft. of heating surface, giving a surface ratio of 28 When built for 160 lbs. steam pressure, it costs about $2,500 in England, and will deliver easily 6,000 lbs. steam per hour. At this rate it is not very economical, but if used at a lower rate, or in conjunction with an economizer, it is as economical as any type of boiler. It is a boiler that is very easy to keep clean, since every portion of the surface outside and inside is of easy access.

The Cornish boiler is exactly like the Lancashire, except that it has only one furnace tube. This single tube is in England placed in the centre; in Germany it is placed to one side with the idea of improving the circulation. It is nowadays rarely built except for small plants, so that the average Cornish boiler is probably considered older than the average Lancashire.

In France and in Elsass, Germany, the type of boiler known as the "elephant" is the standard. This is classed under the head of externally fired cylindrical in Mr. Hiller's table. It is not as regular in size or proportion as the Lancashire. The upper shell is generally from 20 to 30 feet long and some five feet in diameter. The two lower shells called "bouilleurs," are about 2 feet diameter. They have one and sometimes two connections to the main shell. This boiler has the advantage of allowing a very large grate surface, an important consideration with the poor coals in use on the continent.

In boiler construction I judged the English workmanship to be fully equal to our best. In England no punching is allowed; the plates are always planed on the edges and then drilled in place. Steel is being used almost exclusively in England; iron is still preferred in some places on the continent.

The internal flues in the Lancashire boilers are generally welded along the longitudinal seam, and the cross or Galloway tubes are frequently welded in. I did not hear of any cases of welding the boiler shell itself. The flues are occasionally made corrugated in various ways, as the Fox, Purves, and other patents. My impression was that these were considered better, but that most frequently the improvement did not warrant the expense. The steam-pressures, of course, varied from plant to plant. I should judge

that if 140 to 150 lbs. was considered a standard for a new mill in America, the corresponding practice would be 200 lbs. in England, 180 in Elsass, and 140 to 150 in Belgium and Germany. In all countries I found occasionally higher pressures than the above, and, of course, the immense majority were lower.

ECONOMIZERS.

The use of economizers is more general in Europe than in America, and the type known as the "Green," now made by several good firms, is the standard. Occasionally on the continent one of the bouilleurs of the elephant boiler was used as an economizer. The most general practice was to put one economizer for each battery of boilers, making the economizer heating surface and the boiler heating surface the same. In Belgium, however, they were recommending one small economizer to each boiler. Scrapers are used to keep the fire surfaces clear of soot. The water surfaces are subject to scaling if the water be bad, and it is chiefly in the bad water districts that economizers are not used, though they are not much, if any, worse in this respect than water tube boilers. But when the economizers are taken out, the heating surface of the boilers must be more than doubled to get the same economy.

HEAT STORAGE.

An advantage claimed for the Lancashire boilers and the economizers was that the large amount of hot water in them afforded a reserve of heat for a sudden call. An interesting application of this principle were the feed storage and the steam storage systems of D. Halpin, Esq., London. The first is applicable to all plants, and consists in providing tanks in which the feed is heated to the steam temperature by steam from the boiler during light demand, so that during the heavy demand the feed water is supplied hot (360° F.) instead of 100° or 200°. The steam storage consists in having very high pressure boilers, which pressure is reduced at the engine. Water is heated to boiler pressure during light load and stored in tanks, and during the heavy load expands into steam and relieves the demand of the engines on the boilers proper. The steam storage system did not impress the writer favorably If you are going to go to the expense of high pressure boilers anyway, then it seems to him that you will be as apt to save coal by using high pressure steam at your engines as by reducing the pressure in order to equalize the load on the boilers. But the feed storage system, particularly where economizers are not used, seems a very practicable method of reducing the net first cost by a few per cent. (the boiler plant saved would cost more than the feed storage), and at the same time probably increasing the economy. Both the feed and steam storage systems are especially available with bad water.

SUPERHEATERS.

The use of superheated steam is very much in the air all over Europe, and in Elsass (Alsace) it is fairly general, about 500 superheaters being in use. There has never been any doubt that it saved from 10 to 20 per cent. of coal, but the difficulty has been in the lubrication of the engine cylinder and the keeping the large number of superheater joints tight. The Schoerer superheater, which is much used in Elsass, consists of a small number of very heavy ribbed cast-iron pipes placed in a very hot portion of the flue, as, for instance, between the tubes and the drum of a Babcock & Wilcox boiler. The cast-iron is made thick enough so that it may become red-hot without injury, and by being in the hot portion of the flue only a small superheater is required. The trouble with lubrication is overcome by using a high grade mineral oil. In England and on the continent, several forms of superheaters using thin steel pipes were under test. I did not hear of their sale in any number as yet. The superheaters are also placed above a separately fired furnace in some plants

GRATES.

The grates in ordinary use did not noticeably differ from those in use in America. In Germany some of the under fired boilers were provided with grates that inclined downwards to the rear as much as a foot or a foot and a half, which was thought to be easier for the firemen and to give better combustion. The ash-pits of these boilers were unusually deep. The coal is frequently very soft and bituminous, but in their internally fired boilers they had no trouble from having the furnace top only 18 inches or less from the grates; in fact the Lancashire boiler enjoyed a better reputation for smokelessness than many others

MECHANICAL STOKERS.

In England several forms of mechanical stokers were in use, perhaps over one-quarter of the boilers being equipped. They may be divided into two general classes, the coking and the sprinkling stokers. The coking stokers feed the coal at the front, where it cokes and is then carried to the rear by the reciprocating motion of the grate bars. The Vicars stoker is the best known of the class. It is represented in this country by the Roney, Wilkinson, Murphy, Brightman and other types; the chief difference being that on account of the internally fired boilers the Vicars grate bars are level. The sprinkling stokers throw the coal over the grates by means of revolving or oscillating shovels; but they generally use as well a reciprocating motion of the grate bars to carry the ashes to the back end. The Bennis stoker is perhaps the most widely used of this class, but there are several good firms who make stokers of each class.

Opinion is, of course, widely divided on the merits of mechanical stokers. What seemed to the writer to be the general drift of opinion of those best fitted to judge, was as follows: No stoker absolutely prevented smoke, but both types very largely diminished it. In this respect the coking stoker had a decided advantage over the sprinkling. Neither stoker kept up the steam pressure on a sudden call as well as hand firing: in this respect the sprinkling stoker was considered to act more quickly than the coking

The sprinkling stoker was being sold at about three-quarters the price of the coking The cost of the Vicars stoker was about $500 for two stokers, each 2 feet 9 inches or 3 feet wide, and 4 or 5 feet long.

The opinion as to whether the stokers saved coal was evenly divided. The most general reasons for their adoption was the diminution of smoke, the smoke laws being very strict in England, and the use of a cheaper fuel. The use of a cheaper fuel undoubtedly saved money, but when compared on the same grade of fuel, the best opinion, so far as the writer could judge, was that they saved some coal, but not enough to show a net saving after paying the interest and repairs. The saving in labor was not generally considered, and did not amount to very much in small plants, or in plants where no coal-handling devices were adopted. The use of stokers and coal-handling appliances together was thought to save about one-third of the boiler room labor in large plants.

DUST FIRING.

In Germany, grinding the coal to a powder and blowing this dust coal mixed with air into a hot combustion chamber was a method that was being experimented on in several plants and was meeting with considerable favor. The "Wegener" process is used in England; the "Camp," the "Schwartzkopf" and others in Germany. Fig. 10 shows one of these arrangements. The fine dust (almost as fine as flour) is, however, not only a very dirty stuff to handle, but is also exceedingly liable to spontaneous combustion, and the problem of grinding and storing it had not yet been commercially solved so far as the observation of the writer went.

BOILER FITTINGS.

In boiler fittings several differences were noted. All fittings were noticeably heavier and stronger than with us. The use of spring-loaded safety valves is looked on as yet with a great deal of distrust, and those in most common use are the lever valve and also the dead-weight valve.

The use of try-cocks has been entirely given up in every plant that I visited, and two gauge-glasses are used instead, having been found not only nearer but safer On the Continent one glass and a mechanical lever indicator were sometimes used.

The dampers on the smoke flues are almost always of the sliding and not of the butterfly type. This may be because the flues are almost always underground. The dampers are always regulated by hand, damper regulators being practically unknown. Forced, induced, steam-jet, and other artificial drafts are no more and no less in use than with us; that is they are not infrequent in special cases where the ordinary draft is insufficient, but they are in no sense general.

The use of guards on the water-gauges is very common to prevent pieces of broken glass from injuring the fireman. This is peculiarly necessary since in most of the foreign boilers the water glasses are on a level with the fireman's face.

PIPE COVERING.

The average quality of the boiler and pipe coverings did not seem to the writer as good as those in general use in this country. Occasionally he saw wood and even rope covering on high pressure piping, some of which was already distinctly charred. Some plants, of course, had very good coverings, and there was a custom of covering the top of the boilers very thickly with some cheap covering, with the result that nine times out of ten the space over the boilers was noticeably cooler than it is in America.

CHIMNEYS.

In regard to chimneys, the variety of sizes and of theories is just as great as it is here. The few of which the writer obtained both the dimensions and the amount of coal they were intended to burn were larger than those given in the tables in American books of reference for the same capacity. This may be because in Eng-

land they lay a good deal of stress on a good draft as an aid in smoke prevention, and the English laws are very strict as to smoke. Brick is almost universal, iron stacks being used only in very exceptional cases.

BOILER OPERATION.

The admission of air above the fire either at the door or at the bridge was used occasionally. The opinion was very general that this diminished smoke. As to economy of coal, authorities were divided, but the general drift was that this admission of air resulted in a slight loss.

Boiler surfaces seem to be kept cleaner than is the general practice here. In some places they run the boilers until the specific gravity of the water is 1.005, then they blow out and clean the boiler. In England they use soda, lime and potash in the boilers, according to the impurities, and on the Continent they are also beginning to know about the advantages of kerosene. Purifying plants to take the impurities out before the water enters the boiler are not infrequent, but are hardly considered a complete commercial success as yet. A little water is generally blown out once or twice a day, just as with us, and in mills the fires are banked at night. In electric stations the custom was very general to let the fires go out when they were not needed. Several plants gave us the result of experiments on the cost of banking fires. Reducing these to 24-hour days and to equal grate areas, they run about 40 lbs per 24 hours per square foot of grate.

The opinion as to the practice of letting the steam pressure off the pipes when the load was off was divided. On the whole it was in favor of the practice, although some plants said they had tried it and had found the cost of repairs to more than balance the saving in coal.

BOILER TESTING.

Boiler testing is in some respects more advanced than it is with us, chiefly in that they attempt to tell where all the heat supplied goes to, and thus determine the reasons of good or bad performances.

The bomb calorimeter, in one or the other of its various forms, Mahler, Donkin, etc., is considered the only accurate means of determining the heat value of a coal, though the method of analyzing coal and using one of the numerous modifications of Dulong's formula is quite often employed. The Thompson and other calorimeters of that type are not considered in the least available for practical work. It was the custom to correct the results of the calorimeter for the latent heat of the H_2O formed from the hydrogen in the coal, or, if using the formula, to assume that the hydrogen was burned to steam and not to water. Coal tests are, of course, compared on the evaporation per pound of coal, boiler tests were generally compared on the evaporation per pound of coal; "pure and dry," dry referring, of course, to the moisture correction, pure to a correction of the earthy matter contained in the coal, but not allowing any correction for the unburned coal in the ashes. Occasionally, however, pure and dry meant exactly the same as our "combustible." In determining moisture and steam they are as far behind us in their general practice, with the exception of a few of their best engineers, as they are ahead of us in the analysis of the gases. Fortunately at the high steam pressure now in vogue the priming is generally a negligible quantity, so that the results have not been affected.

BOILER ECONOMY.

In boiler economy I could not see that they were either ahead or behind us; they get from 69 per cent. to 80 per cent. of the heat in the coal, according to the air supply and evaporation per square foot of heating surface None of their engineers had ever found any combustible gases in the chimney, except occasionally a little carbonic oxide. Most of their tests, however, left some zero to 15 per cent of the heat unaccounted for, which may be radiation or error. Some said one, some said the other. No one had experimented as to why it is harder to supply the right amount of air to one kind of coal than to another, though they had all gone as far as to realize the immense importance of the air supply, as compared with any other factor in boiler economy, and also to realize and to experiment on the amount of air that leaks through the settings of some types of boilers to the injury of economy. Frequently more air has been found to leak through the settings than came through the fire. In some plants on the Continent they were painting the brick settings with a heavy tar paint to make them air-tight, and occasionally even enclosing them in sheet-iron casings.

The following table prepared by the National Boiler Insurance Co., of Manchester, is appended to the report:

PER CENT OF BOILERS OF VARIOUS TYPES USED IN EUROPE.

	United Kingdom.	France.	Germany.	Switzerland.	Austria.
	1891,	1893-94.			
Lancashire and similar types..	38	4.7	35.7	19.6	*
Cornish and similar types	23.7	8.2	15.3	40.8	*
Externally fired cylindrical[1] ..	6.8	57.3	14.8	15.5	41.0
" " multi-tubular..	..	13.4	5.2	3.5	7.5
Locomotive.....	11.0	5.1	17.3	5.7	10.5
Small verticals	16.6	3.6	5.0	13.5	6.1
Water tubes	1.8	5.7	4.6	1.4	3.8
Other types	2.1	2.0	2.1	..	1.4
Total	100.0	100.0	100.0	100 0	100 0

* Lancashire, Cornish and similar types, 29.7. [1] Including elephant.

THE ROASTING OF IRON ORES, WITH THE VIEW TO THEIR MAGNETIC CONCENTRATION.*

By Prof. H. Wedding, Bessemer Gold-Medalist.

Continued from last issue.

Hydrogen and carbon monoxide certainly act differently in this reducing action. Hydrogen reduces ferric oxide to metallic iron through the various oxide stages, as is shown by the following reactions:

$$Fe_6O_9 + 2H = Fe_6O_8 + H_2O$$
$$Fe_6O_8 + 2H = Fe_6O_7 + H_2O$$
$$Fe_6O_7 + 2H = Fe_6O_6 + H_2O$$
$$Fe_6O_6 + 12H = 6Fe + 6H_2O$$

Carbon monoxide acts differently, since ferrous oxide and carbon dioxide decompose again with the oxides Fe_6O_7 and CO; in other words, two opposite kinds of chemical reactions would have to take place at the same time, which, of course, can never happen. The following reactions are rather the ones that occur:

$$Fe_6O_9 + CO = Fe_6O_8 + CO_2$$
$$Fe_6O_8 + CO = Fe_6O_7 + CO_2$$
$$Fe_6O_7 + 7CO = 6FE + 7CO_2$$

According to Kosmann, what happens in the blast-furnace is much as follows:* Red hematite or ferric oxide is reduced even in the uppermost zone by carbon monoxide. From $Fe_8O_6 + O_6$, six oxygen molecules are separated and absorbed by the carbon monoxide. These oxygen molecules correspond in Fe_8O_6 to a balance of two bonds which are deleted. The remaining four bonds are, however, only able to correspond to four molecules of oxygen. Another two molecules of oxygen, consequently, are split off, and are liberated for the reduction by carbon monoxide. This quite corresponds, according to Kosmann, to Wiborgh's analyses, according to which in the reduced ore only the ferrous oxide exists. There remains in the residue Fe_8O_4 only the composition $4FeO + 4Fe$, that is to say, there exists in the ores reduced in this way 43.7 per cent. of metallic iron. We can further assume, adds Kosmann, that as soon as the six molecules of oxygen are separated from the compound $Fe_8O_6 + O_6$ by the first stage of the reducing action, the reducing action further proceeds to the molecular rearrangement of the remainder of the Fe_8O_6 in such a manner that the sesquioxide constitution approaches that of the protoxide. The separated six molecules of oxygen would then represent not two but three bonds, which disappear in the remainder Fe_8O_6, in consequence of which not two but three molecules of oxygen remain for the further action of the carbon monoxide. The remainder would then only represent the formula Fe_8O_3, and have the composition $3FeO + 5Fe$, that is, it would contain 56.04 per cent. of metallic iron, the same percentage which Wiborgh found in his analysis. The Fe_3O_4 of magnetite behaves differently in the blast-furnace. Being very hard to reduce, the ore must sink to a considerable depth down the furnace shaft to reach the zone of higher temperature. From the compound, $Fe_9O_6 + O_6$ the separated six molecules of oxygen are seized by carbon monoxide, and in the remainder, Fe_9O_6, as the ore approaches in character to protoxide, three bonds become free, so that this residue has the composition $6FeO + 3Fe$. At the high temperature, however, and as the ore is in a zone at which the carbon monoxide that had been burnt to carbon dioxide seeks to decompose again into CO, the liberated metallic iron has to endeavor to pass into the state of the heat-resisting magnetic oxide, and it combines gradually with one or two molecules of oxygen. If it takes up one molecule of oxygen, the remainder $Fe_8O_6 + 3Fe$, assumes the composition $Fe_7O_7 +$

* *Stahl und Eisen*, 1888, No. IX.

2 Fe In the absorption of two molecules of oxygen the composition becomes $Fe_8O_8 + Fe$ In the first case the reduced ore to be reoxidized contains 18 18 per cent of metallic iron and in the other case 8 8 per cent., which again agrees satisfactorily with the results of Wiborgh's investigations Kosmann justly concludes that the degrees of roasting to which an ore is subjected is a guiding preliminary to its subsequent behavior when under treatment in the blast-furnace

The way in which the reduction of the ferric oxide and the magnetic oxide is effected in the blast-furnace may also be considered to be as follows In the first place, with increasing temperature the decomposition of carbon dioxide into carbon and carbon monoxide diminishes, the ferric oxide absorbing far more carbon in this way—which afterwards helps in its reduction—than does magnetic oxide, and, secondly, with increasing temperature the reducing power of carbon monoxide diminishes, the final reduction to iron being consequently rather due to solid carbon than to carbon monoxide.

Ferrous carbonate, too, yields residues of different compositions after being roasted at different temperatures. The higher was this temperature, the greater is the loss of reducibility in the blast-furnace which the ores experience To prepare an iron oxide for reduction in the blast-furnace, it is consequently by no means immaterial in what way, that is to say, at what temperature and in what kind of atmosphere, the roasting is effected. Rather must that kind of roasting be considered the most suitable for the reduction in which, owing to a low temperature and oxidizing atmosphere, ferric oxide is formed from magnetite and spathic carbonate, or is retained in red and brown hæmatites.

This review of the reactions had first to be presented to show that every roasting by which a magnetic product Fe_6O_8 or Fe_6O_7, is obtained, is disadvantageous to subsequent reduction in the blast-furnace or even in the open hearth. Despite this, such a roasting may be of advantage when it is a question of preparing from a poor or impure ore a richer and purer product by subsequent magnetic treatment.

ROASTING IRON ORES FOR SUBSEQUENT MAGNETIC TREATMENT

The farther is the utilization of the world's store of iron ores carried, the rarer become those ore deposits which, combined with adequate richness, are sufficiently pure for blast-furnace treatment, and still much rarer are those which appear adapted for the open-hearth process, that is to say, for the manufacture of ingot iron from pig iron in the reverberatory. The question of the concentration of iron ores is becoming year by year more and more pressing for iron metallurgists. The prosperity of a country is dependent on its iron industry, but largely too on the iron ores it uses being mined in the country itself. Rich and pure iron ores still exist, it is true, in adequate quantity, but they are confined to a few places in different countries. Our excursion brings us to Spain, the country which provides all the iron-producing countries of Europe with ores of this kind Sweden is not less rich in ores such as these, but how long will these sources of supply be available? The iron metallurgist finds it day by day a more pressing matter to enrich and improve unsuitable iron ores, and for this purpose magnetic concentration occupies the foremost place. Of the different compounds of iron with oxygen, practically only the two oxides Fe_6O_8 and Fe_6O_7 are adequately magnetic. Ferric oxide is nearly non-magnetic, and ferrous oxide cannot be produced in practice. On the other hand, the ferric oxide in red hæmatite, or in dried brown iron ore, may be readily rendered magnetic by roasting, that is to say, may be readily converted into the magnetic oxide. Three possibilities exist in this direction. When the atmosphere during roasting is oxidizing in character, that is to say, when air is admitted, either the ferric oxide is converted into the magnetic suboxide Fe_6O_7 or Fe_6O_8, or else by the accurate roasting of carbonates a magnetic oxide is produced, or from the oxide (Fe_6O_9) by a reducing roasting a magnetic lower oxide is obtained

Whether any one of these methods will be profitable is mainly a question of cost The reduction is certainly rendered more difficult, the fuel consumption during reduction becoming greater, and the magnetic roasting with the subsequent treatment also in itself entails additional expenses. Probably, therefore, in most cases a preliminary preparation of the ores for the blast-furnace treatment will be out of the question. On the other hand, a pure ore, despite great cost, may in many cases prove useful in the open-hearth process, that is to say, in the oxidizing fining for ingot iron in a reverberatory provided with heat-regenerating chambers, by means of which, that is, molten pig iron is converted into molten malleable iron. One sees, therefore, that the question as to what is to be done to convert non-magnetic ores into magnetic ores is by no means one that should be overlooked, but that it is rather of great importance

Phillips* has published an account relating to the magnetization of the red iron ores of Birmingham, Alabama, with a view to their necessary further concentration by the magnetic process If the observations of this writer are taken into consideration jointly with the results obtained at Allevard in France, which I have described,† one obtains from these, perhaps, the only cases in practice in which iron ores that are non-magnetic by nature are prepared by roasting for a subsequent magnetic treatment. The first case relates to the roasting of ferric oxide, Fe_6O_9, and the second to the roasting of the carbonate $FeCO_3$ for conversion into the magnetic oxide.

MAGNETIZATION OF THE VARIOUS IRON ORES.

1. *Magnetites.*—Magnetites are of themselves magnetic, and do not, therefore, need to be first rendered magnetic before they can be submitted to a magnetic concentration. Nevertheless, roasting may be necessary for such an ore, partly for the purposes of facilitating its further reduction in size for the magnetic treatment by rendering it more easy to break down, and partly for the purpose of eliminating the sulphides it may contain, such as iron or copper pyrites or zinc blende. Magnetites only lose very slowly their natural magnetic properties on roasting, no matter whether the roasting is oxidizing or reducing in character. Only when they are maintained for a very long time at a medium red heat and with access of air, will the magnetic oxide pass gradually into ferric oxide, and the ores cease to be magnetic. On this point Phillips ‡ has made detailed investigation He made a large series of experiments and heated portions of native magnetite in a strongly oxidizing flame for 30 minutes, without influencing their magnetic character. At a dull red heat in an oxidizing flame some pieces lost their magnetic power, but regained it when raised to higher temperatures. This regaining of the magnetic properties is a fact which was noted long ago by H. Rose, who showed that on heating an iron oxide in a porcelain furnace, the oxide partly lost its oxygen and became magnetic. In a similar manner native magnetite can absorb oxygen and lose its magnetic properties, but regain these when heated to a still higher temperature, the first time through absorption, and the second through loss of oxygen In this connection it may be pointed out that the artificially prepared magnetite does not behave so favorably as the native mineral, but loses and regains its magnetic character more readily.

2. *Spathic Iron Ores.*—From the carbonates, by suitable roasting, the magnetic iron oxide can be obtained direct. By roasting in a neutral atmosphere the "ignition" magnetic oxide Fe_6O_7 is obtained, and by roasting in a moderately oxidizing atmosphere, the magnetic oxide Fe_6O_8. If, however, the carbon dioxide is once eliminated, both these magnetic oxides pass readily under the action of the oxygen of the air into the non-magnetic ferric oxide Fe_6O_9. If, therefore, it is desired to produce the magnetic oxide, the whole success depends on roasting with exclusion of air, or, if this is impossible, on reducing the air access to a minimum. The ferric oxide, which is produced when there is free access of air, is, however, at higher temperatures, just as decomposable again into the magnetic oxide and oxygen, as has already been referred to in connection with the native magnetites. It is possible, therefore, without endangering the magnetic character of the product, to roast spathic carbonates at temperatures as high as may be necessary to eliminate as far as possible the sulphur occurring in the spathic ores, as iron and copper pyrites, zinc blende, etc.

On the other hand, this necessitates a larger consumption of fuel than would be necessary if the spathic ores were only to be converted at a low temperature into the condition of the magnetic oxide. For the preparation of magnetic oxide from the spathic carbonate, no reducing roasting atmosphere is consequently necessary.

3. *Red Hæmatites.*—Magnetic oxide can be prepared from the ferric oxide of red hæmatites in two different ways. (1) By heating strongly in the absence of air. One atom of oxygen separates off in this way, and, indeed, by properly firing, two oxygen atoms may be eliminated—$Fe_6O_9 = Fe_6O_8 + O = Fe_6O_7 + 2\,O$. For this reduction of ferric oxide, as Phillips has shown, a relatively very high temperature is necessary, at which, if the red hæmatite contains a quarzose gangue, slag may readily form. In any case, it is difficult at the high temperatures at which the separation of oxygen takes place, to avoid a sintering, or even it may be fusion of the gangue with the ferric oxide and the formation of an iron silicate. (2) The second method of preparing magnetic oxide from red hæmatites depends on the roasting of the ore under the action of re-

* Transactions of the American Institute of Mining Engineers, Atlanta Meeting, October, 1895.

† *Verhandlungen der Vereins zur Beförderung der Gewerbfleisses*, 1895, page 353.

‡ Transactions of the American Institute of Mining Engineers, Atlanta Meeting, October, 1885.

ducing gases, of which at low temperatures hydrogen, and at higher temperatures carbon monoxide, are most suitable in their action. To be certain, therefore, it is best to employ in the roasting a mixture of both these gases, that is to say, to roast with ordinary water-gas The readiness with which the reduction takes place depends in both cases, with red hæmatites, largely on their more or less dense texture. Many red hæmatites are so excessively dense that just as little reduction takes place with as without the use of reducing gases, even when the ignition is long continued. On the other hand, blast-furnace practice shows that there is no red hæmatite which, given adequate time, is able to resist the reducing action of carbon monoxide, even completely down to the metallic state, and this reduction must, of necessity, be preceded by a transition through the different stages of the magnetic oxides of both kinds.

4. *Brown Iron Ores.*—Before the ferric oxide of the hydrated iron oxides can be reduced, the water must first be eliminated. The residue then behaves as a red hæmatite would, but the reduction proceeds far more readily under the influence of reducing gases, owing to the more porous character of the ore after the elimination of the water. Laboratory experiments have shown me that even from the iron oxides of the dehydrated brown iron ores, magnetic oxide may be prepared both by strongly heating with exclusion of air, and by heating gently in reducing gases. Here, too, it is a question dependent on the character of the gangue contained in the ore as to which method is best to be employed. If one has to deal with ores containing no quarzose gangue, high temperature may be used; if the ores contain intermingled sulphides, this must be employed, or, in the first place, the treatment must be oxidizing, and then reducing in character. On the whole, for brown iron ores the method in which use is made of reducing gases at a low temperature is most advantageous on economic grounds owing to the saving of fuel.

5. *Pyritic Ores.*—Pyritic ores, before a reduction can take place, must first always be robbed of their sulphur contents, or at least mainly so As in any case pyrites is subjected to an oxidizing roasting for the purpose of obtaining sulphur dioxide from its sulphur contents, the residue is, in practice, always ferric oxide, and this ferric oxide behaves exactly as that of red hæmatite, except that it is a little more difficult to reduce, owing perhaps to the presence of some residual sulphur. As is well known, iron pyrites is only then used as an iron ore when it contains copper, or perhaps, too, zinc. In addition to the chlorides of the metals resulting from the oxidizing roasting of the pyrites in admixture with salt, ferric oxide also results. The former are extracted by leaching with water, and the ferric oxide remains behind in a practically pure state.*

SIZE OF THE ORES TO BE ROASTED TO MAGNETIC OXIDE.

The size of the ore pieces to be roasted to magnetic oxide is not unimportant. Before all things it is necessary, in order to obtain a good result, to have the pieces that are to be roasted as nearly as possible of the same size. It may be taken as a rule that the magnetization takes place the more readily the more the ore is in the form of small, but solid, pieces, which do not crumble up or fly into bits on roasting, since the gas can then readily pass through the interspaces, and the relatively small ore particles are rapidly converted into magnetic oxide right through their mass. A much larger size of the ore particles is disadvantageous, as for their conversion into the magnetic oxide too long a time is necessary, and since it is then uncertain whether this magnetization has gone right through to the centres of these ore lumps. Phillips has very rightly pointed out, in opposition to the observations of Barton, that the magnetization always takes place from the outside inwards, and never from the inside outwards.

Pulverulent or very small ore particles are excessively difficult to magnetize, since the passage of the gases through the small interstices is rendered very difficult, and the gases usually form small ways or channels, from which the conversion then begins. It is, therefore, very difficult to magnetize ores for magnetic preparation which have already been broken down very small, or are pulverulent—slimes, that is. All such experiments which have been made, as, for instance, those at Allevard,† have been led to results which have not been altogether satisfactory, as the size of the pieces to be magnetized was much too small. More important than the actual size of the pieces is the necessity for having them under all circumstances of a similar size, and one cannot, therefore, pay too great attention to insure, by twice passing through the screens before the magnetizing roasting takes place, that all the ore pieces to be roasted have been brought to one and the same size.

* Purple ore is pure enough for magnetic separation to be unnecessary.
† *Verhandlungen zur Beförderung des Gewerbfleisses*, 1895.

FURNACES.

The requirements for the roasting of different kinds of ore, and especially of different ore sizes, necessitate naturally the construction of different kinds of furnaces. Lump ores are always best roasted in shaft furnaces, in which an easy and regular passage of the ore through furnaces of circular section is obtained. The section of the furnace should widen slightly from the throat downwards, in view of the gradual heating of the ores and their expansion. Inversely this leads also to a more regular upward passage of the furnace gases through the ore. It is, therefore, a question of causing the ore to pass through two different stages, first heating them, and then reducing them if they are oxidized, provided, of course, that they are red or brown hæmatites. This must be effected by using gas in two ways, partly as fuel and partly as the reducing agent As Phillips has observed in his description of the roasting of red hæmatites, the gas for heating purposes is best introduced into a combustion chamber, in which it is burnt around the furnace, so that only the flame enters the furnace. It need hardly be mentioned that gases cannot be burnt without the presence of a not inconsiderable excess of air, and attention has therefore to be given to seeing that in the heating of the ore an oxidization is, as far as may be, avoided. Only in the case of red hæmatites, which are to be reduced by the splitting-off of oxygen at a high temperature, is a temperature to be employed which may be as high as is possible of attainment, and in this case it may be a matter of indifference whether an excess of oxygen is present, or whether this is absent. In the case of spathic ores, the only thing that is necessary is heating in the absence of air, with no subsequent oxidation, although here, too, the treatment with reducing gases can only be advantageous in character. The reducing gas, whether ordinary producer or, and better, water gas, must then be passed into the heated ore from a lower level, and caution is necessary to insure that no air can enter. The openings which are to be employed for the withdrawal of the roasted ore from the furnaces must therefore be capable of being closed perfectly air-tight during the roasting, and the brickwork, too, must be built so as to withstand the passage of air through it. To be able, however, to readily withdraw the ore, the reducing gas must be passed into the furnace at a level somewhat above that of the withdrawal doors. One obtains in this way the advantage that the gas in its upward passage at the same time cools down the hot ore, with the result that this arrives at the withdrawal openings in an almost cold condition. The space between the entry of the hot burnt gases and those used for the reduction ought never to be small, as is often the case in Swedish calciners.*

In the case of pulverulent or fine ores, the use of shaft furnaces is not advisable, and it is better in such a case to employ zigzag furnaces, such as were used at Allevard, or channel furnaces with inclined beds. Still care should as far as possible be taken to never have to deal with such fine ore, but rather with ore of a coarser character.

CONCENTRATION OF THE MAGNETIZED ORE.

The magnetized ore, after the roasting, must be submitted to concentration, which may, in the first instance, be mechanical in character; this is done to separate from each other the ore particles of different sizes, and then magnetic, or it may be magnetic from the very commencement. This must be entirely dependent on the character of the ore as regards a mixture of gangue and iron oxides. The finer the state into which the ore is brought for magnetic separation, the more satisfactory will the progess of that separation naturally be, and the better will be the yield. The fine state of the ore has, however, in spite of this, various drawbacks. In the first place, as has been mentioned above, the magnetization is, as a rule, by no means regular, and in the second, such finely divided ores can only be added with advantage in quite small quantities to the blast-furnace charge, former experience in this direction placing this maximum at 12 per cent. All methods, too, of converting this fine ore again into larger lumps are too expensive to be, at least generally, commercially satisfactory. If, therefore, the ore is to be used in blast-furnace practice, such very small ore must, as far as possible, be avoided, and the size should be kept at about that of hens' eggs. On the other hand, small and even pulverulent ore may very well be utilized in the open hearth, and it has for this field of operations, I think, a very wide scope indeed, for the scrap which is now necessary for the conversion of the pig iron into ingot metal in the open-hearth process is becoming year by year more difficult to obtain

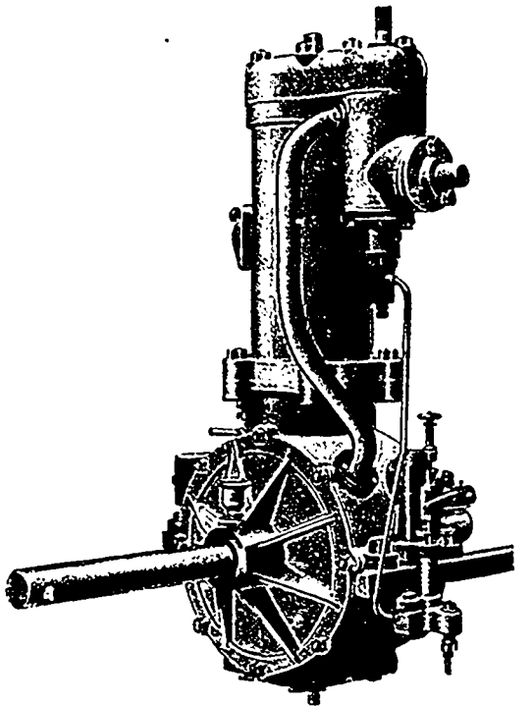
* One of the principal conditions for properly roasting iron ores into the magnetic state is the keeping of a right temperature in every part of the furnace. Since the Le Chatelier pyrometer has been made in the form described by the author (*Stahl und Eisen*, 1896, September), all difficulty in controlling the temperature has been obviated, and the instrument may unhesitatingly be relied upon for this purpose.

and more expensive to purchase, and it might very readily be entirely replaced by oxides. If the ores powder up readily on charging into the bath of pig iron, they may be inclosed in cases of sheet iron or paper (cartridges).

Very few ores are of themselves pure enough for the open hearth process, and they cannot either be converted into an adequately pure form by mechanical concentration, so that there is scarcely any other way of purifying them which could prove itself commercially economical except the method of magnetic concentration, which, if the ores are not magnetic, must be preceded by a magnetic roasting.

THE FACILE PETROLEUM OIL ENGINE.

A representative of THE CANADIAN ENGINEER recently paid a visit to the extensive works of the Britannia Co., Colchester, England, and saw tests made of the "Facile" petroleum engine, invented by Mr. Gibbons, superintendent of the works This engine is remarkable, not only for its lightness and power, but for its simplicity of construction. There is no water jacket to the combustion chamber, and it requires no electrical igniter, heating tube or other igniting device, the heat being started in a bulb which is brought up to the required temperature by the use of a lamp for a few minutes at starting, and after that the ignition is automatic There is only one valve in this engine and it can be taken out, cleaned and replaced in a few minutes. In the operation of the engine a spray of oil is injected against the walls of the chamber, and is completely broken up and vaporized. The force of the exhaust is such as to clean the cylinders out, and there is none of the tarry deposit usual to oil engines in this. The exhaust makes considerable noise, but this—which is the only visible defect of the model shown—can be remedied by an efficient "deadener." In the



THE FACILE MOTOR.

construction of the "Facile" engine the lower piston is larger than the upper one, and the result of the whole design is such a gain in power that the builders believe they can turn out a machine of any given horse-power in one quarter of the weight of any ordinary type of gas engine.

The amount of oil injected is regulated by a governor, which actuates a trip gear, either reducing or preventing the injection according to the work of the engine. In the engine, one valve, like a large safety valve, with a piston-body instead of wings, is used to combine a main air valve and exhaust valve, and the air in rushing into the cylinder helps to keep this valve cool.

Though the "Facile" engine is designed for launches, steam yachts, street railways and power purposes, a special type is now being built by the Britannia Co. for horseless carriages, and we hope to give an early report of tests of this new carriage motor. The Britannia Co. have had offers to purchase the rights from various quarters of the world, and a number of enquiries and offers have already been received from Canada.

Industrial Notes.

THE Port Stanley, Ont., Elevator Co., Ltd., will build a passenger elevator on the cliff at that place.

THE *Niagara Falls Metal Works will produce malleable iron* in future, as the plant is being set up for that purpose.

H. PECK, the late manager, has taken over the business of Reid & Currie Iron Works Co., New Westminster, B.C.

A SEWAGE system for the town of Lachine, Que., is being considered. One estimate calls for expenditure of $150,000.

THE Rossin House, Toronto, is to be remodeled; electric lighting will be introduced and a new system of elevators put in place.

E. H. PHELPS & Co., Merritton, Ont., intend using acetylene gas for lighting purposes in their wood-working factory this winter.

J. M. TABOR is arranging to build and operate a grist mill in the building next Palmer's tannery on Westmoreland street, Fredericton, N.B.

THE plant and premises of the Walker Foundry Co., Belleville, Ont., have been advertised for sale. Wm. Sutherland, Belleville, is the receiver.

E. MIAS, formerly superintendent of the R. S. Williams Company, Toronto, wants to organize a company in Hamilton to start a pipe organ factory.

THE engine at Fishe's Quarries, French Fort Cove, N.B., was broken up by some unknown persons while the premises were closed up on a recent Sunday.

FREDERICTON, N.B., council have decided to purchase a stone crusher, street roller and other parts of a road plant, the cost to be not more than $2,700.

MONCTON, N.B., has decided to give the Acadia Sugar Company 50,000 gallons of water daily as a free grant for ten years, if the Moncton refinery is rebuilt.

WM. GRAY & SONS, Chatham, Ont., carriage manufacturers, have received an order for eighty vehicles from Johannesberg, Transvaal, and are busy filling it.

J. R. BOOTH will, it is said, build a large saw mill at Barry's Bay, Ont., on the O.A. & P.S. Railway, to saw the logs taken out of his limits in the Upper Ottawa district.

THE O. A. and P. S. Ry. Company intend commencing the construction of extensive docks and elevators at Depot Bay, and this work will be pushed to its completion.

THE Rathbun Co., Deseronto, will, it is said, manufacture a new form of kindling, of which the patent right has been secured from a Chicago man, for W. G. Craig & Co., Kingston, Ont.

AT Rossland, B.C., it is proposed to construct a terra cotta pipe sewer through the main business portion of Rossland to a point about 800 feet south of the town. Phillips Wooley is in charge.

BODWELL & IRVING will apply during the coming session of the British Columbia Parliament for an extension of time for the commencement of operations under the Kootenay Power Company's Construction Act.

MCPHERSON & SCHELL are erecting an addition to their wood-working mills, at Alexandria, Ont., to manufacture the new Alexandria butter-box for which they have secured the patent. New machinery will be put in.

THE Cumberland and Vernon Waterworks Company is seeking incorporation from the British Columbia Legislature. They propose to take their water from Hamilton Creek and several small lakes near the town of Cumberland, B.C.

A CONTRACT for plant and machinery has been let by the Kootenay-London Company for the Annie Fraction mine, Rossland, B.C. This property was bought on the advice of Edward Pritchard, F.G.S., of Birmingham, England.

THE Jarvis Bicycle Saddle Company, of Toronto, Ltd., has received an Ontario charter. Capital, $20,000. The incorporators are. Beaumont Jarvis, D. Ogden Jones, R. F. Scott, Neil McCrimmon, solicitor; and T. V. Gearing, Toronto.

A LARGE saw mill is being built at St. Gabriel de Brandon, Que., by Larocque & Reneault, of Joliette, which will have a capacity of over a million feet per day. The same firm also intend building a large saw mill near Lake Maskinonge. The Montreal and Lake Maskinonge Railway will build a line a mile in length to connect with this mill.

THE new Douglas foundry, Berwick, N.S., is completed.

BAILEY'S broom factory will stay in Kingston, Ont., as the city has reduced its taxes.

OTTAWA has decided by a large majority not to spend $444,000 on the main drainage scheme.

T. R. PHILLIPS, stave manufacturer, Chatham, Ont., has assigned, with liabilities of $6,000.

AN addition has been made to the works of the Farmers' Binder Twine Co., Brantford, Ont.

THE addition to the Macgregor-Gourlay Co.'s foundry building, Galt, Ont., will soon be completed.

THE Wharncliffe road sewer, which will drain a very large area of London, Ont., is now being built.

A DRAINAGE scheme, to reclaim about 1,000 acres near Perth, Ont., is under consideration. Estimated cost, $12,000.

TORONTO has recently secured a large new sand pump for use in the harbor, which has been named the "Daniel Lamb."

THE Waterous Engine Works Company, Brantford, will manufacture mining machinery for the gold mines of the Pacific Province

JOHN MCDOUGALL, Montreal, has been awarded the contract for putting in a polarite filtering system at Windsor, Ont., at a cost of $20,000.

THE Gravenhurst *Banner* says. "A. McPherson & Co , of Longford Mills, Ont., are building a large saw mill on their limits at Bethune."

WORK on the York street bridge, Toronto, is progressing, the girders over the tracks running into the Union Station being now in position.

EDWARD NEW, of the Hamilton and Toronto Sewer Pipe Company, Hamilton, Ont., has started a new industry in the manufacture of fire brick and fire clay.

THE Winnipeg City Council recently passed by-laws to create a Board of Control, to spend $650,000 for new waterworks plant; to spend $350,000 for an electric and gas plant.

THE D. F. Brown Paper Box and Paper Company, Ltd., St. John, N.B , has been incorporated. The incorporators are D. F. Brown, C. W. Brown, D. B. Doig, St. John, N.B.; H. McC. Hart, Halifax, N.S.; D. Allison, jr., Sheet Harbor, N.S.

THE work on the new bridge at Niagara is almost suspended on account of the delay in shipping the material. The immense steel derricks used to handle the sections of the big arch have been put in position, and are ready for use as soon as the iron arrives.

THE Paterson Mfg. Co., of Front street, Toronto, manufacturers of building paper and roofing felt, had its premises wrecked by an explosion last month. Three employees were seriously injured. The company's loss of $2,200 was covered by insurance.

THE Northern Nail and Wire Company, Ltd., is applying for an Ontario charter to manufacture wire nails and other wire articles. Capital, $30,000; chief place of business, Alliston, Ont. The incorporators are W. G. Fisher, H. F. Kelly, A. A. Burk, J. D. Shipley, W. J. Kelly, Alliston, Ont.

THE Anchor Wire Fence Company of Canada, Ltd., applies for a Dominion charter; capital, $90,000; chief place of business, Brantford, Ont. The first directors of the company are R. M. Ballantyne, A. C. Mowat, J. L. Bradshaw, J. Welsh, F. D. Hamilton, E. T. Dufton, J. Bennoch, W. S. Thornton and A. J. McPherson.

JOHN T. SILL, of New York, and S. H. Janes, of Toronto, are in the syndicate of capitalists known as the Belmont-Bessemer Ore Company, which owns the Belmont iron mine, and built the Ontario, Belmont and Northern Railway, a ten-mile stretch of road, constructed from a junction with the Central Ontario through Marmora to the mine.

A CONTRACT for twenty-five air compressors and air receivers, of medium and small sizes, has been closed by the Clayton Air Compressor Works, Havemeyer Building, New York, with one company recently, delivery of the entire order to be made within six months from date. They also report sales of five air compressors of standard pattern during the first week in November.

AT the mass meeting of journeymen plumbers and steamfitters held in Montreal recently, it was resolved to form a Journeyman Plumbers' and Steamfitters' Union. The meeting was very largely attended, there being seventy-four shops represented. After the general routine of business the meeting appointed their officers and committees. The officers are: M. A. Verville, president; J. Peard, vice-president; A. C. Barber, English rec. secretary; M. Vaillancourt, French rec. secretary; W. P. Burns, financial secretary; G. Manhire, treasurer.

L. J. TROTT'S sawmill at Oil City, Ont., is to be rebuilt at once.

THE Water Supply Co., Campbellton, N.B., is now putting in house services.

EIGHT new furnaces and an elevator are being put in at the Willson Carbide Works, Merritton, Ont.

THE buildings and plant of the Pictou Iron Foundry and Mfg. Co., Pictou, N.S., are advertised for sale.

MARTIN FRERES, Montreal, planing mill and box manufacturers, have assigned, with liabilities of $20,451.

THE McGillivray Iron Works, New Westminster, B.C., is supplying the Currie mines, New Denver, B.C., with a hoisting plant.

THE capital of the Canada Switch and Spring Co , Ltd., is increased from $200,000 to $250,000, by supplementary letters patent.

MR. LACASSE, who owns a saw and grist mill north of the village of Hemmingford, Que., intends building a new mill in the village.

ROSS BROS., of Buckingham, Que., whose saw mills were burned down on August 6th, will build new mills this winter at a cost of $50,000.

A. D. TURCOTTE, of Montreal, formerly a building contractor, and lately running a planing mill, has had a demand of assignment served upon him.

THE contract has been awarded to the Hamilton Bridge Company for the construction of one of the bridges over the Trent Valley Canal at Auburn.

CITY ENGINEER KEATING, of Toronto, advised that the city should not employ a practical mechanical superintendent of the water works department.

THE fire engine supplied to the town of Miramichi, N.B., by J. D. Ronald, Brussels, Ont , underwent the requisite tests to the satisfaction of all parties.

GEO. WHITE & SONS, London, Ont., engine builders, have let the contract for their new machine shop to John Hayman & Son. The building will be 100 x 40 feet.

PERTH, ONT., is undecided whether to build and own its water works or to give the franchise to a company. Five companies are corresponding with the authorities on the subject.

IT is reported that glass works will be established at Fraserville, Que., next spring, the company purchashing the Pellerine Islands, opposite St. Andre, and bringing its material from there.

THE St. John Bolt and Nut Works Co., St. John, N.B., met its creditors on Dec. 1st. In May last, the company purchased the Cold Brook Rolling Mills and has been running them for some months.

A VERY complete cold storage plant has been put up by the Quoddy Fish Company, at Gull Cove, White Head Island, Grand Manan, N.B. G. W. Ganong, M.P., is the chief promoter of the company.

JOHN MCDONALD, Petrolia, Ont., president of the National Oil Co., has been granted Canada and United States patents for the manufacture of steel barrels, which will be used in the transportation of refined oils.

THE plans for the proposed general hospital at Cornwall, Ont. have been submitted for the approval of the Inspector of Public Charities. As soon as they are returned tenders will be invited for the erection of the building.

THE town of Drummondville has completed a dam across the St. Francis River, from which eight or ten thousand horse-power can be realized. The location of the dam is such that large spaces of land are available for mill sites.

THE Kemptville, N.S., Lumber Co. is building an addition 30x75, two stories high, to its factory, and is putting in a boiler plant. The engines were supplied by Goldie & McCulloch, Galt, Ont. The machinery was formerly run by a motor.

CARLETON PLACE, ONT., is agitated over the granting of a bonus to the C P R. The company, it is said, if it receives a bonus of $20,000, proposes to enlarge its works there and close up at North Bay and Chapleau. It will also manufacture passenger cars, and will require double the number of men now employed.

THE Customs Department has given its decision in the application for free admission of a wire tramway for use at the mine of the Lillooet, Fraser River and Cariboo Gold Fields Company. It is held that the tramway does not come under the category of mining machinery, but of transportation, and is therefore dutiable.

A FOUNDRY to make hot-air furnaces and stoves for Cornwall, Ont., is spoken of. Z W. Earl and N. Turner & Son are interested.

THE machinery at the Wringer Works, Brockville, Ont., will be run in future by a cable from the building of the James Smart Manufacturing Co.'s works.

THOMAS BRYCE is erecting a frame factory on the wharf at the foot of Parliament street, Toronto, for Charles Beck, of Penetanguishene, Ont., who will manufacture boxes.

PREMIER FLYNN, of Quebec, in his report as Minister of Public Works, speaks of the Quebec-Levis bridge scheme in terms that seem to look towards a comfortable subsidy.

PARISTONE wall plaster is being placed before the public by Alex. Bremner, 50 Bleury street, Montreal Paristone has many good points, and should make its way rapidly.

BENNETT & WRIGHT, the well known Toronto firm, has secured the plumbing, steamfitting and electric wiring contract for the new city and county buildings, Toronto, at $187,000.

ENGINEER O'DWYER has been engaged by the town council of Campbellton, N.B., to make a survey and estimate of the cost and value of the town waterworks, which it proposes to buy.

W. H. DAVIS & SONS, of Ottawa, have the contract from the Dominion Government of clearing out part of the Gallops rapids in the St. Lawrence. It will amount to between $8,000 and $9,000.

THE bridge of the Drummond County Railway at Maddington Falls, Que., which was carried away last spring, is to be rebuilt at a cost of $26,000 The Dominion Bridge Company has the contract.

THE estate of the Montreal Paper Mills Co., at Sorel, Que., was recently offered for sale, and part of the machinery brought $2,450 The premises will probably be put to some other use than the manufacture of paper.

THE water supply of Yarmouth, N.S., has been surveyed recently by H. R. Lordly, C E., of St. John, with a view to improving the pumping service The installation of double acting hydraulic rams is under discussion.

AT a meeting of the shareholders of the Halifax Gas Light Company the business of the company was wound up, and final arrangements made for the transfer of the company's works to the People's Heat and Light Company.

J. A. PATTERSON, formerly a T., H. & B. engineer, is fitting up the old canning factory on Young street, Hamilton, Ont , as a sandpaper manufactory. Besides sandpaper, there will be emory cloth and garnet paper made at the factory.

THE Revington Tool and Cutlery Company, Limited, has been incorporated to establish itself in a town in Quebec. St. Henri offers tax exemption for twenty years if buildings are erected at once and at least 125 men employed.

A SERIOUS landslide occurred recently at Montmorency Falls, Que. The top of the cliff, which rises some 300 feet above the sea level, crushed the outer covering of the main water-power pipe of the Montmorency Cotton Mills, causing extensive damage to the property below in falling.

THE Mechanics' Supply Co. Que., is preparing for the new year a very attractive almanac (a proof sheet of which we have seen) which will be an ornament to any office or shop where a "young mechanic" would be appreciated. Drop a post card and mention this paper and you will get a copy.

THE conversion of the business of Parmenter & Bulloch, Gananoque, Ont., into a joint stock company, to be known as The Parmenter & Bulloch Co., Ltd., was completed recently by the election of the following officers. President, Wm. Bulloch; vice-president, J. B. McMurchy; secretary-treasurer, F. L Parmenter; superintendent, W V Bulloch.

JUDGE MCDOUGALL, Toronto; John Kennedy, harbor engineer, of Montreal; and Judge Carman, of Cornwall, Ont., the arbitrators appointed to conduct the arbitration for the expropriation of the works and plant of the Cornwall Water Works Company by the corporation, met recently in Cornwall. The Water Works Company claimed that their case was not ready, and after some discussion the arbitration was postponed until January 18th, 1897.

BY recent decision of the United States Circuit Court at Cincinnati, O., the Dodge and Philion patent for separable wood pulleys, covering the compression fastening and interchangeable bushing system, is broadly sustained. Under the patent laws, the user, the seller and the manufacturer are all held to be infringers and liable as such to the owners of the patent. The Dodge Wood Split Pulley Company of Toronto is taking proceedings against infringers of their patent in Canada.

THE Toronto Junction Foundry Co. is now producing crucible steel, which is said to be of superior quality.

W. T. ENGLEDUE has ordered a steam hoist and boiler from M. Beatty & Sons, of Welland, Ont., for the Mikado mine.

Two boilers and pumps, with a capacity of 500 gallons per minute, are on their way from Halifax to Oak Island, N.S., for use in the Treasure Company's property.

THE Worthington pump which F. X. Bertrand has made for the Drummond Power House, Drummondville, Que., will have a capacity of 500,000 gallons per twenty-four hours.

GENNELL & Co., of Revelstoke, B.C, are about to build a large saw mill at Arrowhead, which will have a capacity of from 75,000 to 100,000 feet per day. They will also add a sash and door factory next summer.

TWENTY tenders for constructing the sewers were received by the Goderich, Ont., council; that of C. A. Humber, of Goderich, and E A. Cawsey, of Stratford, was accepted at $10,000. The work to be completed by first of October, 1897.

J. W TIERNEY, clerk of the works for the new post office that is being erected in Arnprior, has recommended that the stone used in the construction of the building be taken from the Hull quarries, owned by Fortin & Gravel, instead of the Perth quarries, as was first proposed.

H. J BEEMER, president of the Gatineau Valley Railway, says the Hull-Ottawa bridge will not be gone on with until $500,000 in bonuses has been guaranteed. On this basis he asked Ottawa to extend for eighteen months the time during which the civic bonus of $150,000 shall be available.

THE contract has been let for an automatic can factory to be built in Westminster, B.C., for D. Bain. The company will manufacture salmon cans and other tin supplies. The buildings will be 250 by 90 feet and the sides and roof will be of corrugated iron. Operations will be commenced early in January.

THUS says the Windsor, N.S., *Tribune*: "A circular saw, fifty-four inches in diameter, at tBuck's mill at Jacksonville, flew into pieces while at full speed and cut things up in a way that shocked the hands. Some of the fragments slit their way through the roof, one piece cut a 6 x 12 timber in two, and anothe bit hurled against a block of steel was welded by the impact."

D. HIBNER & Co. will rebuild their factory in Berlin, Ont. The firm has been approached by a number of municipalities which were anxious to secure the new works; but Berlin has "come down" promptly with a loan of $5,000 and the promise of a ten-year exemption by-law, and the firm announces it is "not in the market." Naturally.

THE directors of the Bowmanville Rubber Company, which was granted a bonus of $8,000 from the town last summer, has let the contract for the erection of the building, which is to be a three story brick, 140 feet long by 40 wide. The building is to be completed by December 29th. The company has bought the machinery and claim to have contracts on hand already enough to keep them busy for a year.

CITY ENGINEER KEATING, of Toronto, in a report to the Board of Works, recommends the acceptance of the offer of the Blake Mfg. Co., of Boston, to drop their action against the city for the recovery of an $8,600 fine, which was imposed by council for the non-completion within the specified time of the last engine put in at the main pumping station, and to make necessary alterations to engine No. 4 for $10,250.

THE Montreal Brewing Company, with a capital stock of $150,000, headquarters at Montreal, Que., applies to carry on the business of brewers and maltsters in the Province. The names of the applicants are: Thomas Cushing, brewer; Francis Barton, brewer; Daniel Angevine, bookkeeper; Thomas F. Mace, salesman, and Thomas Hubert Cushing, clerk, all of the city and district of Montreal. The buildings will be on Ontario St., Maisonneuve, and will cost about $150,000. The municipality has voted a bonus of $10,000.

A BOILER exploded in Robinson Brothers' saw mill, Parkhill, Ont., November 16, seriously injuring one of the proprietors, Ed. Robinson, and his father, Thomas Robinson, who were in the mill at the time. Mrs. J. H. Cunnington and her two children were in the garden which adjoins the mill yard. One of the children was struck by a brick from the building, which caused her death. Mrs. Cunnington's arm was also injured in saving the other child. A number of windows in the vicinity of the mill were broken, and parts of the boiler carried over 50 yards. The building was wrecked. Ed. Robinson has since died from his injuries.

THE peat beds near Welland, Ont., are now the centre of a flourishing industry. The five-mile M.C.R. spur has been completed. The peat fields cover about 2,600 acres. The moss is about eighteen inches deep, and below is the peat to the depth of about four feet. Underneath the peat is to be found clay that is used for the manufacture of crockery. The clay runs to a depth of one hundred feet.

Mining Matters.

THE Hall Mines Co. has recently bought 50,000 feet one-inch wire rope from a Montreal firm.

RAMSAY LAKE, near Sudbury, Ont., seems to be the centre of a gold bearing district from the number of finds reported lately.

FAVORABLE reports are received from the oil-drilling operations being carried on at North Fredericksburg, Lennox county, Ont.

LEAD ores from Hastings county are attracting favorable notice at present A. C. Morris, of Toronto, has opened up a couple of locations.

GOLD mining operations at the old diggings at Mt. Uniacke, N.S., are reviving. Mr. Hayward has been reaping some good returns at the mines at Uniacke.

COAL is claimed to have been discovered on the Island of Orleans. Prof. Laflamme, of Laval University, however, believes that there is no coal in Quebec.

W. T. ENGLEDUE has ordered a steam hoist and boiler from Beatty & Sons, of Welland, Ont., for the Mikado Mine, to be shipped as soon as possible.

THE Princess Gold Mining Co. has been incorporated. Capital, $500,000. The incorporators are: E. Mackenzie, T. Shortiss, H. O'Brien, J. Flett and H. Lowndes, Toronto.

IT is reported that the New Vancouver Coal Co. intends to put down a shaft on the Wakesiah park, providing the prospects of the present bore are found to be as good as the last.

THE New Egerton Company shipped a new engine, made by I. Matheson & Co., to Fifteen Mile Stream recently. The company has now put in machinery to run a thirty stamp mill.

THE Rathbun Co., of Deseronto, Ont., will, it is said, export granite paving blocks. Granite ledges in the neighborhood of Deseronto are being examined for favorable locations.

THE Tagona Water Power and Paper Co., of Sault Ste. Marie, has recently made a test of 40 tons of talc taken from the mines owned by the Spanish River Talc and Nickel Co., Ltd., of Webbwood.

NEW machinery has been ordered by the British Columbia Smelting and Refining Co. from the E. P. Ellis Co., of Milwaukee, Wis., which will more than double the present capacity of the smelter.

S. T. COPUS, of the Ontario Natural Gas Co., recently examined the territory round Medicine Hat, N.W.T., for natural gas, being engaged by the Canadian Pacific Railway. The C.P.R. will probably drop the field.

QUICKSILVER is to be extensively mined for near Savonas, on the north side of Kamloops Lake, B C. Three claims, the Yellow Jacket, Blue Bird and Rosebush, are being developed. The ore is said to yield $8 per ton in quicksilver.

THE Ontario and Central Canadian Prospecting and Mining Co., Ltd., is applying for an Ontario charter; capital $9,000. The incorporators are H. J. Macdonald, J. Robinson, H M. Drummond, J. D. Naismith, C. McMicken, A. Haggart, of Winnipeg.

THE country between Oil Springs and Bothwell, Ont., is being thoroughly explored for oil. Operations at Bothwell are being extended, and 25 new derricks were in course of erection at one time recently. Several good wells have been completed at a depth of from 450 to 500 feet.

THE bog-iron ores found in South-western Ontario are attracting a good deal of attention at present. Wm. Edgar, of Hamilton, will take out five tons a day in the township of Howard, Kent Co., during the winter. A farmer near Hamilton, Ont., reports ore of good quality at Copetown, Ont.

THE Mines Contract Company, through their local manager, R. H. Ahn, M.E., has closed sales for eleven gold properties during the last few days; four on Shoal Lake, near the Mikado mine; five locations in the vicinity of Andrew Bay, just south of the Golden Gate mine, and two near the Manitou Lake. The aggregate price of the eleven properties is in the neighborhood of $150,000.

F. S. BAKER, M. Fitch, J. Kerman, H. C. Kerman, C W. VanDuzer and J. A. Livingston, of Grimsby, are to be the first directors of the Grimsby Gold Mining Co. Capital, $200,000; head office, Grimsby, Ont.

THE Yum-Yum Gold Mining Company, of Ottawa, Ltd., applies for an Ontario charter, capital, $1,000,000. The incorporaters are J. Mather, J. Coates, C.E., C. Magee, D. Murphy, J. Burns, E. Seybold, Ottawa.

THE Golden Fissure Mining Company, of Ontario, Ltd., applies for an Ontario charter. Capital, $1,000,000. The incorporators are: V. Bedford, W. E. Burritt, D. A. Macdonald, W. C. Kennedy, F. S. Wells.

THE coal oil boring scheme in Fitzroy township, Carleton county, has fallen through, as a sufficient number of the neighboring farmers would not sign the agreement to take one in ten barrels of the output if oil were discovered.

GEO. ALEXANDER, of the International Trading Co., has organized a company to carry on an ore sampling business at Kaslo, B.C. Mr. Whitney, late of the Colorado Smelter and Sampling Works, at Butte, will be the superintendent.

GRAPHITE is going to yield investors good returns in Eastern Ontario. The deposits in Renfrew are being worked by Ottawa capital, and now Dr. Pyne, of Toronto, has bought the property at Oliver's Ferry on the Rideau Lakes, where graphite was manufactured twenty-five years ago.

THE High Court of Praetoria, Transvaal, has declared void the Macarthur-Forrest patents for the cyanide process for the recovery of gold The decision was given in a suit brought by the combined gold mine owners of Johannesburg and the Transvaal, and will, it is expected, have considerable influence when the validity of the patents is called in question in other courts.

THE Smuggler Gold Mining and Milling Company, Ltd., is applying for a New Brunswick charter, to do a general mining business in British Columbia and elsewhere. Capital, $1,000,000. The applicants are: H. H Dewart, J. T. Gilmour, G. H. Maurer, A. Dixon, Toronto; W. H. Boorne, Vancouver, B.C.; A. W. Atwater, Montreal; R. C. Tasker, West Bay City, Mich.

A MEETING was held in Montreal last month, to organize The Midway Company, Ltd., for the purpose of acquiring a thousand acres of land in British Columbia, including the townsite of Midway. The following directors were chosen: Capt. R. C. Adams, president; Peter Lyall, vice-president; Alex. Paterson, Wm. Strachan, John Withell, Charles Cushing and George A. Greene.

W. L. LIBBEY, the manager and the principal owner of the gold mine at Brookfield, Queen's Co., N.S., said recently that $8,000 worth of gold had been taken from this property every month during the past two years. The stamp mill now in use is to give place to one of the finest plants of the kind in Canada. It will handle 16 tons of concentrates daily. The chlorination plant being put in costs $50,000.

THE British and Canadian Gold and Silver Mines Co., Ltd., applies for a Dominion charter; capital, $15,000. The applicants are: N. Clarke Wallace, J. G. Hallet, J. C. Thom, Wallace Brothers (consisting of N. Clarke Wallace and T. F. Wallace), Woodbridge, Ont.; S. W. McMichael; J. J. Cook, real estate broker; J. A. Ferguson, J. Armstrong, J. Eaton, E. T. Carter, C. H. Glassford, Armstrong & Cook (consisting of J. Armstrong and J. J. Cook), W. J. McDonald, Toronto, and J. F. McIntosh, Kalso, B.C.

ARCHIBALD BLUE, Director of Mines, Ontario, has received from Joshua Legg, of Leeds county, a sample of celestite, *strontium sulphate*, from a vein in Lansdown township, in that county. The vein is 26 inches wide, and shows up for a quarter of a mile. It is an old location, and has been exploited by shafts at various times during the past seventy years. The material is used in connection with the preparation and refining of beet-root sugar, and also in preparing certain salts for colored lights in pyrotechnic displays.

THE discovery of corundum on the 14th concession of Carlow, Hastings County, Ont., is attracting a great deal of attention to the minerals in Eastern Ontario. Corundum consists of translucent or opaque crystals of alumina, and is yellow, brown, pink, or bluish in color. It is the substance from which emery wheels are made, and is inferior in hardness only to the diamond. The State of Carolina is the only other place in America in which it is known to occur. It is also found in Asia Minor and Southern India. It is used in polishing and cutting plate and flint glass, jewels and edge tools. The Hart Emery Wheel Company, Hamilton, is treating a sample lot of corundum, and making a comparative test of it with the corundum found in North Carolina. A report of the tests will be made public by the Bureau of Mines in the form of a bulletin.

THE Tweed, Ont., *News* reports gold at Sheffield in paying quantities. The property is being examined.

THE Hammond-Folger syndicate, which owns some three miles of locations on both sides of the Saw-Bill Mine on Saw-Bill Lake, is preparing to instal a 120-stamp mill.

THE new stack of the Hall Mines Smelter, Nelson, B.C., is now in use. The stack for the new roaster and reverberator furnace is also finished, and the large new furnace is well under way.

THE Sudbury Gold and Coal Mining Company, Ltd., applies for an Ontario charter Capital, $1,000,000. The applicants are M. C. Biggar, C. Jessop, A. Fournier, L. O'Connor, H. J. Purvis, Sudbury, Ont

THE Algoma Coal Mining Co of Ontario, Ltd, is applying for an Ontario charter; capital, $1,000,000. The incorporators are W. Wilson, A R Gordon, M.D., J. Todhunter, A. Y. Scott, J. Halley, D. G. Gordon, M.D, E B. Shuttleworth, S. Crane.

THE Elkin Coal Company, Ltd, has received a New Brunswick charter Capital, $10,000 The incorporators are: J. P. Illey, Philadelphia, C.E.; E G. Evans, C.E., H. J Fowler, T. A Peters, Hampton, N.B; J. Edward Elkin, of Coal Creek, N.B.

AN order was not long ago received by the Pontiac and Pacific Junction Railway to ship ten car loads of iron ore daily from the Bristol mines, Quebec, to Pittsburg, Pa. The mines have been worked under lease by Ennis & Co., of Philadelphia, for some years.

THE Victoria *Colonist* said recently "The first bar of bullion taken out by the cyanide process on a commercial scale in this Province has been brought down from Cariboo by F. W. Hawes, secretary of the Cariboo and Williams Creek Consolidated Mining Company, Ltd."

IT is said that a British syndicate is arranging for the purchase of the petroleum deposits on the west coast of Newfoundland. Borings which have been made show a splendid flow of rich oil, yielding 54 per cent. lubricating oil and 43 per cent. for illuminating purposes, as reported.

W R RUST, manager of the Ryan smelter at Tacoma, says that a company has been formed by eastern capitalists, of whom E D. Simpson, Scranton, Pa, is one, to build a smelter at Vancouver, B C., to have a capacity of 250 tons daily. Work is to begin within a month, it is said.

THE Canadian Mining and Smelting Company, Ltd, applies for incorporation. Capital, $200,000 The incorporators are H. J Macdonald, Q.C, M.P., J. H. Brock, W. J. Christie, T. Kelly, F. H. Phippen, D. E. Sprague, J H. Brown, Winnipeg, Geo. A. Coxe, G. Broughall, Toronto.

THE discovery of a large deposit of gold-bearing sand has been reported from Cheticamp, Inverness county, Cape Breton, and there has been a rush at the Provincial Mines Office, Halifax, by parties anxious to secure leases The sand is said to contain much free gold and also magnetic iron.

THE Campbellton *Enterprise* says Capt I Dahl, master of the Norwegian barque "Handy," has reported to the custom house officers at Irvine, Ayrshire, Scotland, that he found a nugget of gold adhering to the tallow on the lead with which he was taking soundings off the coast of Newfoundland.

THE St. John *Telegraph* says. Albert county is once more interested in its possibilities as a mining county, and hopes for a regular mining boom. Apart from the copper, gold and silver of the Point Wolfe region, there has been a new stir in connection with the manganese deposits about Hopewell.

THE Inter-Ocean Mining and Prospecting Co. of Toronto, Ltd, applies for an Ontario charter Capital, $1,000,000. The incorporators are J. R Barber, Georgetown; J. E. Elliott, M.D., Toronto, T. Dunnett, W. Dineen, L. K. Cameron, J. D. Montgomery, Toronto, J. M. Cotton, M.D., Lambton Mills.

R. G E. LECKIE, eldest son of Robert G Leckie, of Torbrook Mines, is in charge of development work on property of his father's, in Gloucester Co, N.B The deposit, we are told, is something of the character of some British Columbia mines, a body of galena and zinc blende, carrying 10 to 12 ounces of silver and $2 to $4 of gold per ton.

THE officers of the Association of Mining Engineers, of British Columbia, for the year, are R. C. Campbell-Johnston, M.E., president, Samuel Robins, New Vancouver Coal Co., vice-president; A. H. Holdich, Nelson; A J Colquhoun, Howard West, A.R.S.M., H. E. D. Merry, H R. Bellamy and J. Newlands, members of committee, and G. F. Monckton, M.E., secretary-treasurer, Vancouver, B.C.

THE Mugwump hoist has been placed in position, and sinking begun in the working shaft.

THE Crown Point compressor has been set going The new plant seems to work admirably.

THE Columbia and Western Railway is putting a side track for the Evening Star and other mines in that neighborhood in Rossland, B.C.

THE men working in the Silver King mine, Nelson, B.C., have had a new boarding house built for them by the company. It will accommodate 200 men, and is described as a model of comfort.

J. W. MCLAUGHLIN, John J. Moynahan, and W. A. Campbell are organizing a syndicate to tunnel through Red Mountain at its base, with branch tunnels to every mine on the mountain not reached by the main tunnels. It is the purpose of the company to convey for the mine-owners all their ore to the entrance of the tunnel by means of electric cars. Red Mountain tunnel will be similar to the famous Sutro tunnel, in Nevada.

SARNIA *Canadian* :—"H. Porter, in charge of the oil operations of the American syndicate in Sarnia township, has returned from Pennsylvania, and is now making arrangements to pump the McGregor wells. A pumping rig will be put on to No. 2 well on the McGregor farm, and the well will be pumped for ten days as a test. If it holds out as an oil producer under the test, pumps will be put into the other two wells, and all of them will be run long enough to make a thorough test of their capacity."

A RECENT despatch from Rossland, B.C., says the famous Le Roi mine has up to date paid above expenses, buildings, and shafts, $225,000. Twenty-three hundred feet of sinking, drifting, and cross-cutting has been done The vein is 27 feet wide, and the hanging wall has not yet been reached. They shipped last month 3,300 tons of ore. The hoisting machinery for the new shaft is now on the grounds, and it is thoroughly up-to-date, and capable of sinking a shaft 2,000 feet. They expect to ship 300 tons daily with the new machinery. A large tunnel has been started on the Black Bear property, also owned by the Le Roi Company. A new 40-drill compressor has been shipped, and is expected soon. The foundation has already been built. California drills will be run from this compressor as soon as it is placed.

IN 1862 the British Columbia Government offered a bonus of $5,000 to anyone who would discover a gold quartz mine and prove that it would pay at a depth of 25 feet. S. T. Walker, now a resident of New Denver, while on his way from Cariboo to Yale in the fall of 1861, found a quartz claim on Bald Mountain, between the forks of the Keithley and Antler creeks, assays of which went $27 in gold. Thinking to obtain the bonus, he returned with some men to where he had found the ledge in July, 1862. Breaking through eight feet of snow they reached the ground on the 8th of July and commenced work. After paying $16 a day wages and sinking a shaft 15 feet, the pay-streak disappeared, and Mr. Walker was out $3,200. As it was the first attempt in the province to develop a quartz mine, Governor Douglas was in favor of paying the $5,000, but the Government voted it down, and Walker received nothing, except the satisfaction of being the first man to open a gold quartz lead in British Columbia.—*The Ledge.*

Electric Flashes.

A. E MUNN, of Kearney, Ont., is installing a Canadian General Electric incandescent plant.

THE Bell Telephone Co. is putting in a copper wire circuit between London, Ont., and Sarnia.

THE cars on the Ottawa Street Railway have been equipped with fenders like those in use in Toronto.

THE Cornwall Street Railway Company has extended its line into the Toronto Paper Company's mills.

IT is said than an Ottawa firm will put in an electric plant in Arnprior, Ont., locating the power house at McCuan's mill.

THE Cocoa Matting Co., of Cobourg, Ont., is installing an incandescent plant in its factory. The Canadian General Electric Co. has the contract.

THE thief who stole a large amount of copper wire from the Hamilton Radial Railway, not long ago, has been sent to Central Prison for two years.

IT has been held recently by the United States Circuit that the Western telephone switch patent expired July 30th, 1895, as a patent covering it had been taken out in Canada July 30th, 1880, thus shortening the term of the patent by five years.

BANCROFT, ONT., is trying to secure electric lighting.

ALLANDALE, ONT., will be lighted by the Barrie, Ont., Electric Light Company.

THE Almonte Electric Light Company has recently added to its plant, and is extending its service.

THE Buffalo Railroad Co. is supplied with 1,000 h.-p. by the Niagara Falls Power Co. since Nov. 15th.

AN electric light plant is to be established in Shawville, Que. The town has offered the company twenty years' exemption from taxation.

A DIVIDEND of two per cent. for the quarter ending 30th November has been declared by the Royal Electric Co., being at the rate of eight per cent. per annum.

THE Canadian Telephone Co., proposes to extend its line from Scotstown *via* Milan and Marsboro to Lake Megantic village. Electric lighting is also talked of for the village.

THE St. Catharines Electric Light and Power Company has placed an increase order for a 2,000-light single-phase alternator with the Canadian General Electric Company.

THE overhead trolley wires of the Metropolitan Street Railway (Toronto) have been run from York Mills to Thornhill. Another generator has been put into the Deer Park power house.

AN Alexandria, Ont., paper says the next move by the village council will be for an electric railway from the Canada Atlantic depot to the C.P.R. depot at Green Valley, four and a half miles distant.

THERE has been war in Aylmer, Que., recently, over the extension of the tracks of the Hull-Aylmer Electric Railway, on Main street, which is claimed to be the property of the Aylmer Road Co. The matter will be settled in the courts, force having proved unsatisfactory.

AT a recent meeting of the council of St. Louis de Mile End, Que., the Citizen's Light and Power Company was awarded the contract for lighting the streets for the next thirteen years, and also awarded an exclusive franchise for lighting private residences for the same time.

THE electric railway from Montreal to Lachine will be completed about the first of January. The agreement with the Lachine council calls for completion in November, but an extension of time will be allowed. The line will probably be extended to Dorval and St. Anne's in the spring.

JOHN MATHERS, vice-president and managing director of the Keewatin Power Co., has recently visited Winnipeg in connection with the proposal to generate electric power in Keewatin, and transmit it to Winnipeg. He claims the project is feasible, and only requires the encouragement of the citizens to make it a success.

JAS. ROSS, of Montreal, and William McKenzie, of Toronto, are interested in a number of schemes for converting European city street railways into electric lines. The project in Birmingham, England, is well advanced. In that city the capital of the company is £1,000,000, which is bonded to the extent of £500,000. The lines are being built, and they are expected to be in operation by spring.

THE Lachine Rapids Hydraulic and Power Company has awarded the contract for the electric cables required for the ducts at present being laid in Montreal to the National Underground Cable Company of New York, for $50,000. The Wagner Company, of St. Louis, Mo., got the contract for the transformers required for reducing the current from 5,000 to 220 volts. They will cost between $8,000 and $10,000. Both contracts will be filled by Christmas.

SOME change has been made in the plans of the Cataract Power Company, of Hamilton, Ont. It has been decided not to acquire De Cew's falls, but to cut across the country for a short distance with the water course. Professor Paterson has made satisfactory arrangements with the St. Catharines Water Commissioners. The Cataract Company has closed contracts to supply power to the Hamilton Electric Light Company and H., G., and B., and has applications for terms from a number of other companies.

THE electric light inspection was the only service of the Weights and Measures Inspection Department of the Dominion Government in which the receipts exceeded the expenditure. A statement is given by the Department showing the number of lamps operated by each electric light company. Ottawa stands at the head of the Ontario list with 50,000 incandescent lights; Toronto, 30,000; Hamilton, 8,000; London, 5,150; Peterboro', 3,000; Kingston, 2,000; Lindsay, 4,000; Brantford, 4,730. Montreal has 58,200 incandescent lights.

EMBRO, ONT., is to have incandescent light. The Canadian General Electric Co. has the contract for a 500-light alternating plant.

THE engine which has been built by Cowan & Co., Galt, for the St. Thomas Electric Light Works, was completed recently and shipped to its destination.

JAMES BONFIELD, Eganville, Ont., is erecting a dam a short distance below the Cascades, on the Bonnechere. A power house will also be built there, thus securing about 102 h.p. to run the dynamo.

THE Chambers Electric Light and Power Company of Truro, N S., has received a 1,200-light dynamo from Connecticut recently, and have installed a 175 h. p. side-crack engine from the Robb Engineering Co.

G. G. AND W. C. KING & Co., of Queen's County, N B., have completed the erection of a brick electric light station in Sussex, the plant for which has been supplied by the Royal Electric Company of Montreal.

THE Kingston Electric Street Railway Company has been granted leave by the city council to lay its rails on various streets for an extension of the line to the Grand Trunk Railway junction, about two miles from the city's centre.

THE Willson Carbide Company, of Merritton, Ont., has now in operation two General Electric alternators having a capacity of 150 kilowatts each, at an initial pressure of 100 volts, at which the current is carried directly to the furnaces.

THE Renfrew Electric Light and Power Company, Ltd., is applying for an [illegible]ocharter. Place of business, Renfrew, Ont.; capital, $90,000. The applicants are W. A. Mackay, A. A. Wright, W. T. Guest, A. C. Mackay, H. Wright, Renfrew.

GODERICH, ONT., is asked to grant a free right of way to the Huron and Ontario Electric Railway, as the promoters claim that New York capital will proceed with the road as soon as all the municipalities concerned have made the concession.

THE Canadian General Electric Co. has been awarded a contract for the installation of a 500-light incandescent plant in Alvinston, Ont. An interesting feature of this installation will be the use of the C.G.E. Company's long burning arc lamps, to the number of 13, for the street lighting.

THE immense 2000 h. p. direct connected railway generator now being installed by the Canadian General Electric Company for the Montreal Street Railway Co., will be by long odds the largest piece of electrical apparatus in Canada. The weight of the armature alone of this machine exceeds 40 tons. It will be ready for a test in about six weeks.

PROVINCIAL ENGINEER MCCALLUM has made an official inspection of the Hamilton, Beamsville and Grimsby Electric Railway. The 17½ miles of the road between Hamilton and Grimsby had been inspected in 1894, and Mr. McCallum pronounces the section between Beamsville and Grimsby, lately constructed, to be in good running condition.

THE O'Keefe Brewery Co., Toronto, is installing a 500-light direct current generator of the Canadian General Electric Company's direct-connected type, coupled to an Ideal engine. The surplus capacity of this unit will be employed in operating motors, which will replace the small steam engines now used for various purposes throughout the buildings.

THE negotiations between the town of Dundas and B. B. Osler, president of the Hamilton and Dundas Railway Company, looking towards its conversion into an electric line, are at a standstill. The two objectionable features of the by-law, from Mr. Osler's standpoint, are the clauses providing for the payment of $1,000 mileage to Dundas, and for the extension of the H. & D. to Fisher's Mill.

THE Amherstburg Electric Light and Power Co., which was recently organized to take over the incandescent lighting business of W H McEvoy, has purchased a 1000-light single phase alternator from the Canadian General Electric Company, the 500-light unit of the same make, originally installed two years ago, having proved too small to keep pace with the rapid growth of their lighting business.

THE Hamilton Radial Electric Railway Co. has placed an order for additional C.G.E. 1,200 equipments with the Canadian General Electric Co. The business of the road has proved unexpectedly satisfactory in spite of the very late opening up of the Burlington line in September. The company has placed an order with the Crossen Car Co., of Cobourg, Ont., for a Ruggles rotary snow plow, which will be the first electric rotary to go into service in Canada.

THE Swansea Forging Co., Ltd., Swansea, Ont., has finished the copper rods to be used in the Metropolitan Electric Line extension.

THE Hamilton, Grimsby and Beamsville Electric Railway carried 147,000 passengers between May 1st and October 31st last, and 26,000 packages of fruit. The total amount of freight carried during the months referred to amounted to 2,259,620 pounds.

THE Royal Electric Co of Montreal has recently closed several extensive contracts for electrical machinery, which will keep its factory occupied night and day for more than a year, and necessitate a large increase in the number of their employees. It has added to its equipment recently some of the largest tools of their kind in Canada.

THE bicycle railway which was intended to connect the G.T.R. station, at Ridgeway, Ont., with Crystal Beach, has proved a failure through inadequate construction and unfortunate designing. The cars were to run on a single elevated rail, the balance being obtained by flangers and twin-wheel guards and weights on either side beneath the level of the rail The operating power was electricity

THE Montmorency Electric Power Co., of Montmorency Falls, Que., have placed an order with the Royal Electric Co, of Montreal, for two 600 K W., "S.K C." two phase alternating current generators and switchboards complete One of these generators is to be placed at Montmorency Falls, where it will be driven by water power, and the current carried nine miles to Quebec, to the sub-station of the Montmorency Electric Power Co, where the second 600 K.W alternating current generator will be located The generator at the Falls will deliver 5,000 volts to the line, and the generator in the sub-station will be used as a synchronous motor, and receive the current at 5,000 volts direct into the machine, no step-up or step-down transformers or any intermediate apparatus being required. The synchronous motor is to be direct connected to a direct current railway generator, which is to furnish power to the new Quebec Street Railway.

IN concluding an interesting paper on the "Present Status of the Distribution and Transmission of Electrical Energy," Dr Louis Duncan forms (among others) the following conclusions: "Commercial transmissions are in successful operation for distances of 35 miles and for voltages as high as 15,000 volts. . . The best system for the long distance transmission of energy for general purposes is the three-phase alternating system." He further concludes that experience with existing plants shows that the transmission to 50 miles with a pressure of 20,000 volts is practicable, but beyond these limits the transmission would be more or less experimental A partial list of the principal transmission plants in operation shows 28 installations in which the transmission distances vary from two to 35 miles (there is one purely experimental plant where the distance is 100 miles), and the power transmitted varies from 150 to 15,000, the average being over 5,000 horse-power. A majority of these plants are using the three-phase alternating current system, and it is a significant fact that all are successful and many of them are already being enlarged.

WE understand that the Kay Electrical Manufacturing Company, of Hamilton, Ont., is about to build an extension to its premises. This firm is one of the pioneers in the electrical business, and its goods are in operation in almost every city and town in the Dominion, and are giving such satisfaction that the demand has increased rapidly. The firm also has repair shops and offices in Toronto. The following is a partial list of their more recent sales. Kemp Manufacturing Co., Toronto, two motors; H R Cuddon, St. Catharines, one motor; M. Hutchinson, wood yard, Toronto, one motor; A. Moore, Toronto, one motor; Aylmer Electric Plating Co., one dynamo; Steel Clad Bath and Metal Co., Toronto, one 4-pole motor; Wehrl Brush Co., Toronto, one motor; Leitch & Turnbull, Hamilton, three motors for elevator purposes; A. R Williams, Toronto, three motors, Davis & Henderson, Toronto, two motors; H. C. Hunter, Dundas, one 4 pole 400-amp dynamo, Haskins Wine Co, Hamilton, one motor; McPherson & Glassco, Hamilton, one motor; Munderloh & Co., Montreal, one dynamo, J. Turner & Son, Toronto, one motor, Wm. Beers, Toronto, one motor, T Bell & Co, wood yard, Toronto, one motor, Barber Bros, Georgetown, one 30-horse-power 4-pole motor; H & F. Hoerr, Toronto, one 15-horse-power motor; Ontario Agricultural College, Guelph, plant for light and power, Small & Fisher, Woodstock, N.B., one dynamo, A. Laidlaw, Toronto, one motor; L. Williams, Toronto, one motor, John Forman, Montreal, three motors; Wilson Publishing Co, Toronto, lighting plant, T E Brandon, Toronto, one motor; Davison & Holmes, Toronto, one motor; Bennett & Wright, Toronto, two 4-pole motors; Diamond Machine and Tool Co., Toronto, one electric-plating dynamo Ten electric machines have also been sent to the North-West and British Columbia

Marine News.

UP to November 15 there were 6,030 vessels passed through the Canadian Soo canal since the opening.

THE Dartmouth, N S., ferry commission has made a contract with John Shearer & Son, Glasgow, to build a steel ferry boat.

THE capital of the Yarmouth and Shelburne Steamship Co., Ltd., is reduced from $42,000 to $30,000 by supplementary letters patent.

THE New Denver *Ledge* says that the C.P.R. will build a first-class steamboat on Slocan Lake as soon as the material can be brought in.

THE work on the Trent Valley Canal was brought to a standstill recently, owing to the sheriff seizing on all the plant, of which he will sell J. A. Corry's interest.

THE tug "W. E. Vroom," owned by J. A. Gregory, St. John, N.B., was destroyed by fire Nov. 3rd. The tug was lying at the wharf at Dunn's mill, Grand Bay. Insurance, $500.

IT is said that the Niagara Navigation Company will decide to take the steamer "Chicora" off the Niagara route and place her on the run between Toronto and Port Dalhousie, making connections with the G.T.R.

THE propeller "Acadia," belonging to R. O. and A. MacKay, Hamilton, which was for some time missing on the lakes, was reported ashore at Michipicoten, and likely to go to pieces. The crew were landed uninjured.

THE Secretary of State of the Dominion has received a petition from the promoters of the Ottawa and Georgian Bay Canal, stating that the company is ready to proceed with the work, and asking that the Government guarantee their bonds for $20,000,000 at 3 per cent.

WHILST the "Shamrock" was being towed up the Soo Rapids, early this month, along with three barges, one containing the Lockhart grist mill machinery, also some $3,000 worth of woolen goods for Lockington, the rope broke and let the barge run rapidly down the river for a mile, when it struck a rock and sank.

THE "Mantinea" has proved such a success that her managing owners, William Thomson & Co., have arranged with Russel & Co, of Port Glasgow, for the construction of another boat. The "Mantinea" is a vessel of 4,300 tons dead weight capacity. The new boat will be of 5,000 tons capacity.—*St. John Telegraph.*

CAPT. MCELHINNEY, of the Marine Department, Ottawa, has accompanied the steamer "Petrel" down to Prince Edward Island from Kingston, Ont The steamer has been leased from the Collins Bay Rafting Company by the Government, and will be placed in winter service between Cape Tormentine and Cape Traverse.

CAPT. CRAIG has purchased the composite steamer "Paul Smith," and will refit and repair her at Kingston, and place her on the Wolfe Island ferry service next season. The "Paul Smith" was purchased at Valleyfield, Que. She has been running from Valleyfield to Montreal in connection with the Adirondack Railway.

THE barkentine "Louvima," built at Port Greville by H. Elderkin & Co., is loading at St. John for Argentina. Her dimensions are as follows: Length of keel, 150 feet; breadth of beam, 36 feet; depth of hold, 13 feet. Her registered tonnage is 518 tons, and she is built of spruce and hardwood, and is copper fastened throughout.

A DEPUTATION waited upon the Ontario Government recently in connection with a waterway to connect Lake Wahnapitae with Lake Matagamshing A charter was granted for this work some years ago, the time for which is now nearly exhausted, and the deputation made application for another in conformity with the new Timber Slides Act. The spokesmen of the party were J. C Moore, M.L.A., and Wm. Morton, of Wellesley, Ont.

"THE Backdoor of Canada" was the title of a paper which Lieut.-Col. Scobie, of Winnipeg, read recently before the Military Institute, Toronto, in which he put forward the claims of the Hudson Bay route Admiral, then Commander, Markham, who accompanied Lieut. Gordon in exploring the Bay, said. "My opinion regarding the feasibility of an ocean route between England and Hudson Bay is decidedly a favorable one, and I have so reported." Admiral Markham was an Arctic navigator and examined the whole subject in the light of history and experience, and he returned to England completely satisfied as to the feasibility of the navigation. C N Bell, of Winnipeg, has estimated that over 750 vessels, from 74-gun ships down to 10-ton pinnaces, passed through Hudson

Straits during a period of 274 years, and that only one, or, as is claimed by some writers, two vessels, were lost in the passage. It must be understood that these were all sailing vessels, most of them small and rudely constructed, and quite unable to push their way through icepans of any thickness. The point chiefly dwelt upon by Lieut.-Col. Scobie was the advantage accruing to Great Britain in case of war of securing supplies from the Canadian North-West by this route.

Railway Matters.

THE Red Mountain Railway has been mortgaged to the Manhattan Trust Co. for $237,000.

THEY have at present four engines on the Lake Dauphin road, which were built by the Kingston Locomotive Works.

WIARTON, ONT., is agitating for a railway to connect with the C.P.R. The town proposes to offer a bonus of $50,000.

THE Grand Trunk Railway is working again independently of the Joint Traffic Association, and is meeting the C.P.R. through rates from St. Paul.

F. A. HEINZE recently advertised for tenders for the construction of a railway from Trail to Robson, B.C. He wishes to secure the ores from Slocan for the Trail smelter.

A DOMINION charter is to be applied for the Minden & North Western Railway from Irondale Junction, Haliburton Co., Ont., to Minden, thence to some point on the Georgian Bay.

RECENTLY the only engine in commission on the Niagara Central Railway burst some flues, and consequently the rolling stock of the company was forced to take a short holiday.

CHIEF ENGINEER SCHREIBER recently visited Hamilton for the purpose of looking into the vexed local dispute over the Toronto, Hamilton and Buffalo Railway Company's crossing over Desjardins Canal.

CAPITAL from the United States is promoting a bridge over the St. Lawrence at Cornwall, Ont., to cost $750,000. The Ontario Pacific Railway is to connect Ottawa with New York State by this bridge.

M. MENIER, the owner of the Island of Anticosti, is sending out from France steel rails and cars for a narrow gauge railway, already commenced, which next spring will be extended to all parts of the island.

APPLICATION is to be made for a Dominion charter for a railway from Sayward, B.C., through Trail and Midway to Okanagan Lake near Penticton, boats will be put on the lake in connection with the line.

AT the annual general meeting of the Great Northern Railway, Quebec, the following were elected directors. Hon. P. Garneau, Hon. Jno Sharples, and Frank Ross, V Chateauvert, T. H. Dunn, John C. Eno and Vesey Boswell.

THE London and Port Stanley Railway Board will ask the London city council to issue $85,000 worth of 3½ per cent debentures, to run 40 years, in order to meet the expenditure for bridges, terminals, etc., on the L. & P. S. R.

THE C.P.R. short line from Montreal to Ottawa will shortly be finished as far as Vankleek Hill, sixty-two miles from the city. Alfred, twelve miles beyond Vankleek Hill, was the objective point for this season, but it will hardly be reached.

QUEBEC city hopes much for its trade from the completion of the Ottawa, Arnprior and Parry Sound Railway. The *Saturday Budget* says that it will save 800 miles in distance from Duluth to Liverpool, as compared with the present route via Buffalo and New York, and that the greater depth of water will permit of the use of vessels on the upper lakes as large as ocean steamers, carrying twice the cargo to Parry Sound that they can now carry to Buffalo.

THE Windsor, N.S., *Journal* says that the prospects for the construction of the Midland Railway are brighter than they have been for a long time, and it is possible that active work may begin next spring A meeting in the interests of this railway was recently held at Halifax. There were present Messrs. Strong and Reid, of Montreal, and S. H. Holmes, of Halifax, of the Midland Railway Co., Hon. H. M. Goudge, Dr. Allan Haley and Arthur Drysdale. The meeting was held for the purpose of making arrangements with the Local Government for building a line from Truro to Windsor.

THE Crossen Car Company is building ten new fruit cars at Cobourg, Ont., for the G.T.R., which are to be used next season in bringing fruit from the Niagara peninsula.

THE municipal council of Joliette, Que., has come to an arrangement with the Great Northern Railway, under which the city gives a bonus of $40,000 in debentures payable in 40 years, and bearing interest at four per cent. The company will pay the town $500 per annum for water and $200 for light.

THE volume of business from the Western States over the Grand Trunk Railway via the Sarnia Tunnel, Toronto and Montreal, to the Atlantic seaboard, has more than doubled under the present management. On one Sunday recently 250 cars of live stock passed through Toronto, en route east.

THE promoters of the Atlantic and Lake Superior Railway hope to induce the Government to complete the Baie des Chaleurs Railway, operating it as a feeder to the Intercolonial, and then subsidize the line along the south shore of the St. Lawrence from Montreal to the Baie des Chaleurs line, and authorize the taking over of the Sorel road.

IT is said that the Canadian Pacific Railway has leased for a term of fifty years the line from Drumbo to Buffalo, and will use it as part of a through line between Detroit and Buffalo. It will be only a few miles longer than the Michigan Central, and will permit the Canadian Pacific to handle business to Buffalo, New York and other eastern points. The line from Drumbo to Buffalo is part of the old Buffalo & Goderich Railroad, and has for several years been operated by the Grand Trunk.

THE dynagraph car of the New York Central Railway, the only one of its kind in America, was in Montreal recently in charge of Prof. Dudley, its inventor The dynagraph is an extremely sensitive machine, connected with the trucks of the car by means of springs and wires, which, as the car vibrates, cause a perfect system of ink cells to eject a number of small dots of ink which, falling upon a long roll of white paper, become parts of a track chart, indicating the spots where there are imperfections in the track.

GENERAL MANAGER HAYS, of the Grand Trunk Railway, recently said in connection with the reported tendency of the road under his management to employ fewer Canadians: "It must be remembered that there are employed on the lines in Canada between 16,000 and 18,000 men, and it is simply ridiculous to talk of substituting even a small proportion of foreigners in their stead, as it would be impossible to get that many good men who would want a change. I am very glad to say that you can find as many capable and efficient workers who are anxious to give good service on the line of this road as can be found on that of any road of an equal number of miles in the United States or elsewhere, and all that is expected of them is that they shall promptly, cheerfully and loyally carry out such instructions as they may receive from time to time from the officers of the company: when this is done they will find that as opportunities for promotion or advancement occur they will receive every consideration from the management."

THE half-yearly report of the Grand Trunk Railway which was presented to the directors in October, shows marked improvement under the new management. In this connection it must be remembered that trade conditions have been exceptionally adverse to the G.T.R. during the period under discussion.

	31th June, 1896.	30th June, 1895
Gross receipts	£1,707,539 19 2	£1,653,092
Working expenses.....	1,218,244 18 5	1,171,072
Net traffic receipts	£ 489,295 .. 9	482,010

There was a net revenue deficiency of £82,062 3s. 9d. for the half-year. The balance from last half-year of £224,707 5s. 8d., added to the above deficiency of £82,062 3s. 9d., makes a debit balance of £306,769 9s. 5d., to be carried forward to the next half-year's account. The net revenue deficiency for the half-year ending June 30, 1895, was £94,083, and the operations of the half-year have thus resulted in an improvement of £12,021. The average receipt per ton in the past half-year was 5s. 7¼d., against 5s. 6¾d. in the corresponding period of 1895, but there was a decrease in the average rate per ton per mile, which was .64 of a cent as compared with .68 of a cent for the half-year ended June 30, 1895. The total amount expended on capital account during the half-year amounted to £35,740 15s. 8d.; of this amount £12,199 is on account of the Union Station at Toronto, under agreements entered into in 1892 with the city of Toronto and the Canadian Pacific Railway Company. The report concluded with the following reference to General Manager Hays: Mr. Hays, since he assumed the position of General Manager on January 1 last, has applied himself with zeal and energy to

the varied and important duties of his office, and the directors confidently anticipate that a gradual improvement in the affairs of the company will result from the various measures which, with the approval and sanction of the Board, he has introduced in the administration of the system.

Personal.

J B. Moore, for many years identified with the mining engineering of Nova Scotia, died in Montreal, November 18.

H. R Ibbotson, soliciting passenger agent for the Canadian Pacific Railway, has been succeeded by David Kavanagh.

J. W. Tyrrel, of Hamilton, has gone to Lillooet, B.C., to act as engineer in the construction of extensive mining works.

The Board of Management of the Technical School, Toronto, has appointed E. R Hooper to teach mineralogy and geology.

W J. Hands, engineer of the Gananoque Electric Light and Water Co., has been appointed engineer at Upper Canada College, Deer Park, Toronto

James Peddar C E. who practiced his profession as a civil engineer in Toronto for some time is lying dangerously ill at his home, near Doon, Ont

W C B Rathbun, youngest son of the late H. B Rathbun, and a member of the Rathbun Co., was found dead in bed Nov. 20th Heart failure was the cause

R. E. Chambers, C.E., has returned from Newfoundland, and resumed the management of the Nova Scotia Steel Company's Works, at Bridgeville, Pictou county

H. D. Ellis, formerly assistant engineer for roadways, Toronto, has recently been engaged in constructing a railroad from Gladstone, Manitoba, to Lake Winnipegossis.

Myles Pennington died at his residence, 347 Jarvis street, Toronto, November 26th Deceased was 82 years of age, and was the first general manager of the Grand Trunk Railway

Jas A Steward, C E. of Renfrew, Ont., a graduate of the School of Practical Science, Toronto, who holds a good position with an engineering firm at Athens, Pa., is visiting his native town at present.

Some years ago W A Logan, of Cardinal, one of the best men on the government engineering staff, was discharged, it was said, for political reasons He was reinstated by Hon A. G. Blair, who visited the works not long ago.

E. W Summerskill, soliciting passenger agent of the Grand Trunk Railway, has resigned his position He will probably be succeeded by Mr Malone, who until recently acted as passenger agent for the company at Quebec.

George Spotswood, mining engineer, formerly of Kingston, died recently in Newfoundland. Since May last Mr. Spotswood has been working in the coal oil wells in Newfoundland, as chief engineer for the Newfoundland Oil Co., Ltd

J F Macartney, E E., president and general manager of the Macartney, McElroy Co consulting and contracting engineers, New York, who was in charge of the electrical construction at the Burlington Canal bridge Hamilton has returned to New York, as the structure has been completed

Alexander C. Leslie.

Alexander C. Leslie, senior member of the firm of A. C. Leslie & Co., died recently in Montreal. He was well known in the hardware trade, and was universally esteemed. Mr. Leslie was born in Aberdeen, Scotland, in 1833, and came to Canada when a child, and spent most of his boyhood in St. Catharines, Ont., where he learned the hardware business. He afterwards went to Hamilton and entered the wholesale house of R. Dusen & Co., one of the largest in the trade at the time, and was manager when the firm sold out in 1866. He came to Montreal in the same year, and commenced business as broker and manufacturers agent in hardware, iron, steel and metals. He had continued in the same line ever since, representing some of the largest manufacturers in England, Scotland and the United States. Mr. Leslie was a member of St. Andrew's Society, the Montreal Club Board of Trade, Commercial Travellers Association, etc. Mr. Leslie leaves to mourn his death a sister, three daughters and three sons.

Willis Chipman, C.E., has been appointed consulting engineer to the city of London, Ont., where important works are in progress.

Thomas Craig, who has been master of the Richelieu and Ontario steamer "Passport" for four years, has resigned his position. He will take charge of the ferry business between Kingston and Wolfe Island in future.

John Wimperley, engine driver on the Grand Trunk Railway, who has retired after twenty-eight years' service owing to the loss of his right hand in an accident, was presented by the engineers and firemen at Beeton, Ont., with a complimentary address and a handsome gold watch.

The Portland Rolling Mills Co., of St. John, N.B., have recently put in a plant for making horse shoes. Samples of these were shown to a representative of this journal last month, and the new plant, which is now in working order, certainly makes a fine shoe. The new machinery is of special design, not heretofore used in Canada. These are the first horse shoes made by machinery in the Maritime Provinces.

Delegates representing New Westminster, Vancouver and Victoria, as also the Burrard Inlet and Fraser Valley Railway proposition, and the Vancouver, Victoria and Eastern Railway Company, waited on the Provincial Government and discussed the whole question of a railway from the Coast to the Kootenay country. The Government promised to give the subject the most serious consideration and expressed the hope that there would be an amalgamation of the companies, as their rivalry was inimical to the success of the project.—*B.C. Commercial Journal.*

At the regular meeting of the Board of Examiners for Ontario Land Surveyors, held at the Crown Lands Department, Toronto, recently, the following were successful in passing the examination for admission to practice as land surveyors for Ontario, and were duly sworn in at that session and the succeeding special meeting, viz.: John Andrew Heaman, London; John Edward Schwitzer, B.A. Sc. (McGill), Ottawa; William Verner Taylor, graduate School Practical Science, Toronto, Gananoque; Elias John Boswell, graduate School of Practical Science, Peterboro'; James Nevin Wallace, B.A., B.E., Dublin University, passed the examination for admission to apprenticeship, and received a certificate for the same.

The eleventh annual meeting of the Canadian Society of Civil Engineers will be held in the society's rooms, 112 Mansfield Street, Montreal, on Tuesday, January 12th, at 10 a.m., when council will be elected for 1897, and other annual business transacted. The Grand Trunk, Canadian Pacific and Intercolonial Railways will grant to members and their families who shall have paid full one-way first class fare going to the meeting, a free return ticket on presentation of a certificate signed by the ticket agent [from whom the certificate must be obtained] at the point of starting, and by the secretary of the society. A supplementary circular giving details of the meeting will be issued about Dec. 15th.

The rush to the oil fields of Bothwell, Ont., continues to grow. G W Whitman and C. E. Brinton have leased 700 acres, and their first well yields at the rate of 150 barrels per day. J. F. Carmen and Dr Fairbanks, of Petrolia, have put in five wells on the Goodyear, of which one yields 75 barrels per day. A power house and extensive plant is being put in by this firm. The Walkers, of Walkerville, Ont., have formed a joint stock company and have spent $50,000 on developing the 2,200 acres they hold. Among the other operators are Alex Elliott, the Ohio Oil Co., the Detroit Oil Co; Samuel Rogers, Toronto, W. H. Emerson, Chatham.

From motor-cars to motor-houses is not a very long step. The house on wheels is already represented by the gipsy van. It is no wonder, then, that a gentleman who, we are told, has immensely influenced the development of cycles and motor-cars, should be now devoting his attention to the building of a two-story house, which is to be propelled by a motor underneath it. He is planning a four-roomed house with a collapsible upper story, so that the house may be readily got under a bridge. There is nothing at all wild in the notion, and though we may not have Belgravian mansions "on tour" in the near future, we are likely to have large and decent house-cars, readily movable at will, and without calling in the aid of draught-horses or traction engines One of the pleasant ways of spending a holiday is to go up and down the land in a caravan, and when the motor is added to it, the caravan will be in demand for the purpose of taking the refreshing summer vacation. In fact, we think it quite probable that the house-autocar will ere-long be as much a feature of the road as the house-boat now is of the river.—*The Auto-Car.*

PROFITABLE LUMBERING.

The great waste incident to lumbering as carried on in the Canadian forests is in marked contrast to the thrifty operations of our European relatives. Across the Atlantic every chip and twig may be said to enter into the operator's calculations, and no source of profit is too insignificant to be overlooked While much of the value of what are in Canada the waste products of lumbering, find their value in Europe from the neighborhood of a large market; yet much more can be made of our timber than has hitherto been generally attempted, as the splendid achievements of the Rathbun Co, of Deseronto, prove. In this connection much interest is taken in the report of Ontario Clerk of Forestry Southworth, issued not long ago. He says:

"I had, in a general way, understood that the Rathbun Company employed methods somewhat different from most of our lumbermen, and that those methods caused a consumption of many forest products usually considered as waste material, and treated as such. My ideas in this respect fell far short of the reality. The Rathbun Company is unique in Canada, if not on the continent. Originally a lumbering concern purely cutting down white pine and sawing it into deals, they seem to have been impressed with two ideas, the attempted realization of which has revolutionized their business and sent it into different channels from that of ordinary lumbering In the first place it became apparent to them that in a few years at best, with their at that time improvident but immediately profitable methods, the supply of white pine tributary to Deseronto would be gone, and they would have to leave the place where they had made their home, and seek new fields, with the alternative of making a radical change in their method of working. Secondly, the enormous waste incident to the lumber business in Canada appealed to them as it doubtless has to other lumbermen, but unlike other men in the trade, they set out to find a remedy for this and to devise means for the profitable converting of what had formerly been waste material into a manufactured product, affording employment for labor and a profit for the capitalist. For thirty years these two ideas seem to have been kept in view by the Rathbun Company, and the result is a vast industry, giving employment steadily and directly to three thousand men—indirectly to many more and by its consumption of waste materials in the forest and mill adding greatly to the wealth of the province.

"The Rathbun Company float logs, cut from their own limits and bought from settlers down the Napanee, Moira, Salmon and Trent rivers to Deseronto, and by the Madawaska and Calabogie. Considerable quantities are also brought in by rail, over a thousand car loads of cedar and non-floatable timber coming in this way yearly. Upon reaching Deseronto, the logs are separated, and to some extent classified. The cedar is taken to the cedar mill, and if large enough they are sawed up into lumber, now become very scarce If the log is not large enough or good enough for lumber, it may do for a couple of railway ties, in which case it is sawn in two and flatted, or it may make a tie and a fence post, or two fence posts, leaving enough over at the end for one or more blocks for street paving. In some cases, the log has to be made into shingles, but it is a pretty tough stick that is not manufactured into something, if it is no more than steam.

"The sawdust is used partly for fuel, as is that from the other mills, which I will further refer to. With the other logs the process is similar. In the case of pine and spruce, waste pieces that cannot be made into lath may be long enough for matches, and if so, they are cut into match splints and exported to England. This branch of their business, though of quite recent date, already gives employment to nearly one hundred hands. Short pieces of lath not long enough for use as lath are cut regular lengths and sent to New York to be made into banana crates. Oak, maple, cherry, ash, birch, butternut, tamarac and other woods are used in ship and car building Of the timber found unfit to be sawn into any kind of lumber, the worst and roughest is sent to Napanee mills to be used in the Portland cement works to burn lime and hydraulic cements Other of the rough wood is fed to sixteen big bee-hive furnaces or kilns, and is made into charcoal and a variety of other articles of commerce A cord of wood will produce forty five bushels of charcoal, and quantities of alcohol, oil of tar, pitch, etc., which are distilled from the smoke of the wood during carbonization in a large building erected for that purpose. Scarcely any wood is consumed in the process of carbonizing the contents of the kiln, as this is effected by means of the gas generated from the wood being carbonized, the generating of this gas being started by a small quantity of wood placed in an arch inside the kiln. When this quantity of wood is consumed the gas does the rest of the work.

"Of the product of the charcoal works and the chemical works nearly all is exported to the United States. The charcoal is sent to Detroit and is used in smelting iron. The Rathbun output would run a twenty ton iron furnace, and it seems odd that with so much iron ore of good quality as is known to exist all through Eastern Ontario, this charcoal should be sent to the United States to be used in making iron there. The greater part of the saw-dust and small chips and blocks too small to be worked up into anything, is used to make steam, but a considerable portion of the saw-dust is sifted, mixed with an equal quantity of clay and made into a building material now coming into very general use, known as Porous Terra Cotta brick. This brick possesses some remarkable qualities and is fast growing in favor with the building trade. It is said to be absolutely fire and frost proof, is a good deadening material for partition walls in houses, is very warm and dry, and will stand a very heavy crushing strain and is very light in weight. It can be sawn and nails can be driven into it as into wood. When heated to white heat sudden immersion in water will not make it crack."

THE TAYLOR HYDRAULIC AIR COMPRESSING COMPANY, LIMITED.

On November 18th a party of nearly 100 people interested in various ways in the Taylor Hydraulic Air Compressor constructed for the Magog cotton mills, visited Magog, Que., on the invitation of the company, to observe the working of the compressor. In No. 12, Vol II, of THE CANADIAN ENGINEER, will be found a description, with diagram, of the apparatus, which will enable any careful reader to understand its working. When first brought before the public many engineers of experience pronounced the scheme impracticable, and it was generally believed that, supposing the plant perfect otherwise, air obtained must be very damp. It is now found that the air in the receiver is six times drier than when it enters the air inlets A change of opinion is often reluctantly made and always slowly, but it would be impossible to maintain any objection to this contrivance after studying it, and the party was unanimous in the expression of its complete satisfaction.

Great difficulties had to be overcome in sinking the shaft, and it is entirely due to Mr. Taylor's unbounded faith in his invention that so successful a consummation has been reached. The compressor has been at work for nearly four months without any interruption, and the continuance of this happy condition is assured by the simplicity of the mechanism. Mr. Taylor finds that by a slight change in construction he can obtain 25 per cent more power, but this compressor now provides more than the contract provides. There are also some problems of a purely scientific interest yet to be attacked, but these are for the scholar rather than the actual user of power In the mill both management and operatives are perfectly satisfied Mr Dolphin, superintendent of the cotton mill, says that the saving in coal is enormous, it is easier to regulate the machinery, there is no damp caused by condensed steam, and the absence of heat is a great benefit The six cotton printing machines were at work, and standing beside them Mr. Dolphin pronounces the operation of the compressor perfect.

The plant, it appears, is fitted with an automatic valve which would turn on steam the moment any failure of compressed air became apparent. Such a contingency has not yet happened. The visitors were very careful in their investigations, and questioned not only the management, but also the individual operatives Some felt the supply pipes, and finding them slightly warm, thought they had discovered a plant of another kind. Prof Nicholson, in the course of some subsequent remarks, explained that a small quantity of steam was run through the compressed air pipes, partly to further dry the air, and also to produce a little more pressure by causing expansion of the air By this means another horse power was produced at the expenditure of 1 lb. of coal

The arrangements made by the Taylor Co. for the comfort of guests were admirable. Two special cars were chartered to convey the party to Magog, where an excellent dinner was provided. After this the party was taken down to the mills by the cars and inspected the compressor under the guidance of Messrs. Taylor, Sutherland and the shareholders, and the mill under the guidance of Manager Whitehead and Superintendent Dolphin On the journey home a stop was made at Farnham for tea. During the homeward journey J C Wilson proposed, and P. W. St. George seconded, a vote of thanks to the company for the opportunity that had been afforded. Mr S. Carsley, president of the company, replied Prof. Nicholson also thanked the company on behalf of the contingent of McGill fourth year students, who had so heartily enjoyed their trip and the opportunity of increasing their knowledge of hydraulics.

Among those present were S. Carsley, president; J. K Fair, vice-president and managing director; R. W. Sutherland secretary; Chas. Morton, Robert Archer and George Durnford

directors; P W H. St. George; A. Davis, C.E; P. B. Casgrain, C.E.; S. C. Curry, C.E.; R. P Fleming, C.E.; E. Marceau, C.E.; R. C. Adams, J. C. Wilson, James Wilson, jr., Wm. McMaster, O. N. Gould, Lewis Skaife, Joseph Haines, John Taylor, Maurice Perrault, Charles Griffiths, George R. Prowse, George Brush, John Bate, C H. Millen, H. A. Budden, A. C. Hutchinson, A W. Duff, C H Taylor, Lieut-Col Crawford, Dr Carmichael, James Peck, James Shearer, Henry Millen, J T. Ewart, Walter T. Ross, Dr. Porter, Charles Morton, J Chevrette, W. G. Ross, D. Ford, E. McLea, E Fiske, Prof John Nicholson, Prof C. H McLeod, Prof. C B Smith, Prof R S. Lea, Prof Umney, Messrs H. Lockwood, F W. Lamplough, E M Renouf, E Hallamore, Hooper, Mallet, Alfred Bean, J Rankin, jr, Percy Millen, Bourgeois, C. E.; Lamoureaux, C E., and Hamilton White.

LITERARY NOTES.

Mining News, H. Bragg, Board of Trade Building, Montreal, is another claimant for recognition which has appeared before the public. *Mining News* is not a technical journal, but rather what its name implies, a medium for presenting to those interested the latest reports about the properties under development in different parts of Canada, chiefly, however, to give items about Rossland and the British Columbia mines, it would appear. Issued weekly, $2.00 per annum.

We have been favored with copies of the announcement of Lehigh University, South Bethlehem, Pa., which set out fully the work covered and the very full equipment provided for the different courses in the liberal arts and scientific courses. The Lehigh University offers the following courses:—In General Literature. The Classical course, the Latin-Scientific course, the course in Science and Letters. In Technology. The course in Civil Engineering, the course in Mechanical Engineering, the courses in Mining Engineering and Metallurgy, the course in Electrical Engineering, the course in Analytical Chemistry, the course in Architecture.

The Ledge, New Denver, B.C., thus presents itself with all the added grace which varied type and red paper can be thought to afford. "Fellow pilgrims all! *The Ledge* is located at New Denver, B C., and can be traced to many parts of the earth. It comes to the front every Thursday, and has never been snowslided by cheap silver or raided by the sheriff. It works for the trail blazer as well as the bloated and chicken-fed capitalist. It aims to be on the right side of everything, and believes that hell should be administered to the wicked in large doses. It has stood the test of time, and the paystreak is growing wider. The annual assessment is only $2, and no palace, cabin or shack is complete without it. A vein of job printing is worked for the benefit of humanity and the editor. Come in and see us, but do not step on the fighting editor's bull pup, he is small, but savage. R. T. Lowery, editor and financier."

"Citizenship and Technical Education," an address delivered on Founder's Day, before the Lehigh University, by John H. Converse, A.B., of Philadelphia, is an exposition of the claims of those who very rightly press for the recognition of technical scientific training as true education Among other bright things Mr. Converse says: "At a time when the ruling interests of the country were agriculture and the products of the forest and the sea, a college curriculum moulded in mediæval form was sufficient. But with the development of mines and manufactures of every kind, and the extension of new conditions of life, a different training was demanded."

CATALOGUES.

An illustrated catalogue of Case's Perfected Outward Thrust Propeller Wheels has reached us, in which we notice a number of testimonials from Canadians. A. Wells Case, Highland Park, Conn.

The *Scientific American* Hand-Book is a most valuable pamphlet, being a treatise relating to patents, caveats, designs, trademarks, copyrights, labels, etc., in the United States. It is published in the interest of Munn & Co., patent solicitors, etc., of New York, proprietors of the *Scientific American*.

We have on our table a very comprehensive illustrated catalogue of some 75 pages, being the price list of John Starr, Son & Co, Ltd., manufacturers and importers of electrical apparatus and supplies, 134 Grenville street, Halifax, N.S.

B & S Massey, engineers, Openshaw, Manchester, send a catalogue of their steam hammers, which received the highest award at the World's Fair, Chicago The catalogue contains 117 pages and enumerates steam hammers, steam forging presses, power hammers, kick stamps, forging machines, saws for hot and cold metals, smith's furnaces, etc., with illustrations.

J. & E. Hall, 23 St. Swithins Lane, London, Eng., forward an illustrated catalogue of their refrigerating machinery. It extends to 119 pages, and one of the features is a detailed description of their patent carbonic anhydride refrigerating machines.

Because of the great and increasing use of electricity generated by steam, each of the three steam engineering courses in the International Correspondence Schools, Scranton, Pa., includes instruction in the care and operation of dynamos and motors. Steam engineers everywhere feel the crowding influence of electricity, and this may be merely a beginning of what is to follow. The dynamos which are to-day everywhere present, are managed by men who were yesterday steam engineers. The dynamos in use to-morrow will be cared for by the engineers of to-day. The engineer who, in addition to a knowledge of his trade, acquires a knowledge of how to care for electrical power, railway and lighting installations, is reasonably sure of permanent employment.

About one-half of the entire copper product of this country is now refined by electrolysis—a fact which illustrates in a striking manner the progress of electricity in this field, which has been none the less rapid because but little noise has been made over it, and but little is publicly known about it.—*American Machinist.*