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The Canadian Engineer

VOL. X.—No. 2. TORONTO AND MONTREAL, FEBRUARY, 1903. PRICE 10 CENTS $1.00 PER YEAR.

The Canadian Engineer.

ISSUED MONTHLY IN THE INTERESTS OF THE

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

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

OFFICES—Cor. Church and Court Sts. Toronto; and Fraser Building, Montreal.

Toronto Telephone, Main 4310. Montreal Telephone, Main 2589.

BIGGAR-SAMUEL, LIMITED, Publishers,

TRAVELING REPRESENTATIVE: A. W. SMITH.

All business correspondence should be addressed to our Montreal office. Editorial matter, cuts, electros and drawings should be addressed to the Toronto Office, and should be sent whenever possible, by mail, not by express. The publishers do not undertake to pay duty on cuts from abroad. Changes of advertisements should be in our hands not later than the 15th of the preceding month or if proof is desired, 4 days earlier.

CONTENTS OF THIS NUMBER:

The articles now running in the Canadian Engineer on the Electrical Power Developments of Canada, will be reprinted in book form, with diagrams and folding plates. Price $5.00 per copy Advance orders received.

Subscribers who intend binding the last volume of The Canadian Engineer, and who require a copy of the index, will please advise us at once.

THE KOOTENAY-ROSSLAND POWER TRANSMISSION.*

BY GEO. P. LOW.

A few miles east of the Columbia river, at a point some sixty miles below its source, are two comparatively small lakes a mile or so apart. From the northerly one the Beaver Foot river rises, eventually reaching the Columbia; in the southerly lake the Kootenay river finds its source and continues in a south-easterly direction, parallel with and at a distance varying from ten to fifteen miles from the Columbia river, though the streams flow in opposite directions for about sixty miles. When the head of the Columbia is reached and further paralleling is impossible, the Kootenay approaches within three miles of its rival, but quickly turns from it, flowing away one hundred and fifty miles further south into Montana, whence it retraces its course into British soil and finally joins the Columbia near Robson, some thirty miles north of the boundary line. Before doing so, however, it forms the Kootenay lake, which is perhaps sixty miles long and from four to eight miles wide, and from the lake it continues to the Columbia through a broad, resistless water course something less than fifty miles in length. It is near the lower end of this portion of the Kootenay river, which forms the connecting link between Kootenay lake and the Columbia river, that the Bonnington Falls are located, and at the lower Bonnington Falls is the generating station of the West Kootenay Power and Light Company, Limited. Thirty-two miles distant is Rossland, which is one of the newest and most prosperous and promising gold mining camps in British Columbia, and in which electricity is not only fast superseding all other forms of power in mining work, but is also put to mining service ordinarily classed as impossible of accomplishment. It has been my fortune to make personal examinations of the principal electric power transmissions of the West, and it is without hesitation that I state that in none of them is the West Kootenay transmission exceeded in points of thoroughness, of engineering design and commercial advantage. The manner in which it has grappled with every phase of the power problem as applied to mines, and the thoroughness with which it has worked out the complete solutions of these problems, enables it to stand as one of the most perfect mining transmissions on the Pacific Coast. Among its features may be enumerated the extraordinary thoroughness and reliability of the water power development, and the difficulties which attended the building of the pole line over a rugged route. The plant was built essentially for power purposes, and of its present load only about twelve per cent. is in lighting, the remainder being in both synchronous and induction motors in mining duty for the operation of compressors, hoists, rock breakers, roasters, bricquetting machines, blowers, machine shops and other equipments used in and about mining and smelting work.

The general view of the Bonnington Falls, upper and lower, and the country about the power house, is given in the accompanying engraving. At low water the falls, both upper and lower, are capable of delivering 267,000 horse-power, but the West Kootenay company utilize only a portion of the lower falls, which, under the 40-foot head available at extreme low water, are capable of delivering 100,000 horse-power. The river is 400 feet wide at the lower falls and in developing a portion of its water power the West Kootenay company constructed a canal 650 feet in length and some 26 feet in width, all through the hard country

* Condensed from description in Journal of Electricity.

rock. Towards its lower end the canal widens out into a forebay 54 feet in width, the forebay being closed in by a solid concrete dam 32 feet high and 26 feet in width at the bottom, tapering to six feet in width at the top. Between two high bluffs at a point in the head race, 150 feet above the concrete dam, has been constructed a wooden dam sloping at an angle of 42 degrees up stream and having a vertical height of 44 feet. The sills and timbers of this dam are spaced five feet apart, and all timber, including sills, are of 12 by 12 material solidly bolted to the rock, the whole

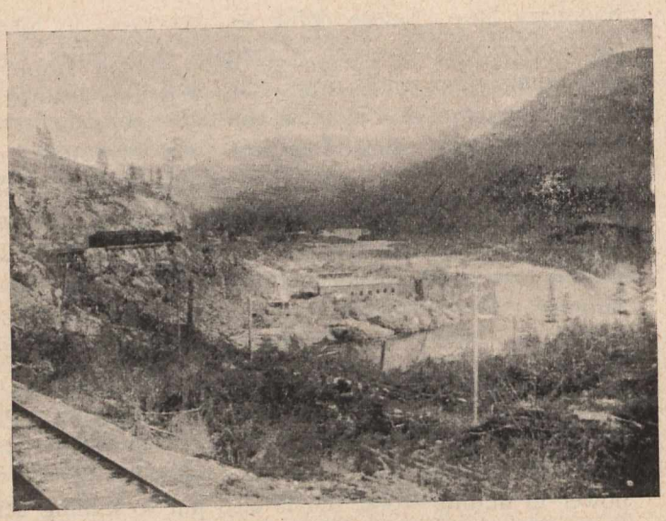


Figure 1.—General View of Bonnington Falls and the Power House.

being then planked by a double layer of 4-inch planking. In the bottom of this dam are five sluice-ways and its object is to break the impact of water flowing into the head race from the canal during high water, or, in general, to insure the control of water entering the forebay at all times.

Lower Bonnington Falls have an extreme difference of level of 32 feet, which measures the head of water available at the power house. The main concrete dam is provided with three feeders, two of nine feet each and one of ten feet. The upper ends of the feeders are closed by gates which measure respectively 12 by 13 feet, 12 by 13 feet, and 13 by 14 feet. These gates are of wood, and consist of a framing of 12 by 12 timber to which is solidly bolted 8-inch planking. The two outside frames extend upward of 38 feet, and to the walls of each pit are bolted the racks for raising and lowering the gates. The gates are further provided each with a small iron flood-gate, 12 inches by 12 inches in size, and the main gates are raised and lowered by means of headgate irons rigidly bolted to the top of the dam. The winch controlling the headgate irons are operated by one man. These and other features are shown in Figure 4, which gives the end elevation of the dam, power house and tail-race. The three steel penstocks, each nine feet in diameter by 20 feet in length, run through the concrete dam into the hydraulic section of the power house near the base of the dam, and from each penstock is carried a 10-inch stand pipe, the height of which nearly reaches the top of the dam. The back of the dam practically forms one side of the power house and tail-race, the latter extending at right angles to it, and consisting of a pit approximately 30 feet in depth by 20 feet in width, extending nearly the length of the power house, which is 66 feet. In the clear water the tail-race is flanked by built masonry and concrete retaining walls which vary from four to six feet in thickness and extend upward to approximately the level of the power house floor. Bolted to the lower end of each penstock is a 13-foot casting containing one pair of 39-inch horizontal cylinder gate turbines. To these castings or wheel housings are bolted the draft tubes, which are 22 feet in length and 10 feet in diameter at the lower end. The housing is supported on each end by the retaining walls of the tail-race and are further carried by I-beams. The turbines for driving the exciters are supplied with water taken from the main turbine housings.

To be more explicit, the three 40-kilowatt, 125-volt multipolar exciters are direct-driven from independent horizontal, 12-inch registered gate turbines, which are contained in the cast-iron flumes, the latter in turn supported by transverse beams bolted to the main beams of the large wheels, while bolted to the cast iron flumes are the draft tubes and feeders. The latter are connected to the shaftings of the large wheels from which they derive their water supply. The portion of the power house containing the generators and switchboards, together with the transformer house built thereon, as an L, is bedded on the solid granite rock, which, after being suitably dressed and surfaced with concrete, gave most perfect foundations for the heavy machinery to be placed therein. A single roof covers the entire structure with the exception of the transformer house, which is independently roofed. The building is fireproof, with walls of brick and roof of wood covered with galvanized iron. The inside dimensions of the turbine house are 25 feet by 64 feet, those of the gen-

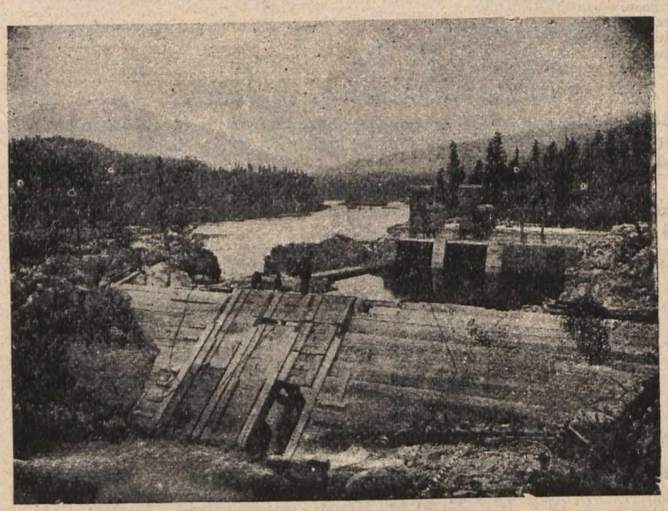


Figure 2.—Wooden and Concrete Dams and Forebay.

erator room are 31½ feet by 66 feet, while the transformer house measures 17½ feet by 28 feet. A flight of nine stairs takes one from the floor of the generator room to that of the transformer house, the difference in elevation of the two floors furnishing space for the blowers of the air blast transformers and ducts, as will be described hereafter. The height of the building from floor to the ridge of the roof is 40 feet, and

ample room is thus provided for substantial framing on which to carry the high tension leads.

Two 725-kilowatt units and a 1,200-kilowatt unit are in operation in the power house. Two 1,200-kilowatt units, with accompanying wheels, may be substituted for the two 725-kilowatt equipments as installed at any time, if desired, without necessitating changes

Figure 3.—Rear View of Power House Showing Draught-Tube and Tail Race.

in the power house. These generators are of the standard General Electric revolving field type, as built by the Canadian General Electric Company, as is also the entire electrical equipment of the whole installation, with the exception of the induction motor operating the War Eagle hoist at Rossland, which was built at the Schenectady works of the General Electric Company. The generators run at 180 revolutions per minute, have forty poles, and deliver 60-cycle, three-phase current at 1,100 volts delta. Underground waterproof ducts carry the generator leads to the switchboard, which consists of three exciter panels, three generator panels, three transformer panels, and four line panels. Nothing of novelty is imparted in the switchboard, as all instruments, appliances and methods are of standard General Electric varieties. It is interesting to note that at the outset considerable difficulty was experienced in synchronizing the generators, but the trouble was finally located as being due to the fact that the slip-rings on the revolving fields were out of true one-eighth of an inch. Rotation thus introduced a varying resistance in contact between the brushes and slip-rings which, though imperceptible in the voltmeter and ammeter readings, made synchronizing an uncertain performance. However doubtful station engineers may be that the trouble experienced was due to the cause ascribed, it is certain that after the slip-rings were turned down no further difficulty was encountered in synchronizing, which is done with perfect ease under a variation of 200 amperes.

Ducts placed under the floor carry the leads from the transformer panels to the step up transformers. There are twelve of these, each having a capacity of 282 kilowatts and wound for 1,100 volts on the primary with either 11,620 volts, 20,100 volts on the secondary, according to whether delta or Y. The higher potential of 20,100 volts is delivered to the line.

It is the opinion of the writer that if it had been the general custom to install air-blast transformers in the manner adopted by the West Kootenay Power and Light Company and to have maintained them under the same care and attendance as the Kootenay company is administering to the air-blast transformers in its installation, a greater degree of success would have attended their use than has been the experience of a few of the many transmissions which have adopted them. More detailed reference to this matter will be given in describing the step-down transformer installation at the Rossland sub-station. In this transformer house, three 60-inch Buffalo blowers, together with the two horse-power, 110-volt induction motors from which each is driven, are placed under the platform forming the floor of the transformer house. These blowers furnish an air blast to the transformers through large ducts or tunnels after the manner and for the purpose to be described later. The high tension circuits are led from the transformers to porcelain insulators placed on

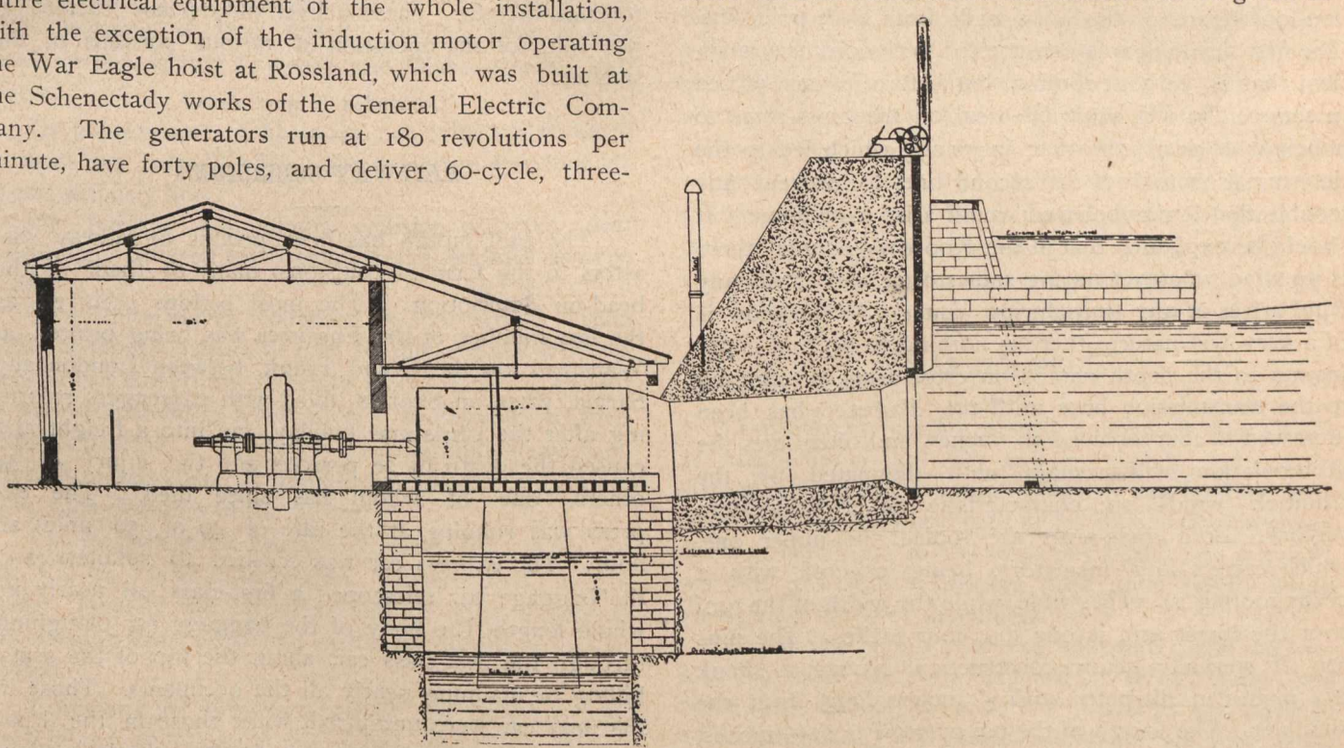


Figure 4.—End View of Power House, Tail Race and Dam.

framings overhead in the transformer house and generator room whence they are carried to the line out through eight-inch, vitrified, terra cotta piping built in the front wall of the station. Fifteen such pipes exist, thus providing for five three-phase circuits, and the outside orifices of these outlets are roofed.

The Pole Line.

The profile of the Kootenay-Rossland transmission astonishes one because of the extreme irregularity of the country it traverses from one end to the other. In fact, it resembles the work of the tracing pen on the recording voltmeter chart of a badly regulated incandescent plant, or perhaps even of a railway power service, much more than the profile of a transmission pole line. There is not over a level mile or two in its whole length, and the grades are of all degrees of steepness, reaching the maximum at about 70 per cent. Its length is practically 31 miles, in traversing which its altitude above sea level varies by over 2,200 feet. A distinguishing feature consists in the span of 1,500 feet that the line wires take in crossing the Columbia river, these wires being unsupported by cable. Both pole lines are of a very substantial type of construction, being of round, specially selected cedar, varying in length from 30 to 65 feet, according to location. They are set 100 feet apart, or 52 to the mile, with all corners and curves properly guyed. The right of way lies through a heavily wooded country throughout which a 100-foot clearance has been made from each pole line. The first line built was constructed in the ordinary manner, that is, without roofing, but before it was placed in service the wet snow piled up on the cross-arms to a height of nearly two feet in places, which led to the determination to roof the second line to prevent any trouble that it was believed would arise from snow. It should be explained that in the Kootenay country there is no wind whatever during snowstorms and hardly any wind arises at any time during winter. As the snow is of a very wet nature, there is nothing to prevent it piling up to the depth named on cross-arms, or clinging to the transmission lines until the diameter has been increased to four or even six inches, and oftentimes the accumulation will remain until dissipated by the Chinook winds so characteristic of Northwestern regions. Both cross-arms are roofed, the upper one, which carries four insulators, being covered with a cedar roofing 24 inches wide, while the width of the roof over the lower arm is one foot four inches. The pins are of specially heavy construction, having a shank 2⅞ inches in diameter and 5 inches long from the shoulder. The length of the pin over all is 11½ inches, which gives 6½ inches from the top of the cross-arm to the top of the pin. These pins are of locust and the treatment administered to them consisted in boiling them in paraffine oil, after which they were taken out, and when cooled they were dipped in hot paraffine oil. No further treatment was given. Porcelain insulators of the Redlands type are used, and while the three wires of a circuit in three-phase transmissions are generally placed so as to form an equilateral triangle, the wires of the Kootenay transmission form an inverted isosceles triangle with 20 inches on the base and 22 inches on each of the sides.

The lines are No. 0, B. & S. gauge medium hard drawn copper wire, with the exception of where they cross the Columbia and Kootenay rivers, where they are changed to No. 000 bimetallic wire, the increase in cross-section being for the purpose of maintaining the conductivity of the bimetallic wire equal to that had in the regular line. The Kootenay river is crossed in a single span of 600 feet, and the Columbia river by one of 1,500 feet in length. There is a sag of 52 feet in the stretch of 1,500 feet, and the strain is supported on ordinary porcelain insulators placed close together and mounted on very substantial framings. At times wet snow has adhered to the line wires at these crossings until it has reached a diameter of about four inches, yet trouble has not arisen therefrom nor from swinging crosses at the rivers, as the separation of six feet that has been placed between wires at these points has proven adequate to prevent it.

The Trail Sub-station.

At a point three miles from the sub-station in Rossland branches are taken off at right angles and carried to the town of Trail, which is four miles by pole from the main line. At Trail, where is located the great smelter of the Canadian Pacific Railway, the three-phase current is taken into a neat brick sub-station containing the usual equipment of choke coils, lightning arresters, and the high and low tension switchboard panels necessary for the safety and control of the three 135-kilowatt, oil-insulated, air-cooled, static transformers therein. These deliver three-phase current at 550 volts for the operation of various portions of the smelter.

(Concluded in next issue).

RAILWAY COLLISIONS.

The past month has been prolific of railway disasters in the form of collisions, many of them of the head-on description. The most serious occurred as the last number of the Engineer was being printed, at Wanstead, on the Grand Trunk, between London and Sarnia, when an express, filled with passengers returning after the Christmas holiday, ran into a freight and caused the death of 28 persons and the injury of 34 others, one of whom has since died. The express was running at the rate of 40 or 50 miles an hour. The express car was crushed to splinters and the baggage car telescoped a first-class car nearly its whole length, the body of the baggage car ploughing through the first-class car, about the top of the seats, killing or maiming nearly all the occupants. Those in the next car were uninjured, while those in the Pullmans in rear scarcely felt the shock. Both engines were destroyed. The coroner's jury failed to fix the responsibility on anyone in particular, though the evidence seemed to place it between the despatcher at London and the operator at Wyoming. Had there been an experienced operator, instead of a boy who was unfamiliar with his work, at Kingscourt Junction, the express might have been stopped and the catastrophe averted. An investigation is to be held by the railway authorities. Besides the damage to property, which will amount to at least $10,000, the Grand Trunk will have to pay large claims to the relatives of those who were killed.

On December 31st an engine and a freight train collided on the Victoria Bridge, at Montreal, killing a conductor and causing a wreck, which took fire and did some damage to the bridge. The driver of the engine was held responsible by the coroner's jury.

On January 3rd a collision took place near Merritton, between an express train and an unattached engine, killing a fireman and seriously injuring both engineers. The inquest, in this case, is not concluded, but the despatching office at London, concerned in the Wanstead disaster, has also to do with this accident.

On January 11th, two freight trains collided near Port Robinson, killing a fireman. This accident is supposed to have been caused by the air brakes failing to work.

Another smash-up took place near Milton, January 13th, when a light engine overtook a freight and dashed into it. The engine and two cars were badly damaged, but no one was killed, though several train hands were injured.

On January 20th a collision, at Bradford, between a light engine and two moguls resulted in the total destruction of the former. No lives were lost.

On January 21st two freight trains collided near Port Hope, and two men were killed. The fault lay with an operator, who failed to hold one of the trains at Newtonville.

A freight train, and an engine sent to help it, while running at high speed, collided near Battle Creek, Mich., killing two men and fatally injuring two others.

On January 24th, at Montreal, two collisions occurred the same day caused by fog. Some damage was done bu no one seriously hurt.

On January 29th, another collision occurred near Newtonville between two freight trains, without any loss of life.

The above eleven collisions on the Grand Trunk within a month, naturally lead to the enquiry whether there is not something radically wrong with the system of train despatching, when such a succession of accidents is possible. A system of telegraph inspection, referred to elsewhere, is announced, to prevent, if possible, such disasters in the future.

On January 7th a head-on collision took place on the C.P.R., near Sherbrooke, between two freight trains. Most of the cars were thrown down a fifteen-foot embankment, a fireman was killed, and a brakeman injured.

Collisions are also reported on the Pennsylvania, the Rutland, the Boston and Maine, the Great Northern, the Missouri Pacific, the New Jersey Central, the Southern Pacific, and the Colorado and Southern, resulting in all cases but the last in more or less loss of life. An engine on the New York Central blew up and killed the engineer and fireman, and nearly wrecked a fast express. A Grand Trunk engine also blew up at Berlin Falls, N.H., killing one man and wounding another.

In connection with these accidents we observe that experiments have been made on a railway near Frankfort, Germany, with a device to prevent collisions, which is said to have been a conspicuous success. The invention consists of a small apparatus fitted to the locomotive, which gives visible and audible signals if another locomotive is approaching on the same line of rails, or if a switch is misplaced, while in addition it also renders telephonic communication between locomotives possible. For the purpose of the experiments two locomotives were started for the same point on the same line of rails. When they were a certain distance apart, the apparatus on each gave signals to the engineers, who were then able to enter into communication. Certainly any plan to prevent such frequent destruction of property and loss of life must be hailed with satisfaction, both by the railway companies and the travelling public.

—Another evidence that the pen is mightier than the sword is shown by the fact that more steel is used in the manufacture of pens than in all the sword and gun factories in the world.

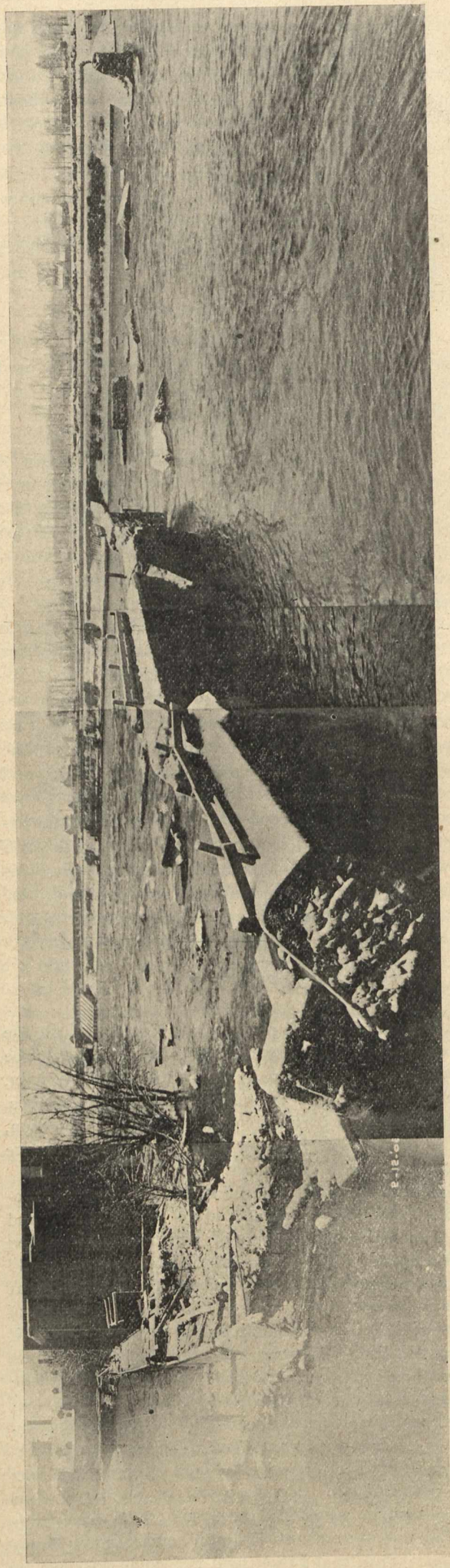
—Hartford has put down a 24-inch water main of vitrified clay pipe. This material has long been used for sewers, but it is a new departure to use it for water mains. There is one decided advantage in that it will not be subject to electrolysis, which is playing such havoc with iron pipe in so many places. It is also cheaper.

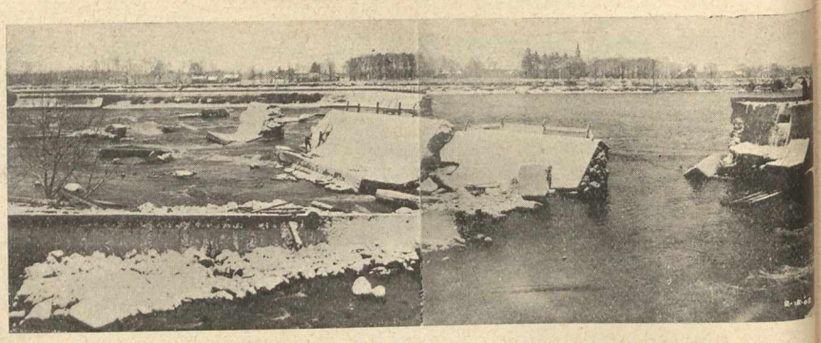
—Crude oil for smelting is a comparatively new departure, which promises to be a success. In California, which has no coal fields of its own, it is now being employed. Tests at the Selby works show that 3½ barrels of oil are the smelting equivalent of one ton of coal, in a locality where coal is $6 a ton and crude oil 80 cents a barrel. The use of oil thus shows an economy of 50 per cent. Oil fuel is advantageous in another respect. The oxidizing atmosphere of a roasting furnace can be maintained without those interruptions which occur when fresh coal is added. By regulating the air inlet the temperature of the smelting atmosphere can also be raised or lowered at will.

GAS FOR FUEL.

A Boston newspaper recently announced that all the gas companies in that city and its vicinity were to be merged, and would eventually furnish gas for fuel only, electricity superseding it entirely for illuminating purposes. Perhaps here lies a partial solution of the coal question, which is this season pressing itself upon public notice through the strike of the miners.

Gas is now largely produced from water, and the process has been greatly cheapened in recent times, and water is an element, the supply of which is not lessened by consumption. The general use of gas for fuel would result in a conservation of the coal supply, especially that of anthracite, which is limited. It is only a question of cheapness, for that mode of producing heat will prevail which costs least. Ingenuity will adapt appliances to its use, whatever it may be. But gas must not only be made cheaper than coal for fuel in order to take its place, but electricity must cost less than gas for light if it is to supersede it in the field of illumination. Possibly that revolution is under way, for certainly the limit of reduction has not yet been reached. The day may be at hand when our houses will be heated and our cooking be done with gas as fuel and our artificial light will come wholly from electricity. Then coal strikes will not come so close to our hearts and homes.





THE FAILURE OF THE CHAMBLY DAM.

The fact of the failure of the dam of the electrical power works at Chambly, Que., on the 30th November, was reported in our news columns. We now give two views, showing the displacement of the larger section of the dam. The section broken was that part which ran across the river at right angles to the bank and was about 350 feet long, extending from the bulk-head to that part of the dam which runs up and down the river.

The detached piece of the dam, shown in the engraving, was carried 80 feet away from its proper position, and some large pieces were swept down the river. The head-race of Willett's woolen mill, shown dimly on the left of the long picture, was washed out and the flumes strained. An east wind blowing up the Richelieu river at this point frequently raises the water a foot or more above the normal level, and at the time of the accident, such a wind was blowing, thus adding an unusual volume of water to the overflow. Men were working at the time on the section running up and down stream, which was being reinforced with concrete, these repairs having been rendered necessary by the previous failure of a year ago, when the dam was undermined by water rushing through the waste ways. The recent failure appears to have been a further undermining, the concrete having been laid on red shale and without sufficient hold upon the river bed.

The contractors appear to have followed the specifications as to the kind of cement to be used and as to the method of laying it down. The moral of the failure is simply this—that to have a safe dam one must have a sound foundation, and money saved in laying a foundation may be more than lost in the breaking of a dam and injury to the structures and machinery connected with it.

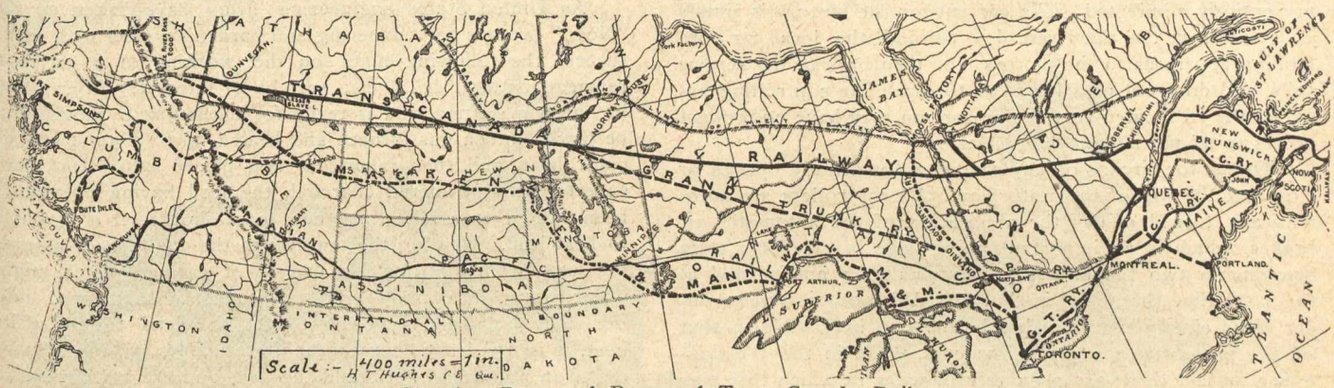
BIG TIMBER FLUME IN CALIFORNIA.

A remarkable engineering feat has been accomplished in the building of the great flume at Madera, Cal., 185 miles from San Francisco, in the heart of the redwood forests. This flume is the longest in the world. It is 53⅜ miles long, or, including feeders, 71 miles. The flume is V shaped with 36-inch sides and is 46 inches across the top. It is built of double two inch plank. It has a carrying capacity of 400,000 feet of lumber daily. In building it 5,700,000 feet of lumber were used and 21,000 kegs of nails. The water for operating is taken from the mountain streams which supply the Madera canal, and after it has served its purpose of transporting lumber it is turned into the canal at its lower end and used for irrigation. The timber is carried through it at the rate of 3½ miles per hour. All that is required is a man at the top and bottom. If timber is coming in from the branches a man is stationed at the junction to prevent jamming. The building of the flume was a gigantic task. Mountains had to be overcome, great gorges bridged, deep forests penetrated and steep hillsides and precipitous cliffs blasted to make secure foundations for the heavy scaffolding which supports it. The total cost was $270,000.

TRANS-CANADA RAILWAY.

The accompanying map, prepared by H. T. Hughes. C,E., for the promoters of the Trans-Canada Railway, shows the proposed route of that road from Quebec to Port Simpson on the Pacific Coast. The line will be the furthest north of all the trans-continental railways built or projected. The route of the proposed Grand Trunk Pacific Railway, as laid down on the map, is, of course, only approximate, as no surveys have yet been made. A table of distances has also been prepared by the promoters of the Trans-Canada, the following being the distances (approximate): Quebec to Port Simpson via Trans-Canada Railway, 2,831 miles; Quebec to Port Simpson via Grand Trunk Railway, 3,407 miles; Portland to Port Simpson via Grand Trunk Railway, 3,603 miles; Liverpool to Yokohama via New York, 12,089 miles; Liverpool to Yokohama via Trans-Canada Railway, 9,831 miles; Liverpool to Yokohama via Grand Trunk Railway, 10,944 miles (Portland); Quebec to Vancouver, 3,078 miles (via C.P.R.); Chicoutimi to Port Simpson, 2,705 miles; Quebec to Yokohama, 7,367 miles (via Vancouver); Chicoutimi to Yokohama, 6,645 miles (via Port Simpson); Vancouver to Yokohama, 4,290 miles; Port Simpson to Yokohama, 3,940 miles; Quebec to Nottaway, 570 miles; Roberval to Nottaway, 380 miles; Winnipeg to Quebec, 1,572 miles (via C.P.R.); Winnipeg to Chicoutimi, 1,284 miles; Winnipeg to Nottaway, 850 miles; Winnipeg to Churchill, 840 (projected); Halifax to Port Simpson, 3,516 miles; Halifax to Vancouver, 3,662 miles (via C.P.R.); St. John to Port Simpson, 3,419 miles; St. John to Vancouver, 3,387 miles (via C.P.R.); Boston to Port Simpson, 3,236 miles; Boston to Vancouver 3,248 miles (via C.P.R.); New York to Port Simpson, 3,368 miles; New York to Vancouver, 3,290 miles (via C.P.R.); New York to San Francisco, 3,303 miles; New York to Yokohama, 8,490 miles.

The following are given as the elevation of the summits of the different passes over the Rocky Mountains in Canada: Peace River, 2,000 feet; Pine River, 2,800 feet; Yellow Head, 3,800 feet; Crow's Nest, 4,425 feet; Kicking Horse, 5,400 feet.



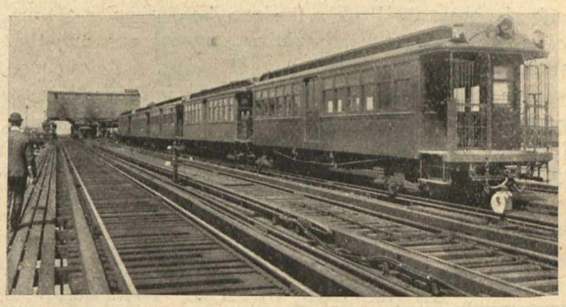
Map Showing Route of Proposed Trans-Canada Railway.

ELECTRO-PNEUMATIC SYSTEM OF TRAIN CONTROL.

The Brooklyn Elevated Railway Company has just given an order to the Westinghouse Electric & Mfg. Co. for 210 multiple train-control equipments which will be used for the operation of electrically propelled trains on its lines. A few years ago the management of this road decided to discard steam locomotives and to operate all trains electrically. Before making such a wholesale change, however, it was deemed prudent to test exhaustively the different methods of handling electric trains. If the steam locomotive were to be replaced by simple electric locomotives, many of the advantages of electric traction would be sacrificed. In order to reduce the dead-weight hauled and to obtain a higher tractive effort when starting, it is better to place the driving motors on the trucks of several of the passenger cars of a train and thus take advantage of the weight of the cars than to put the motors on a locomotive, which must be artificially loaded down to give it the necessary adhesion. Other reasons for choosing a system employing a number of motor cars per train rather than a single locomotive were that, since the service is fluctuating, during a part of the day the large motors of the locomotive would be operated at a light load and consequently low efficiency. Moreover the trains could not be broken up into single units, as is possible when a number of the cars carry their own motor equipments.

The Brooklyn Elevated Company, therefore, went to the leading electrical manufacturers who had developed systems for controlling a number of motor cars in a train, and asked them each to equip a number of model trains for testing purposes. These trains were placed on the Brooklyn road a few years ago and have since operated in the regular daily traffic. The companies furnishing equipments were the Westinghouse Electric & Mfg. Co., of Pittsburg, the General Electric Co., of Schenectady, N.Y., and the Sprague Electric Co., of New York City. Careful records were kept of the number of miles run by each train, the number of accidents met with, the cost and time required for repairs, the comparative convenience in operation, and all other matters that might influence the decision. The result of this investigation has been the placing of the order mentioned above. All steam locomotives now in use will be in a short time replaced and trains will be operated by the Westinghouse system. In addition to the order for 210 cars, the company has already purchased about 150 equipments which have been in satisfactory operation for nearly a year.

The Westinghouse Multiple Train Control system has been developed by George Westinghouse, and, on account of his long experience in railroad and electrical matters, is eminently adapted for the operation of trains under everyday railway conditions. The Westinghouse system involves the use of compressed air for moving the current-controlling apparatus, electro-magnetic valves governing the admission of air to the controlling cylinders and low voltage electric circuits running



from car to car for controlling the action of the magnet valves. The connection for the low voltage circuits are the only ones which have to be established between the cars of the train, no air connections being required outside of the ordinary brake hose. A complete equipment for each motor car consists of two or four electric motors, a controller very similar to the controllers used on ordinary street cars, and one or two motormen's controlling switches, from any one of which all the car controllers on the train may be operated. The car controller, as stated, is similar in design to the ordinary form of hand controller which has been successfully used on electric street

cars for many years. It consists essentially of two drums which revolve in bearings, and stationary contact fingers which make contact with points upon the revolving drums. The large, or main drum, opens the main circuit and makes the motor and resistance combinations; the small drum reverses the motors. A multiple control switch is placed at one or both ends of each motor car, and by means of the one at the front of the leading car the motorman controls the action of the controllers on all the motor cars in the train. Some of the points of superiority of the system over other systems may be stated as follows:

It employs compressed air for operating the control apparatus and thereby uses a powerful and reliable agency. It uses the standard type of controller and standard types of valves and magnets, the latter having been used for years in the operation of the Westinghouse electro-pneumatic system of switches and signals upon the largest railways in the world. The control circuit is isolated from the main power circuit, and is, therefore, not affected by a momentary interruption of current due to ice and sleet on the rails, or other causes. With the low voltage current, ground and short circuits at the connectors between the cars during stormy weather or fires resulting from high voltage circuits through the train are entirely eliminated. The current for the motors is simply collected from the third rail, led through the local car controlling apparatus to the motors, and then back to the service rails, and does not pass from car to car. The controlling apparatus is so located that the motorman may have convenient access to all parts from the platform.

The motor circuits on any car are automatically opened or closed at the will of the motorman. All controllers are automatically turned off by the application of the automatic air brakes, which is an important point since in case of a train breaking in two the brakes are automatically applied and at the same time the power is shut off. With other systems under some circumstances, it has been found impossible to shut off the power from some of the cars, while in the Westinghouse system there are a number of ways in which this may be accomplished, greatly reducing the possibility of accident. Both controllers and circuit breakers are opened by a breaking in two of the train, this action being independent of and in addition to the effects obtained by the application of the air brake. The controllers may be operated by hand, thus permitting the train to run to a terminal station in case of any derangement of the controlling apparatus. The operation of both brakes and controllers is effected by a single air hose connection between the cars, the air compressor which furnishes air for the brakes also furnishing air used to operate the controllers.

The Brooklyn Elevated will equip all its new cars with four motors each. The 150 cars now in use equipped with the Westinghouse system have each two motors. The trains on the road are made up of five or six cars, two or three of which are usually motor cars. When these trains reach the suburbs they are broken up into smaller units of one or two cars, each of course containing a motor car, and the smaller trains branch off on different divisions. By the use of this system it is possible to operate cars individually as on ordinary trolley roads, or to make them up into trains of any length. Also, any proportion of motor cars may be used, making it possible to obtain any desired amount of power for starting the trains quickly, which is necessary in any service involving many stops.

ENGINEERS' CLUB OF TORONTO.

The annual meeting of the Engineers' Club, of Toronto, was held in the club rooms, 94 and 96 King St., W., Toronto, on the 7th of January. The reports of the various officers and committees for the past year were presented, showing the club to be in a good position. It has now over one hundred members. The following were elected officers for the ensuing year: President, C. H. Rust; first vice-president, C. M. Canniff; second vice-president, Capt. K. Gamble; treasurer, H. F. Duck; secretary, Willis Chipman; directors, R. A. L. Gray, R. F. Tate, W. H. Patton. The following standing committees were appointed: Finance—T. A. Culverwell, chairman; F. L. Somerville, C. W. Dill, W. E. H. Carter, Norman McLeod. Rooms—J. G. Sing, chairman; W. J. Bowers, A. B. Barry, A. C. Larkin, A. A. Bowman. Library—G. R. Mickle, chairman; C. E. Cooper, H. S. Holcroft, A. J. Van Nostrand, A. M. Wickens.

A special meeting was held January 22nd, when the members of the Ontario Association of Architects and of the Toronto Architectural Eighteen Club were present to take part in a discussion on Concrete Construction. H. F. Duck opened, and was followed by F. W. Barrett, of the Expanded Metal Fireproofing Co., who went into the matter fully, giving the result of numerous tests as to the strength and fire resisting properties of concrete, especially when used in connection with expanded metal. The discussion was taken part in by a number of others, and brought out the fact that concrete is destined to become more and more a material for construction, displacing to a large extent stone.

Arrangements were made for a curling match between the engineers and architects at an early date.

HARDENING ANNEALED NOVO STEEL.

As United States engineering firms have taken up the "Novo" process for tempering and hardening steel with much success the following hints on the working of it on taps, reamers, cutters, drills, etc., will be of interest: After a tap has been machined, and is ready for hardening it should first be placed into a gas furnace and heated up to a good orange color heat, and then taken out and placed into a lead bath covered with powdered charcoal, the lead having previously been heated to a full white heat or as hot as it is possible to heat lead. Heating the tap first in the gas furnace assures the same from any possible danger of warping which might occur were the entirely cold tap suddenly submerged into the white hot lead. In order to get the lead to the white heat, it is necessary to use graphite crucibles, as an ordinary cast-iron pot would not stand the heat and the bottom would be apt to drop out. The tap thus heated in lead to the required full white heat, which is absolutely necessary for the hardening of this steel is prevented from scaling on account of absolute exclusion of air. When the tap has acquired the proper full white heat in the lead, it should be dipped into oil, any good fish oil, linseed or cotton seed oil, will answer the purpose, and entirely cooled off in the oil, but where the shank of the tap is considerably smaller in the diameter than the body of the tap, the shank should not be submerged in the oil, thus allowing the part outside of the oil to remain softer than the balance of the tool hardened in the oil. Taps larger than 1-inch diameter by 6-inches long should be dipped gradually and slowly into the oil. When the tap is taken from the oil, it will have a silvery white appearance and should this not be the case, it is a sure sign that the tap has not been heated hot enough in the lead.

Novo taps hardened in the above manner will come out correct to size and with perfect teeth and no scale, and will be so hard that no file will touch them. The temper of the tap should then be drawn in hot sand to a deep straw color, but the drawing of the temper should not be checked in any way and the tap when it has reached that color should be taken from the sand and allowed to cool off in the air. The lasting and cutting quality of the taps can be greatly improved by giving the teeth of the taps a good backing. It is claimed that the speed of Novo taps can be safely increased three times that of the regular tool steel taps, if the shank is reheated in the lead to an orange heat and the shank only placed into lime and permitted to cool off.

Reamers and drills and all special cutters of this kind should be hardened in the above manner, only with the exception that for reamers above 5/8-in. diameter it will not be necessary to draw temper after hardening, and also the shank may not require reheating or softening.

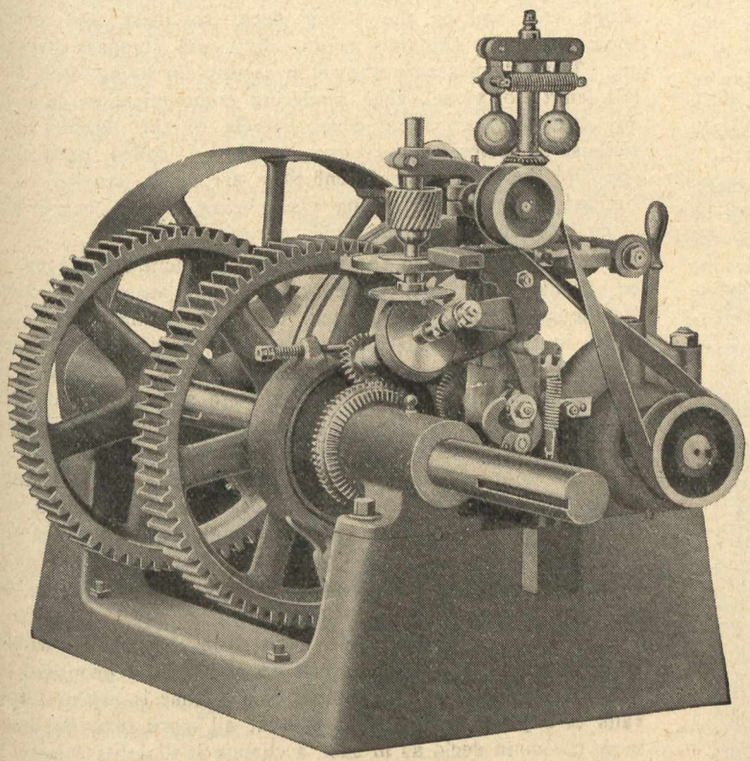
Milling cutters should be hardened at a white heat, same as the taps, in oil. Cutters which can be ground into shape, and where the scaling is not objectionable, may be heated in an open fire to a white heat and plunged into oil or small cutters and end mills into hot water. The temper

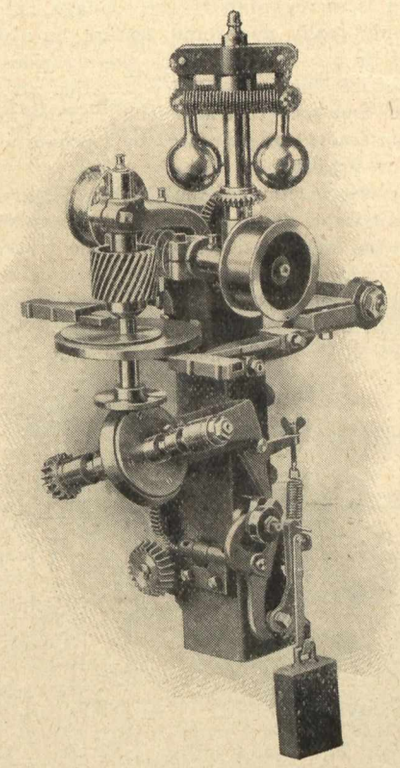
need not be drawn except on cutters with very fine delicate teeth or on extremely large cutters, to take the hardening strain out. When you draw the temper, then draw to a straw color.

Wm. Abbott, 13 St. John street, Montreal, has been appointed Canadian agent for the makers of this steel.

WOODWARD FRICTION WATER WHEEL GOVERNOR.

The power to operate this governor is supplied from the main shaft of the water wheel installation and is delivered to the shaft of the governor by the large pulley seen in the rear of the cut. On this shaft is mounted a compressed paper friction which is almost indestructible and the wear is inappreciable. Supported by sleeves on this main shaft are two pans, which, when pressed against the friction, move the gates of the turbines in either direction by means of suitable gear connection to an intermediate shaft seen in the front of the cut, this intermediate shaft being connected in turn to the turbine gate shaft. The speeder balls of the governor are separately driven from the main shaft of the installation. There is also a cam continuously revolved by means of the belt shown in the cut and a spiral gear, which can be plainly seen in the foreground. This cam will be noticed just below the spiral





gear. As the speed changes the rod of the speeder raises and lowers, carrying with it the tappets arms and tappets. These tappets can be seen one above and one below the cam mentioned above. As soon as a change of speed occurs, either one or the other of the tappets, as the condition demands, is engaged by the cam and forced out from its center. This motion is then conveyed through suitable crank shafts to the main shaft on which is mounted the friction, and as this shaft is forced back and forth the friction is brought to bear on either the opening or closing pan. When the speed is normal this cam revolves between the upper and lower tappets without engaging either. The cam mechanism is capable of very close adjustment, enabling the governor to act on so small a change of speed that for the ordinary conditions of lighting service, no perceptible variation of speed will be allowed. At the same time the governor will not act upon the gate when the speed and load are steady, and consequently there is much less wear on the gate mechanism than with a governor that keeps the gate in continuous motion, although so slight as not to affect the speed. Just below the cam and fastened to the same shaft is a concave disk. Below this disk will be seen the compensating wheel which travels loosely upon an oblique shaft. This disk can be clearly seen in the cut. This oblique shaft is geared to the intermediate shaft so that it revolves only when there is a movement of the gates. It is further provided with a square thread as is also the compensating wheel. The object of this device is to avoid racing of the governor, and the principle is as follows: When the speed is normal the compensating wheel seeks the center of the disk which is supported upon it because this disk is constantly revolving with the cam. When a movement of the gates occurs the compensating shaft is revolved and the wheel will travel along its shaft in such a direction that it will separate the cam from the tappet when the gate has been moved to that point which will give the correct speed, after the momentum of the machinery has been overcome. During this interval the disk will return the compensating wheel to the central position. This device can be designed to properly compensate for any condition as the time element can be varied, not only by varying the pitch of the screw, but also by varying the speed of the oblique shaft with a change of gears. This compensating mechanism is the same as has proved so satisfactory in the vertical model and absolutely prevents racing. This governor is the largest and most powerful one manufactured. The friction wheel, twenty-four inches in diameter and twelve inches wide, is made with sufficient surface to transmit, if necessary, 5,000 foot pounds per second to the turbine gates. All the gears of this governor are cut from the solid and are wide face and coarse pitch. The shafts are of ample size and are well supported in large bearings. The friction shaft, which is the only shaft that runs continuously, has ring oil bearings and from them there is a continuous supply of oil carried to the hubs of the pans which are loose on the shafts. These pans are so constructed that it is impossible for oil which may work out of the bearing to get onto the friction surface. All the parts are made to be interchangeable. Special tools have been made to accomplish this, and should any part give out from wear or accident, a perfectly fitting part can be provided without delay. For operating generators in parallel, there is an equalizing device that will give perfect distribution of load when the proper adjustments have been made. This model has been in successful operation for over a year and as it follows the same principle of design as the vertical type, it can be said that it was never in an experimental stage. The Ottawa & Hull Power & Mfg. Co., of Hull, Que., have had one of these governors in use for some time on their temporary plant, and are now installing two of them on their large station, which when complete will have an output of 10,000 h.p.

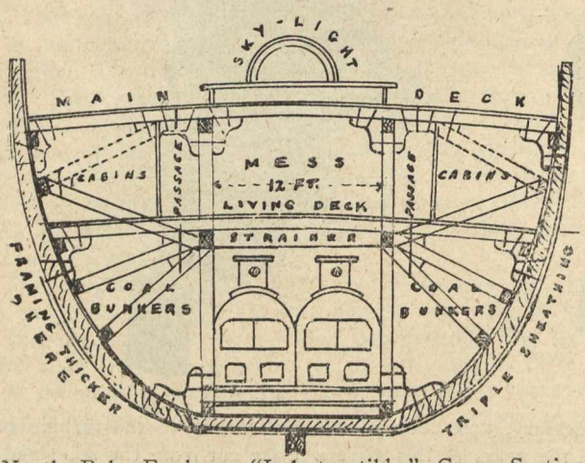
Each governor will control four 51 inch horizontal cylinder gate turbines, operating the full range of gate in five seconds. Each set of four wheels is connected to 1500 K.W. generator. Two of the small vertical governors are installed on the exciter units. This governor is made by the Woodward Governor Co., Rockford, Ill.

A VESSEL FOR NORTH POLAR NAVIGATION AND DISCOVERY.

BY CHAS. BAILLAIRGE, C.E., EX-PRESIDENT OF THE QUEBEC GEOGRAPHICAL SOCIETY.

Some months ago there appeared in your columns an article of mine on Bernier's proposed voyage to the North Pole, detailing how he was to steer to get there, and what he had to do in the astronomical way to locate the exact position of the Pole, and prove that he had actually solved the problem, or stood on that particular point of the earth's surface where, during 24 consecutive hours, "Polaris," or the so-called North Polar star, had been observed to remain, during a whole revolution of the earth at its exact elongation (co-declination) from the polar zenith or true pole of the heavens. You also, on another occasion, after an interview with the captain, published diagrams of his proposed vessel, that is in regard to its size, tonnage, cut and rig. Now, sir, the only really important feature in a vessel for this purpose is its cross-section, with sloping sides to allow of a pressure of ice, having a tendency rather to lift it than to crush it in, and such that any such crushing tendency of the ice be counteracted or prevented by a proper system of inside strutting or staying.

At the last meeting of the Quebec Geographical Society, held to hear Capt. Bernier and have him explain his plans, he submitted for the consideration of the society and of the engineers present, plans made by a German engineer for one of the South Polar expeditions, as also an improvement on this in point of ice resisting capacity, by a Mr. Auger, one of Quebec's best shipbuilders. Now this vessel is trussed



North Pole Explorer "Indestructible," Cross Section Amid-Ships.

Centre of vessel throughout, clear of all obstructions but masts, for engines, boilers, carpenters, machinists, etc. below, and mess, kitchen, larders, smoker, cabins, etc. above.

Trussed frames of 12" x 12" timber at 4 ft. centres whole length of vessel leaving 3 ft. clear between them for bunks, cabins, stairs, scuttles, etc. Passages run whole length both sides.

in a way to leave the hold free of obstruction for boilers, engines, coal, etc., but in a way to render it dangerous in so far that any tendency to upheave the bottom or bilge of the vessel by ice pressure would have nothing to counteract it from within, and such again that the decks and bottom being absolutely unconnected, the action of the lower stanchions would be such as to force up the decks in case of a tight hug from without.

I therefore now send you an amended section of how I consider the hull should be stanchioned, stayed or strutted, braced and bound into one solid, unyielding and absolutely indestructible system of framework, while, as stated in legend on diagram, leaving the whole centre of the vessel, throughout its entire length, completely free of any obstruction whatever to its internal economy. The trussed bents or ribs or members of the vessel are at 4-ft. centres, and supposed to be of stout, or say 10 to 12 inch timbers, while the intermediate spaces, composed of say three ribs or members of double timbers, breaking joints, and covered on the outside with triple sheathing, must be considered capable of resisting any force to be brought to bear on a space of only three feet square; in fact of only 18 inches radius, the spaces between the abutting points of deck beams, struts and braces, being, by the system of stiffening used, reduced to that just mentioned, throughout the whole length of the vessel and over so much of its height or depth of hull as likely to be ice bound. The whole system of bracing to each and every of the trussed members is in one and the same vertical plane, and abutting against the strainers as shown. This system of construction is such, while rendering the vessel indestructible by ice pressure, as to allow of division of the interior into rooms, cabins, closets, wardrobes, stairways, hatches, coal or other shutes; the spaces between the trussed members being ample for berths or bunks, or clubbing them together in twos, threes or fours, for cabins for the men and officers of the expedition. Again, these 3-ft. spaces between trussed members are just suited to the storage and piling up of barrels of oil, pork, fish and other provisions, while the central portion of the vessel all along can be devoted below to boilers, engines, carpenters' and engineers' workshops, etc., and on the living deck, to mess and other rooms, kitchen, captain's room, chart and compass rooms, etc. The side passages shown in section on living deck run full length of vessel, thus rendering communication easy in any direction, and along which barrels of the lighter provisions, as biscuits, etc., may be freely rolled until just opposite the 3-ft. compartment they are to be stowed in; a similarly floored space being made below for the barrowing of coal to boilers, or for other purposes.

If, notwithstanding the vessel's indestructible make-up, it be considered prudent to separate it into water-tight compartments, nothing will prevent this from being done, with doors in the bulkheads at passages, and at this higher level, affording more time to get at and close on an emergency; with corresponding doors below, though as high as possible from the bottom of the hold, to allow of some flooding before the water reaches them and thus again giving time to slide the doors to or close them as required. There should at any rate be a longitudinal bulkhead between boilers, so that in case of a rush of water extinguishing the fires on one side, the others may remain in working order, and allow the vessel to proceed at half speed while repairing the breach.

The only other pertinent suggestion the writer would make, is that the vessel be canvassed, as it is now proposed to do with freighters in the United States, that is, without top rails of any kind, and in a way that all work may be done from the main deck, as in such a climate it ill befits a heavily and awkwardly bemittened man to have to go aloft to furl and unfurl sails, and because, what is just as important, if not more so, only half the hands are required to manipulate the sails from deck level, or when not necessary to go aloft for the purpose.

Capt. Bernier has been indefatigable in his endeavors to raise the funds for his expedition, and there has been a tendency to wait and see whether this and that one would be successful in the proposed discovery of the end of the earth's axis, but Peary and Baldwin have returned, and the problem is still unsolved. Bernier, I believe, saw Ziegler in relation to a subscription for the purpose. Ziegler, of course, could not well accede to this proposition while patronizing an American venture, but said, so I understood, "if Baldwin does not succeed I am bound to be successful, and you can then come to me and we shall see." "Well then," said the writer to our Canadian would-be pioneer, "if the lower provinces will do nothing for you, and especially Quebec, your own, your native province, while upper Canadians have generously promised you to do their share, and Laurier to give you $60,000 towards the voyage when you shall have raised an equal sum elsewhere, then fall back on Ziegler, and if we cannot have the whole glory of the enterprise, and a half loaf is better than no bread, both nations will have contributed in

the capture of the pole; the one by paying the piper, while at any rate the piper or discoverer will be a Canadian, and thus give Canada its share of the honor of discovery."

TRACTION SYSTEM FOR INTER-URBAN RAILWAYS.

The Westinghouse Electric and Mfg. Co., of Pittsburg, has recently contracted for the equipment of a line from Washington to Baltimore, about forty miles in length, with a branch to Annapolis, fifteen miles in length, with alternating current apparatus.

This contract marks a step in advance that has long been awaited by engineers. In the ordinary method direct current is fed to the trolley line for the car-motors. For city lines the current is often generated as direct current, but for long distance inter-urban roads this would involve a cost of copper conductors entirely prohibitive. To meet this objection a system has been used thus far in this country involving the generation of alternation currents at high pressures of from 10,000 to 30,000 volts and the transmission of the same to substations where by means of transformers and rotary converters the current is supplied to the trolley wire as direct current at the usual railway voltage from 500 to 650 volts. The substation has always been an undesirable feature, on account of cost. The plans that have been proposed to do away with this feature are numerous, but hitherto none have appealed to practical street railway engineers. In Europe the polyphase induction motor has been used to some extent, but it implies the use of two or three overhead wires, and the characteristics of the induction motor in regard to starting and average efficiency in railway service are said to be not of the best. Other systems which have been proposed involve the use of single-phase motors upon the cars driving generators which in turn supply power to the motors on the axles. However, this involves the placing of a substation upon the car itself. Details regarding the new system of the Westinghouse Co. are not at hand, but it is known that by its use the limitations of the induction motor and the disadvantages of the multiplicity of overhead conductors as well as the great cost of the system just described will be avoided. For the road referred to single-phase, alternating current will be generated in a main power house by three 1500 K. W., single-phase, Westinghouse generators, delivering current at 15,000 volts. Current will be distributed from the power house at 15,000 volts to transformer stations at suitable intervals along the line. These transformer stations will contain only stationary transformers with the necessary switches and fuses, but no moving machinery, and therefore will not require the presence of an attendant. From these stations current will be fed to the single trolley wire at 1,000 volts. The pressure of 1,000 volts which has been adopted for the trolley wire is not a necessary part of the system, as a much higher voltage could have been used if it had been deemed advisable by the engineers of the road.

The cars are to be equipped with four motors, each of 100 h.p. The motor, which is the novel part of the equipment and the key to the entire system, is a variable speed motor, having characteristics adapted to railway service and in all respects equal to the present direct-current railway motor. A speed of 40 to 45 miles an hour will be attained, which can be increased to 60 miles if necessary.

It is to be remarked that this latest development in electric railroading follows in the path already traced by electric lighting. The first electric lighting systems employed direct current at low voltage, but as the area to be supplied increased, this involved a cost of copper cables. To meet the difficulty alternating current distribution at high voltage was adopted, wih rotary converter sub-stations to enable the current to be distributed on the existing mains as direct current. However, most electric power plants now being installed distribute low voltage alternating current directly to the lamps and motors, thus avoiding the expensive rotary-converter substations.

—Surveyors are in great demand in Western Canada at present. Besides all the regular survey work now going on there are railway lines to be plotted, timber limits to be surveyed and a great deal of private work to be done.

A NEW MATCH.

Another kind of match, intended to supplant phosphorus matches, has lately been introduced in the Swedish market. The inventors of the new match are Messrs. Landin and Jernander, of Stockholm, who have patented their invention in several countries. This match looks like the well-known potash and paraffin matches, which, however, by reason of the fact that they contain poisonous phosphorus, come under the same prohibition as the old and worthy lucifer match. But the new match which has been named "Repstickan" (the scratch match), possesses a property which the potash match lacks—viz., it is damp proof and can therefore be lighted against a damp or wet surface, provided this is hard. The inventors claim that Repstickan is the least poisonous match in existence, the safety match not excepted.

LACOSTE'S STEAMSHIP BRAKE.

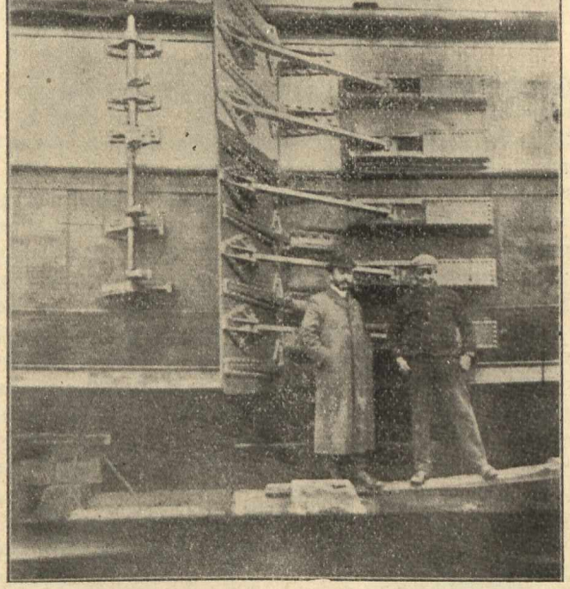
In the December number of the Canadian Engineer, there appeared a notice of a steamship brake, invented by L. J. Lacoste, of Montreal. We give herewith an illustration of the brake, together with the official report of James Howden, superintendent of dredging for Canada, on its operation as applied on the Government steamer Eureka. The report is as follows:

DEPARTMENT OF PUBLIC WORKS,

Montreal, 1st December, 1902.

To the Right Honorable Sir Wilfrid Laurier, G.C.M.G., Prime Minister of Canada, Ottawa, Ont.:—

SIR,—I have the honor to send you my report on the test made with Mr. Lacoste's ship-brake, which was adopted on the Government steamer, Eureka. A private test was made on the 25th of November last in the Lachine Canal,



and the following day the steamer was taken to the harbor of Montreal, where the tests were continued for upwards of a week, the most severe being in St. Mary's current. After the Eureka had attained the speed of 11 miles an hour, by the log, the fins were opened on both sides, steam shut off, and the vessel was brought to a full stop in less than her own length. Subsequently, the fins were again opened, the engines were reversed, and the vessel was stopped in about half her length, or within a distance of fifty feet. Tests were also made of the turning of the vessel in a limited space at full speed with one fin opened, and they were very satisfactory, the Eureka turning within her own length. In order to test the strength of the fins, one was opened when the steamer was going up the current with her engines at full

speed, and the apparatus successfully withstood the strain. The tests were all most satisfactory and thoroughly demonstrated the great utility of the invention. Although the apparatus was not placed in a recess, no disadvantages were experienced in the manoeuvering of the vessel.

(Signed), JAMES HOWDEN,
Superintendent of Dredging, Canada.

The cylinders of the brake used on the Eureka were 7-in. by 3-in., 13-in. stroke. The brake on the Eureka was rigged on the outside of the boat, but on a boat built to use it, there will be a recess provided, so that it will come flush with sides.

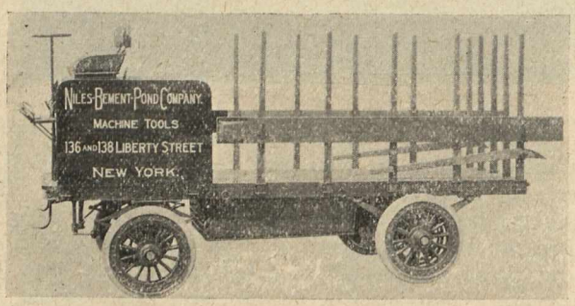
Lloyds' statistics are said to prove that over 50 per cent. of accidents are due to collisions and strandings, which this brake is calculated to prevent to a very large extent.

Louis Lacoste, Inventor of the Patent Ship Brake.

Mr. Lacoste is now promoting the Parent Company to handle his invention. He has already received offers for United States rights.

A NEW ELECTRIC TRUCK.

The illustration shows an electric truck in use by the Niles-Bement-Pond Co., of New York. The body of the truck is 16 ft. long by 5½ ft. wide. It is built on the Gibbs system of steel frame construction, with what is known as pedestal running gear, instead of the reach system heretofore used on electric vehicles. The pedestal is a single steel casting fastened to I beam body frame, and has diagonal brace bars for support. The axles are placed into the jaws of this pedestal, and have absolute freedom vertically, but none whatever laterally. This overcomes the intricate mechanism resulting from split axles, differential gears, etc. The I beam steel frame relieves the vehicle body of any strain and tendency to buckle, and at the same time affords substantial support for suspending the battery and leaving the inside of the wagon body absolutely clear. The battery is made in



sectional trays which slide out at either side. The power is furnished by two motors of General Electric make, operating independently on rear wheels. Tires are 6-in. solid rubber. Forward springs are full elliptic, the rear one-half elliptic. A double brake operates on inside of gear wheels, being worked by foot pressure. The controller has four speeds ahead and two reverse, maximum speed of truck being 5½ miles per hour. The battery has radius of 25 miles on a single charge. An important and labor saving device peculiar to this style of truck is the electric windlass which is placed forward under the seat. This is operated by an independent motor and controller, the power being derived from the storage battery. This apparatus will hoist five tons at rate of 8 feet per minute, and has all safety appliances, including brake, ratchet-pawl and reverse controller.

AN AMERICAN IRON MASTER.

John Fritz was recently honored with a dinner in New York as a mark of appreciation for what he has done for a generation to place and keep the United States in the front rank of iron and steel producers, and who contributed more than any living man to the means which have enabled that country to attain its present pre-eminence in the metallurgical industries. He was the son of a small farmer in Chester county, Pennsylvania, but left the uncongenial occupation of tilling the soil at the age of sixteen after very little and extremely intermittent schooling, and found work in a machine shop in Parkersburg. Before many years he was sent to Safe Harbor, Penn., to erect and install the machinery for a rolling mill. Next he was manager of an anthracite blast furnace at Norristown, and in 1854, at the age of 32, was engaged to remodel and rebuild the plant of what is now the Cambria Steel Company. In 1860 he returned to the Lehigh valley to begin the erection of what has since developed into the Bethlehem Steel Company's plant, and under his hand it grew to its present rank and importance. He designed and built the plant needed for the creation of an American navy, and did not retire from its active management until his 75th year. He is a man of the highest and most amiable character, widely beloved and everywhere honored.

WATER WASHED SAND FOR HIGH GRADE WORK.

The Sand and Dredging Co., of Toronto, have had in operation the past season a steam barge with a sand-dredging apparatus, with a daily capacity of 80 yards of water-washed sand, suitable for the best quality of concrete, mason work, brickwork, or plastering. This sand is not lake shore sand which has been rolled along the beach for years until each grain is worn round, but it is taken from deep water, and is sharper and more angular than the best bank sand, and absolutely free from any trace of loam, which is a drawback to almost all the bank sands around Toronto. Examples of the class of work which has been done with water-washed sand are seen in the new Dairy Building, and the foundation and cement blocks in the Art Gallery Building at the Exhibition grounds, and Spadina avenue pavement foundation, from Queen street to College street. The city engineer says he never saw a better piece of concrete laid in Toronto than the latter. Appended will be found a report of tests which show the advantage of water washed sand.

Report of Comparative Tests of different Sands for Concreting Purposes.

All tests made with German Hercules cement. All briquettes made with same percentage of water in the mixtures. All mixtures 3 parts sand to 1 part cement. Results are tensile strength in pounds per square inch:

	Standard Quartz.	Pit Sand.	Coarse Water Washed Sand.
24 hour test	64 lbs.	51 lbs.	52 lbs.
7 day test	177 lbs.	157 lbs.	213 lbs.
28 day test	275 lbs.	212 lbs.	300 lbs.
Specific gravity ...	2.62	2.67	2.66

(Sgd.) Chas. W. Dill,
December 29th, 1902. Assistant Engineer.

It will be noted that in 7 days the water washed sand showed an additional strength for same cement of 36 per cent., and in 28 days 41 per cent.

STEAM TURBINE GENERATING PLANT.

A steam turbine for generating power is being installed by the Rockland Light & Power Co., of Nyack, N.Y. This company has for a number of years been engaged in furnishing light and power to territory around the town of Orangeburg, N.Y., where the generating station is located. The territory embraces the towns of Nyack, Grand View, Piermont, Sparkhill, Tappan, Orangeburg, Blauvelt, Nanuet, Spring Valley and Monsey, and is covered by five independent distributing systems, each fed by a separate transmission circuit from the power house at Orangeburg. The load consists mainly of incandescent lighting, but motors of considerable capacity are installed at a number of points. The present equipment of the station comprises a number of different types of boilers, engines and generators. The latter are belted outfits, and will be largely replaced by the new steam turbo-generator unit. The present system is a twophase, 3,300 volt alternating current system, each generator operating independently upon a separate circuit. In the new arangement, provision has been made for operating the entire system from the turbo-generator unit, the remaining machinery being held in reserve for periods of heavy load. The turbine is of the standard single cylinder, multiple-expansion type, built by the Westinghouse Machine Co., of Pittsburg, Pa., and is of the same type as installed in other power works, notably the Westinghouse Air Brake Company, Hartford Electric Light Co., and the Yale & Towns Mfg. Co., of Stamford, Conn. The turbine will be furnished with superheated steam at 125 lbs. pressure, this being accomplished by an independent superheater, with which a superheat of 100° to 125° F. will be obtainable. The mechanical equipment includes also a Snow condenser, capable of maintaining a high vacuum, an Alberger cooling tower for cooling the circulating water, and a mechanical draft outfit. The turbo-generator will be of the type recently standardized by the Westinghouse Electric and Manufacturing Company, for this class of service, and will furnish two-phase, 60 cycle current at 3,300 volts, directly to the station bus, from which the several transmission circuits extend in various directions to the local centres of distribution.

ONTARIO ASSOCIATION OF ARCHITECTS.

The annual convention of the above association was held at Toronto on the 13th and 14th of January. A number of interesting papers were read and discussed, one of the most interesting being by E. C. Shankland, C.E., of Chicago, on Modern Construction Methods, in which he referred to the growing use of concrete and the advantages it possesses as a building and foundation material. The following were elected officers: W. L. Symons, president; Geo. W. Gowanlock, 1st vice-president; Prof. C. H. C. Wright, 2nd vice-president; A. R. Denison, treasurer; Wm. R. Grey, registrar. A new order was formed in the association, to be known as the Order of Honorary Presidents. The charter members are Kivas Tulley, Henry Langley, James Smith and Joseph Connolly.

QUICKSAND.

Very little is known by the general public about quicksand, remarks a contemporary, and that little is usually obtained from novels. Such information is usually wrong, being composed of a pinch of truth and a handful of fiction. The sensational novel goes so far as to give to quicksand some attributes that belong only to living creatures. No ordinary observer could distinguish quicksand from any other if it were dried; and if he wished to restore its fatal property artificially, he would, in all probability, fail. Suppose he fills a bucket with it in the dry state, and soaks it with water; it does not in consequence become mobile. If he drains the water off from the bottom, the sand will be found wedged firmly in place, and if the water be measured it will be found to equal thirty per cent. of the bulk of the sand, or about twenty per cent. of its weight. From this we may infer that a cubic foot of dry sand weighs nearly 94 pounds. This, for sand, is very light weight, for there are other qualities of sand which weigh as much as 171 pounds. Quicksand, when examined under the microscope, will be seen to have rounded corners like river sand, as distinguished from angular or sharp sand, which will pack more solidly than the other. It is quicksand that is used in the hour-glass and in the smaller egg-boiler, partly because of its fineness and partly because it does not obscure the inner surface of the glass by scratching. The lightness of quicksand is the quality which will lead us most surely to the cause of its reputation, and to illustrate this, the bucketful of sand must be loaded with water from below, and made to overflow very slowly. The upward current will be found to loosen the sand, and to raise the surface very slightly, separating and lubricating the particles so that they are easily displaced. The bucket now contains quicksand, and this sand, from the support it receives from the water, has its weight or supporting power reduced. In the dry state it weighed nearly 94 pounds, but if weighed in the water it is reduced to 32½ pounds, and its mobility prevents any animal from walking on it. The mixture of sand and water weighs quite 112 pounds per cubic foot, or nearly twice the weight of water, and bulk for bulk, nearly twice the weight of a man, but it is too thick to swim in, and the person engulfed would soon be too exhausted to escape. He would probably die of suffocation if not drowned by an advancing tide, for quicksands are found mostly within the influence of tides. He would not be swallowed by the quicksand, because it is so much heavier than his body. Quicksands require in all cases an upward current which is not quick enough to form what is called a spring or fountain. It may be formed in two ways—in tidal rivers and on the shores of tidal seas the rising tide may saturate a porous stratum of ground below high-water mark, and when the tide falls a return current is established through the same porous (sandy) ground with a sufficient velocity to loosen the sand, as above described. This sand, as soon as the rising tide reverses the current, ceases to be quick. The other case is that when a slow current of fresh water finds an exit through a surface of sand above or below water. This is a permanent quicksand. Any sand and almost any material might have the quality of quicksand imparted to it by means of a suitable current.

FLASH BOILERS—WHY THEY DO NOT SCALE.

When flash boilers were first proposed for motor cars the experts who had not tried them said the scale deposited in such narrow tubes would choke them in no time. When the bolder spirits found that they did not choke at all the experts said the scale was blown off the inside wall of the tube by the rush of steam, or else cracked off by the heat of the tube. My theory, says J. Brown in the English Mechanic, is that scale never gets on. The experts were thinking simply that all boilers scaled, therefore this one would. They omitted to consider an essential difference. In ordinary boilers the water is in intimate contact with the iron, and the lime in solution, gradually depositing in crystalline form by evaporation of the solvent, fixes itself on the solid with which it is in contact. In the flash boiler the water is not in contact with the metal, but is separated from it by a layer of steam through which the heat passes to the water. Any solid deposited by evaporation is therefore isolated by this steam layer, and forms in small particles in the water. It has no chance to attach itself to the metal tube. The following very pretty and simple experiment illustrates this: Put into a clean silver spoon a few drops of lime water and evaporate to dryness by boiling over a spirit lamp. The lime is deposited on the silver in a rather tenacious coating. It may be cleaned instantly with a drop of dilute hydrochloric acid. After drying and polishing the spoon place it over the lamp and keep it hot while two or three drops of the lime water are allowed to fall into it. The liquid immediately assumes what used to be called the spheroidal state, i.e., it gathers up into a pretty head, which, supported on its layer of steam, runs about the bright bowl of the spoon. At first it is limpid, but soon becomes turbid by deposit in it of the lime in small particles. The motion of these indicates

violent internal emotion in the spheroid, and there is evidently evaporation, which rapidly reduces the size of the spheroid till the liquid, having all gone, there remains only a little heap of loose particles not adhering at all to the metallic surface of the spoon, which has not even been dimmed in the process.

WEIGHT OF ICE-LADEN TREES.

The wholesale breaking of limbs from ice-incrusted trees during a storm at Philadelphia led some persons of enquiring minds to experiment with a view to determining how much more a rain-soaked, ice-covered limb weighs than one that is dry. A resident of Overbrook hauled into his house a limb that the storm had blown from a stately tree on his lawn. When weighed the ice-covered, rain-weighted limb tipped the beam at fourteen pounds. A day or two later the same limb, dry, weighed but 1½ pounds. More remarkable was the experiment conducted by a Chestnut Hill man. A limb from a maple tree snapped short, due to the covering of ice that weighed it down. This fragment was put on the scales and seventeen pounds was recorded. Two days later, when dry, the limb weighed precisely one pound. Taking this last experiment as a criterion the trees at Philadelphia weighed about seventeen times more in the storm than in dry weather.—Philadelphia Press.

EXAMINERS AT TORONTO UNIVERSITY.

The following have been appointed examiners at Toronto University this session: Civil engineering, W. T. Jennings, C.E.; mechanical and electrical engineering, R. A. Ross, E.E.; mining engineering, G. R. Mickle, B.A.; mineralogy, T. L. Walker, M.A., Ph.D.; geology, A. P. Coleman, M.A., Ph.D.; metallurgy and assaying, G. R. Mickle, B.A.; thermodynamics and hydraulics, R. W. Angus, B.A.Sc.; theory of construction, J. Galbraith, M.A.; properties of materials, C. H. C. Wright, B.A.Sc.; electricity and magnetism, T. R. Rosebrugh, M.A.; analytical and applied chemistry, J. W. Bain, B.A.Sc.; geodesy and astronomy, L. B. Stewart, D.T.S.

THE TELEPHONE PROBLEM.

Editor Canadian Engineer:—

We note with interest your editorial on "Telephony in Canada." You will kindly pardon us for offering our opinion with reference to this, but we wish to say that while we believe that the tendencies are toward a national or even an international system, with its policy regulated by the Government or Governments, we do not believe that the ideal solution would be for the Government to purchase present systems of the Bell companies. This would be, in our opinion, a very poor investment on almost any basis, as their systems practically all need rebuilding in their outside construction, which costs as much or more than putting in a new plant, and nearly all their systems are equipped with antiquated apparatus and need a complete new outfit. Practically all the Bell companies have is their franchises, which in fact, belong to the people, and their contracts, which in every instance can practically all be secured by a new company starting with a first-class system and in most instances be more than doubled. On the other hand, however, their property cannot be confiscated even though their profits have exceeded many times their investments.

We believe that the quickest and best solution is the policy adopted by the towns of Port Arthur and Fort William with reference to this question. These towns have confiscated no property, they have simply started a straight business transaction the same as any individual corporation would have a right to do.

We wish to also say, with reference to the statement regarding the Grand Rapids, Wisconsin, exchange, that while their original charge to subscribers may be a fair basis for a co-operative system, we do not believe, however, that they can continue to pay back the amount in dividends, as stated in the article, and operate the plant by itself, and take care of any emergency such as breaking down of the pole line in case of a sleet storm or accidents of this kind, which should be provided for. While there have been less failures in independent telephone exchanges in the States than any other line of business, not excluding banks, the failures that have occurred are practically all traced to systems where the rates have been put upon a basis without taking into consideration depreciation or accidents. To make independent telephony a success, rates in the first place should be encouraged upon a fair and equitable basis, and, secondly, that the plants should be installed, not at the lowest possible original cost, but in the most durable and efficient manner possible.

INTERNATIONAL TELEPHONE MFG. CO.

THE FUEL PROBLEM IN CANADA.

Editor, Canadian Engineer,—

Sir,—In reading "Fuel Famine," in December, I agree with much that he suggests about sources and saving of fuel. I would like also to suggest a few sources and conditions which are peculiar to Canada.

1. Though coal is not to be expected below the carboniferous strata in any case, yet there may be an absence of the intervening strata between it and the archean rocks so common in the greater part of Canada. Between the coal measures of the Ohio Valley and the granite vertebra of North America is a long distance; but on the northern slope towards James' Bay, the series is more closely grouped, and coal may be expected in the great clay belt recently explored by the Ontario Government, or even farther south. I received a piece of cannel coal from a hunter, who picked it up near the head of Moose Waters and about 70 miles north of the C.P.R. It was submitted to Major Hamilton Merritt, who declared it genuine coal, save one crystal of iron pyrites, which had induced the hunter to pick it up.

2. The occurrence of red sandstone is considered a good indication of coal in British Columbia, and I am informed that in places it lies in contact with the granite and good coal in the immediate vicinity. Exposures of the same rock are to be found in the Moose Waters, in the district from which my specimen of coal was obtained. A careful exploration of the district would probably result in finding both coal and gold, in conditions similar to those of East Kootenay.

3. But while nature works slowly in forming coal beds, and even peat bogs, she supplies carbon, in unlimited quantity, more rapidly in our forests, and even prairies. Enough of carbonaceous material is left to waste and endanger the remaining forest, every year, by our lumbermen, to supply fuel to all the cities and towns of Canada. The stumps and tops of pine are rich in turpentine and by-products of distillation; the charcoal left could be ground and compressed for fuel, both domestic and mechanical—relieving the strain upon the coal mines, and removing a dangerous nuisance from our back country. It would also be a benefit to our new settlers, who have to clean up the waste left by lumbering before they can raise crops for themselves. The terrible fires that have devastated Michigan and Northern Ontario are the direct outcome of allowing men to remove about 40 per cent. of the pine tree, while the other 60 per cent., together with other trees cut down in getting it out, are left to devastate the land in after years.

A system of forestry, which would preserve pine lands to be cut when ripe, use up the remaining portions of the tree, and cultivate the intervening arable land, while supplying fuel as well as lumber to older lands and cities, is the only logical solution of the problem. Export less lumber and produce more fuel, while having a great export of products of destructive distillation, will be better for the nation, and immeasurably better for future generations of Canadians. Economy of our latent wealth, domestic comfort, and steadily increasing resources, ought to be the watchword of every thinking citizen. Our water power would be conserved, and our agriculture improved by prudent utilization of our forests, instead of vanishing entirely, as in many portions of the United States.

On page 322 you remark the advantage of finely pulver-

izing fuel, in causing it to yield more caloric per unit—thus approaching liquid fuel. As liquid fuel is now used as a direct source of power, our timber waste, and specially, copsewood, or second growth, might be made to play a very important part in the future progress of mechanics. Petroleum products are limited in quantity and locality; but a vegetable substitute which springs up spontaneously will never be exhausted. It will be like pulpwood to linen rags in the paper industry, and make our unsightly brules a source of wealth and seat of endless industry. Our prairie grass may also, at some not distant day, become a source of wealth, and lands unsuitable for grazing become feeders of paper and fuel factories.

THOMAS FROOD.

UP-TO-DATE CHINESE ENGINEERING.

L. F. Bellinger contributes an interesting article to Engineering News, in which he describes several types of waterwheels used in that country. Two undershot wheels are mentioned which are made entirely of bamboo; floats, buckets, rims, spokes, axle, irrigating trough, journals, pillars, wind bracing and all. Both are used for irrigation purposes. The one at the river is 30 feet in diameter, and has a 4-foot face; the one at the side channel is larger than the average sizes, being 35 feet in diameter with 4-foot face.

The water is raised in the same manner in both wheels—viz., large bamboo stalks are sawed off at the joints, leaving the hollow stem about 4 inches inside diameter and 4 feet long. These are placed at an obtuse angle with the plane of the rim, squared on the sides to afford some resistance to the water, and thus aid the floats, which are at 90 degrees to the plane of the rim. As the current forces the wheels slowly around, the buckets rise out of the water and discharge into the trough at the top about two-thirds full. While a little trickles out on the ascent the economical height at which to place the trough is well chosen. All the water is discharged by the time the greatest altitude is reached, and the water flows from the trough into the irrigating ditches.

With apologies to E. D. Leavitt, the following comparison of the cost of raising water between the Chinese type of wheel and that described in Engineering News is herewith given in parallel columns:

Items.	American.	Chinese.
	Wheel.	
Diameter of wheel, feet	65	35
Height water is lifted, feet	50	25
Face of wheel, feet	12	4
Number of buckets	550	48
Revolutions per minute	7	1
Peripheral speed (per second) feet	12	2
Capacity, gallons per 24 hours	75,000,000	120,000
Cost of wheel (about)	$60,000	$1.80
Investment per 1,000 gals. capacity, cents	80	1½
Investment per 1,000 gallons capacity, per 25-foot lift, cents	40	1½

We may offset the cost of the wing dam for the Chinese wheel by the boiler and electric plant of the American wheel as being about in the same proportion of cost as given above. The capital invested in the Chinese wheel is arrived at as follows: Professor Brill states that five men can build such a wheel in a week, and that the average wage in that section is 6 cents per day. Then we have this table as the cost of constructing one wheel:

Three farmers at 5 cents per day each ..... 15 cents
One skilled wheelwright, at 7 cents a day ..... 7 cents
One general superintendent, at 8 cents a day ..... 8 cents

The total, each day, makes the owner feel like..30 cents

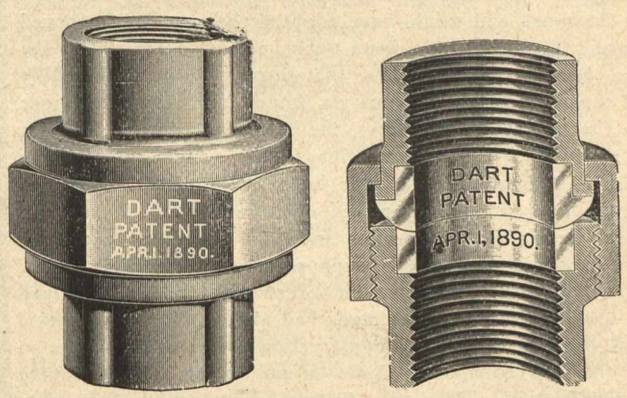
This for six consecutive days makes a grand total of $1.80 per wheel. It is even said that some wealthy landlords have as much as $11 or $13 invested in such improved machinery. As these wheels displace much manual labor, they are not liked by the labor organizations, who favor the good old method of the strike-water, by which the water is raised by manual labor.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

At the ordinary meeting of the society held on December 18th, E. Marceau, vice-president, in the chair, some lantern slides in connection with C. H. Rust's paper on Sewage Disposal were exhibited and described by R. S. Lea. Correspondence in discussion of this paper was also read. An important contribution on the subject of The Economy of Large Ships from E. L. Corthell was read. The scrutineers of the ballot for the election of members declared the following elected: Members, F. S. Anthony, C. O. Foss, E. P. Gutelius, G. F. Hardy, F. D. H. Lawlor, C. C. Lelnau, E. H. McHenry, J. S. Metcalf and J. Spelman. Associate members, R. B. Evans, W. F. Grant, C. S. Moss, H. R. Miles, J. H. Parks and H. N. Smith. Associate, H. F. Larkin. Transferred from associate member to member, W. E. Mann. Transferred from student to associate member, A. R. Dufresne, G. R. Duncan, T. T. Irving, H. H. Shaw, L. Sherwood. Students, W. J. Blair, H. V. Brayley, R. Collins, F. S. Drummond, W. M. Edwards, H. Frechette, T. M. Fyshe, L. J. Houston, Jr., F. C. Jewett, A. P. Joseph, E. B. Jost, G. Kydd, J. A. Lacoutre, H. F. J. Lambart, H. M. Lamb, A. C. Loudon, R. F. McIntosh, D. W. McLachlan, W. R. Maher, J. W. Porter, C. H. Sutherland, A. Roger, F. Vanasse, Jr., H. A. Wheaton, I. Wheaton.

THE DART UNION.

The accompanying is a sectional view of the Dart Union. The makers cite the increasing demand for it as justifying their claim that it is "A Union forever." It has bronze ball seats, ground points and malleable iron ends and nuts. This union is adapted to all uses and very extensively used throughout



the Dominion and the United States, and is highly commended for railways and locomotive service. These are made by the E. M. Dart Mfg. Co., of Providence, R.I., the Fairbanks Company, of Montreal and Vancouver being sole Canadian agents.

A TRANS-AUSTRALIAN RAILWAY.

History will probably again repeat itself. The Canadian confederation was followed by the construction of the Intercolonial Railway, the addition of British Columbia was followed by the building of the Canadian Pacific, and the federation of the Australian colonies is likely to result in a trans-Australian railway. An act passed last year provides for a land grant for a railway from Oodnadatta, in the state of South Australia, to Pine Creek, in the Northern Territory, which will bridge the gap in Central Australia between these two points, and complete the Adelaide-Port Darwin Transcontinental. The road will be 1,063 miles long, single track, 3 feet 6 inch gauge, with 60-lb. steel rails. The act provides that within three months of its passing the Commissioner of Railways shall call for tenders for its construction, and this is now being done. Eighteen months is allowed for receiving offers, and the road is to be completed in eight years. When the road is built, it will be possible, in connection with the Chinese-Eastern Railway, for London mails and passengers to reach Port Darwin (Australia) in 145 hours, and Canton will probably become the Asian port for the European-Australian traffic. The Adelaide-Port Darwin Railway will thus be not only an interstate but

like the Canadian Pacific, an international line of communication. Further particulars with reference to the conditions under which the road is to be built can be obtained from the Commissioner of Railways, Adelaide, the Agent General for South Australia in London, or the North Australian League, Melbourne.

ENGLISH PLUMBING METHODS.

BY W. M. WATSON.

For over five months last year I was employed as leader in a plumbing and steamfitting shop in Nottinghamshire, Eng. The object of our principal and owner was to secure new ideas, and it gave me the opportunity of investigating some new methods of sewage cleaning, drainage systems, etc. While there I corresponded with W. J. Burroughes, formerly master plumber of this city, now in business in London, and three of the American plumbers' and steamfitters' supply merchants, who keep in stock articles used by the trade in Canada, which is handy for Canadian steamfitters who go over to Great Britain to do heating work, because many of our handiest kind of fittings are not yet made by British manufacturers. They cannot, or they will not, see the value of them. I was apprenticed and for a few years in business in England myself, before coming to Canada. I also visited the North of England in 1896, and from having lived there well understood the habits and methods of the trade as carried on over there. During the twenty years I have resided in Canada I have witnessed marked improvement in the style of arranging heating pipes and heat distributors, and expected that the British mechanic would have advanced with the times, and would have adopted the new and improved scientific ideas that have been published and explained in the press, but it is very evident that they have never carefully read them, and they do not yet understand anything more than that hot water circulates, the hottest seeking the highest and the coolest the lowest points in the system. They have no idea of arranging the pipe lines and radiators in a way that the flow shall be even and quick, and make a true and perfect circuit void of pockets and dead spaces. I examined many apparatuses that were supposed to be in working order, that would have worked far smoother with at least one-third less coal, and with less leakages had about half the weight of metal been used in their construction and the pipes run so that the flow could easily pass along on its rising course without friction. They still use cast-iron pipe for sizes of 2-inch and upward, and instead of giving their pipe lines the proper swing to allow for expansion, they use a clumsy cast-iron expansion joint that rusts fast during the months the apparatus is out of use, and when it is lighted up again they leak if they happen to move, and if they do not move, the expansion of the pipe line causes something to give way. They use the old pattern wrought-iron square box for heating water for domestic purposes. They cannot believe that a few feet of iron pipe placed behind a kitchen fire, or run round a baker's oven fire, will heat more water and be less liable to get damaged by the forces of expansion than the heavy clumsy box that costs ten times more than the pipe, and that never works satisfactorily for more than a year at a time. Everything must be heavy, clumsy and very expensive to suit the British workman, and a Canadian examining such heating appliances is dumbfounded to find such ignorance existing among his fellow tradesmen in the twentieth century.

Everyone that conversed with me on the American heating subject assured me they were up to every point that any American was, and pointed out to me that they used a radiator similar to that used on this side of the Atlantic. They also used the hot water cylinder. Yes, so they do, but the way they fix them, and the useless lengths of costly pipe and fittings they attach to them, would surprise an American builder. For example, there is a hot water apparatus placed in a 600-year old church, situated 14 miles from Nottingham, near the place where the great underground caves used by Robin Hood and his followers can be seen, and where the moulders' sand comes from, used often in Toronto. This heating was done up to style, and date, expense not being considered. The church has a stone floor, and is void of all plaster on the walls. The contractor thought he had adopted the American indirect system of heating. He sunk several square pits into the floor of the church, and filled them with pin radiators, but omitted to provide a current of air to carry the heat thrown off by the radiators up into the church, and the result is the church was never comfortably heated or ventilated, though by far too much fuel was used for the purpose. I was shown this apparatus, and heard the complaint of its worthlessness, and I could not help telling the party that the English fitter was stupid, and if the system had been installed by an American fitter, and he had used the same materials, the church would have been properly heated and ventilated at a far less cost, both for construction and fuel.

When I was over there was during the Coronation season, I came in contact with many leaders of society, and almost daily had to give long talks on Canada, and its trades and customs. I believe that the wealthy classes and public bodies are very anxious to have the very best systems of heating they can secure. I met many persons that had been over here on a visit, and who had noted our artistic designs, adopted in our methods of attracting and radiating of artificial heat and ventilating of buildings, and there is an unlimited quantity of such trade ready to be picked up at good prices and prompt cash payments, but in all cases where any business is done the leading working fitter must go over from this side, and young men must be taught our way of working, who have not been contaminated by being in a plumbing or heating shop, for if the men that I had to lead while over in England be a true sample of those who work in the shops then it would be wise not to use such men and boys when constructing such work.

Steam and water heating goods can find a market in the North and Midland counties. London and its surroundings are fairly well supplied with merchants selling our goods. But to secure trade our manufacturers must show their own goods in all the leading central market towns, and provide skilful fitters to handle them. This would bring profit to the manufacturers and fitters, and greatly please many of the capitalists and property owners over there.

BOOKS AND PAMPHLETS RECEIVED.

A Treatise on Roads and Pavements, by Ira O. Baker, C.E., Professor of Civil Engineering, University of Illinois. John Wiley & Sons, scientific publishers, New York. Price, $5. A most useful work for engineers.

Elementary Applied Mechanics, by T. Alexander, C.E., M.I.C.E.I., Professor of Engineering, Trinity College, Dublin, and A. W. Thomson, D.Sc., Professor of Engineering, College of Science, Poona. Macmillan & Co., London. An excellent work for the engineer or architect.

Metallurgical Laboratory Notes, by Henry M. Howe, Professor of Metallurgy in Columbia University, New York Published by the Boston Testing Laboratories.

The Minerals and Mineral Localities of Texas, by F. W. Simonds, Ph.D., Professor of Geology in the University of Texas. Published as a Bulletin of the University Mineral Survey, W. B. Phillips, director, Austin, Texas.

Annual Report of the City Engineer of Halifax, N.S., F. W. W. Doane, C.E.

Rainfall Notes, Nova Scotia. Paper read before Nova Scotian Institute of Science, by F. W. W. Doane, C.E., City Engineer, Halifax.

Western Canada. British Columbia. Two pamphlets issued by the C.P.R.

Opinion of Judge Cox in the suit of Weston Electrical Instrument Co. vs. Keystone Electrical Instrument Co. re certain U. S. patents.

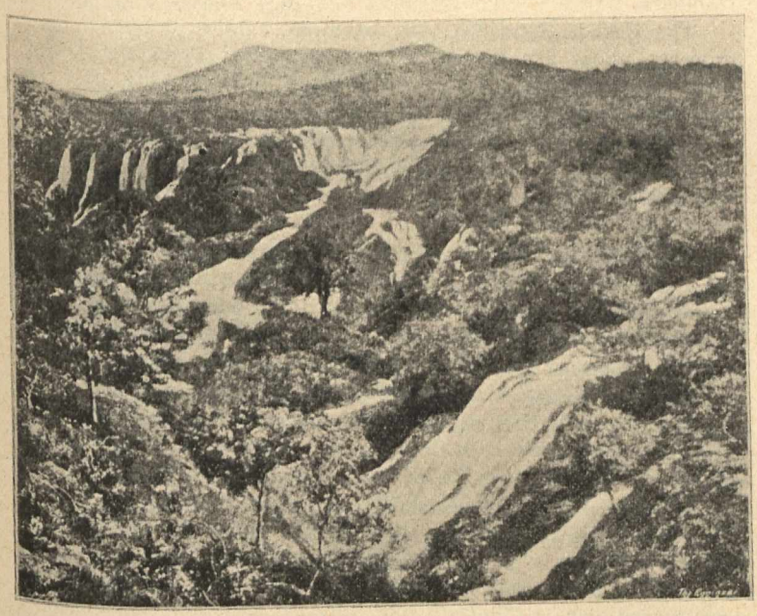
Economical Gas and its Application to Lighting, Heating and Motive Power, by J. deClercy, Engineer of Arts and Manufactures of Paris.

American Railway Engineering and Maintenance of Way Association, Bulletin No. 30.

Fire Tests with Roofs. Fire Tests with Doors. Fire Tests with Automatic Fire Alarms. Testing Arrangements of the Committee. These are a continuation of the series of publications of the British Fire Prevention Committee, and contain much useful information relating to fire prevention.

CAUVERY FALLS POWER PLANT.

The Canadian Engineer has referred already to the Cauvery Falls power plant in India, one of the greatest long distance plants in the world, of special interest to Canadians because Capt. A. J. de Lotbiniere, R.E., son of the Lieut.-Governor of British Columbia, and a graduate of the Military College at Kingston, was the chief engineer. The plant was constructed to furnish 6,000-h.p. to the mines of the Kolar gold field, 90 miles distant, and the electrical apparatus was supplied from America. Great difficulty was experienced in obtaining labor, the natives believing that the god of the falls was very irate at any of the water being diverted, and as malarial fever and cholera broke out, this idea was strengthened and the people fled in all directions. It was only when assured that a new god, imported in the



shape of the machinery, was much stronger than the old one, who guarded the falls, that they were willing to return and go on with the work. We present an illustration of the Cauvery Falls, the source of this great power development.

The Grand Trunk is to build a handsome new station at Brantford. A new station has also been built at Fergus.

It is now proposed to tunnel the Strait of Canso instead of bridging it. P. S. Archibald, engineer of the proposed bridge, is said to have expressed the opinion that a tunnel would be cheaper and less costly to maintain. Meantime the ferry transfer Scotia is doing good work, having proved herself a splendid ice breaker.

—The Department of Militia propose to create two corps of engineers, one to be raised in the district of Montreal, and the other in the Maritime Provinces. The Montreal corps has already been authorized, and Stuart Howard, C.E., assistant city surveyor, who is well qualified, both by his experience in civil engineering and his knowledge of military organization, has been appointed to command. There will be no difficulty in keeping up the detachment, as nearly the full force of 106 has already volunteered to serve under Mr. Howard, all of them being handy men, who understand railway and construction work. The Government will take over the club house of the Athletic Association of Point St. Charles for the new corps.

Industrial Notes.

The Lake of the Woods Milling Company will build a new mill at Keewatin.

Sutliffe & Muir, of Morris, Man., will build a 300 barrel flour mill at Moosomin.

The old beet sugar factory, at Farnham, Que., is to be utilized for furniture making.

The capital of the Dominion Cartridge Co. has been increased from $250,000 to $1,000,000.

Shaw, Cassels & Co., of Montreal, are trying to arrange to build a large steam tannery at Windsor, N.S.

The name of the Pressed Steel Car and Wheel Company has been changed to the Imperial Steel and Wire Co.

Geo. Reid's flour mill at Dunnville is to be rebuilt, with a daily capacity of 50 barrels. He will also put in a buckwheat mill.

The Port Huron Engine and Thresher Co., and the Buffalo Tool & Machine Co. have been licensed to do business in Ontario.

The Sussex Foundry and Machine Company have amalgamated with the Sussex wood working and electric light company.

The Pratt & Letchworth Co., makers of malleable iron goods, celebrated the enlargement of their works at Brantford by giving a banquet.

The Canadian Elevator Co. will build 70 elevators on the line of the Canadian Northern Railway and establish 20 lumber yards in the Territories.

The Owen Sound Portland Cement Co. has increased its capital from $200,000 to $500,000, and that of the Gold Medal Furniture Co. from $100,000 to $250,000.

Berlin, Ont., has a prospect of getting a factory for the manufacture of condensed milk. The pulp from the sugar factory is very suitable for feeding cows.

The London, Ont., Builders' Supply Co. is building a brick-manufacturing plant, at a cost of $30,000. The project is the result of a combination among brick and tile manufacturers.

The Canada Furniture Manufacturers Co. is building at Waterloo, Ont., an up to date mattress factory. It has opened new sample and office rooms at Toronto. The company now operates 21 factories, each of which is devoted to some special line.

St. Hyacinthe, Que., has passed the by-law to grant a bonus and other assistance to Ames, Holden & Co. for the establishment of a shoe factory for making staple goods. The factory in Montreal will be operated on special lines and higher grades of footwear.

Popular Mechanics declares the new German process of making brick in a few hours from sand and lime to be a failure. There have been no less than 80 factories erected in Germany to carry out the process. The plant is expensive, and the bricks are said to possess no advantages over the old time clay brick.

Two men were injured, one badly, and the foundry of the Canadian Pacific Railway at Hochelaga, was damaged to the extent of $4,000, by a gas explosion when the furnaces were being emptied after casting. The cause of the accident is laid to gas that had accumulated underneath the furnaces, and exploded as soon as the coke and hot metal came in contact with it.

The Toronto Forge and Bolt Co. has been given an order for enough track bolts for 65 miles of the Temiskaming Railway, and the Pillow & Hersey Mfg. Co., Montreal, an order for spikes for the same distance, The contractor has been instructed to purchase 57 sixty ton flat cars, with automatic couplers and Westinghouse air brakes, to be used in construction. They will afterwards be taken over by the commission at a valuation.

B. Bell & Son, St. George, are erecting a large sawmill.

The Canada Printing Ink Co., Toronto, will erect a three story factory.

The Lake of the Woods Milling Co. has a new barrel factory at Keewatin.

Hamilton expects to have nickel copper works in operation soon, under the Sterling Co., of Chicago.

Heintzman & Co., piano manufacturers, Toronto, are preparing plans for large additions to their factory at Toronto Junction.

Kerr & Coombes, iron founders, Hamilton, Ont., have bought the Copp Bros.' foundry buildings, and will extend their business.

The Western Hardware Co. has acquired the stock of John A. Kerr, Regina, and will carry on a wholesale and retail hardware business.

The International Harvester Co. have purchased 35 more acres of land at Hamilton, and will make their works larger than first proposed.

The cleaning elevator of Jos. King & Co., at Port Arthur, is to have a storage addition added besides a number of improvements to its cleaning machinery.

The Humber Power and Light Co. has been authorized to increase its capital from $50,000 to $100,000, and the Sun Oil Refining Co., of Hamilton, to make a similar increase.

Aluminum has been found to possess the property of sharpening cutlery to a high degree. Though a metal it has the structure of a fine stone, and imparts a fine razor-like edge.

The Canadian Tinplate Decorating Co. is looking for a location and is negotiating with Berlin and London. They purpose spending $13,000 on plant and will employ about fifty men.

Thomas Kennedy is installing twenty wood-working machines in his factory at Fort William, Ont. H. H. Dale, of the same place, is also adding more machinery to his sash factory.

The Car Wheel Works at Lachine, burned some years ago, are to be rebuilt. They will be near the Dominion Bridge Co.'s works, will employ about 100 men, and have a capacity of 30 tons a day.

Capt. Mansell, acting chief engineer of the Militia Department, has been visiting the armories in Buffalo, New York and Chicago to get new ideas with reference to the construction of such buildings.

The Canada Paper Co. will instal at Niagara Falls the largest paper machine in Canada. It weighs 350 tons, and will take 25 cars to carry it. The company will be making paper by the 1st of April.

A pulp concession has been granted to the Rainy River Pulp & Paper Co., of which Hon. G. E. Foster is the leading spirit. It is to build a pulp mill of 20 tons daily capacity at Turtle Lake near Fort Francis, and employ 50 hands.

Representatives of ten out of the fifteen large cement factories doing business in Canada, met and formed a branch of the Canadian Manufacturers' Association. They hope to secure the entire trade of Canada for the home manufacturers. Last year cement to the value of $699,000 was imported from the United States.

Twelve men, two whites and ten Chinamen, were killed by an explosion of nitro-glycerine at the works of the Hamilton Powder Co. at Departure Bay, B.C. The cause can only be surmised. The railway track near by was torn up and two rails twisted like corkscrews around the trunks of trees. One large tree was cut off fifteen feet above ground. In a building 400 feet away one man was engaged in a most dangerous process in the mixing room, the doors and windows around him were blown in, and one side of the building wrecked. He was flung on the machinery, but to allow the work to stop at that stage would mean another explosion, so with the greatest coolness he stayed at his post and kept the machinery going until his task was completed. The concussion was felt 40 miles away.

A colony of Swedes have built a sawmill at Malcolm Island, B.C.

The Globe-Wernicke Co., makers of office systems, sectional bookcases, etc., have built a fine white brick factory at Stratford, Ont.

The contract for the equipment of the million bushel elevator at Montreal has been awarded to the Dodge Manufacturing Company of Toronto.

The Dominion Iron Wheel Co. has increased its capital from $20,000 to $100,000, and the Dominion Wire Rope Company from $50,000 to $200,000.

The T. S. Simms Co. has built a new brush factory at St. John, N.B., has its own dynamo and lighting apparatus and smoking and reading room for the employees.

The Milner Wagon Co. has erected a factory at Petrolia for the manufacture of wagons and sleighs. It contains 63 machines. Wm. English is president and Wm. Pratt, secretary.

A hot water pond has been installed at the Pigeon River Lumber Co.'s mill at Port Arthur, enabling it to operate all winter. The capacity of the mill is 20,000,000 feet, which is to be doubled.

The Snowball Wagon Works at St. George, Ont., have been sold to the Hamburg-American Co., who, as soon as the stock on hand is worked up will remove them to New Hamburg.

The Canada Paint Co. has acquired another graphite property, about five square miles in area, near Petitcodiac, N.B. They will have to greatly enlarge their capacity to meet next season's trade.

The Canadian Heating and Ventilating Company offer to establish works at Owen Sound, employing 80 hands, for the manufacture of all kinds of heating apparatus, if they get exemption and free water.

The manufacturers of a line of oil engines in England are looking for a good agent to push the sale of such engines among the farmers of Canada. The address of the firm can be learned on application to The Canadian Engineer.

The Manitoba Iron Works Co. will take over the business of the Standard Machine Works at Winnipeg, and build new shops, covering an acre and a quarter of ground, to manufacture engines, boilers, pumps, elevators and agricultural machinery.

The manufacture of brick and pottery at New Glasgow, N.S., which has been of late neglected, is to be developed anew, a company of St. John and Montreal capitalists having purchased the clay deposits, which are said to be the only ones of the kind in Canada.

The Nova Scotia Steel & Coal Co., are planning extensive additions to their plant at Trenton, N.S., for the manufacture of cars in addition to the car axles, shafting, nails and other products now turned out. Smelting will cease at Trenton and Ferrona, that operation being concentrated at Sydney Mines.

The great manufacturing plants in Chicago produced, it is stated, during 1902, 75 per cent. of all the grain and grass harvesting machines made in the world. The aggregate business for the year approximated $50,000,000. Of these the International Harvester Company, now erecting a factory in Hamilton, claims to manufacture about 90 per cent.

The Dominion Iron & Steel Company will build a small mill at Sydney for the manufacture of steel rails, which will be enlarged subsequently if the market warrants it. It will have an initial capacity of 400 tons a day. Three additional mills, one for plates, one for angle bars, and one for wire rods, will also be built, all, with the structural steel mill now under way, to be in operation by May 1.

The London Machine Tool Co. have added a considerable amount of machinery to their plant during the past year. Among these are a new milling machine and a gear cutter of their own design, a boring machine made by the Bullard Machine Tool Co., of Bridgeport, Conn., and a lathe by Reid & Co., of Worcester, Mass. They are also building a planer 72 by 72 in., and are putting in a 10-ton crane.

The Westinghouse Co. is said to be negotiating in England for the establishing of large smelting works and pulp mills at the Chats Falls on the Ottawa.

E. V. Tanner, perceiving the needs of the west, has a proposition to manufacture straw fuel, and believes that he can supply inexpensive machines for the purpose. The straw will be packed in the shape of cordwood, and will, he claims, make splendid fuel.

The Belleville Portland Cement Works, to be built at Point Ann, near that city, will, it is stated, be one of the largest cement works in the world, and will turn out as much as all the other works in Canada put together. Enough material has been quarried to manufacture from 600,000 to 1,000,000 barrels.

Work on the Nova Scotia Steel & Coal Co.'s blast furnaces, at Sydney Mines, is soon to commence. The Rarig Engineering Co, of Columbus, Ohio, who have the contract, have a force of machinists and engineers on the spot getting the structural material, which came from Germany, ready to be placed in position.

The Dominion Iron and Steel Company will erect two more large piers at Sydney, one, similar to the present one, near the blast furnaces, to ship the products of the steel company; the other, of steel, to be used as a coal shipping pier. The company has decided to manufacture steel rods on an extensive scale.

The Wm. Buck Stove Co., Brantford, have purchased the Canada Cycle & Motor Co.'s building, and will remodel it, and add new buildings to give them increased facilities, at a cost of about $100,000. The company at present employ 265 men; the new works will cover about six acres, and will give room for 365 men at the start, to be increased to 400 or 500. The new foundry will be one of the largest stove works on the continent.

The Canada Foundry Co. will erect new buildings at Toronto in 1903, equal in extent to those built in 1902. A large rolling mill, and ultimately locomotive works, are in contemplation. As some of the directors of the Foundry Company are directors of the Dominion Iron and Steel Company, it is likely the pig iron for the rolling mill will come from Sydney. The Toronto Steel Co. will also use Sydney iron.

The Imperial Oil Co. has now four large storage tanks at Fort William, Ont., two of a capacity of 426,000 gallons, and two of 211,448 gallons. The oil comes in tank steamers from Cleveland, Chicago and other places, and is pumped into the storage tanks at the rate of 10,000 to 12,000 gallons an hour. Some is barrelled, but the bulk is shipped in tank cars for points west as far as Vancouver. The company has a splendid wharf and modern power house and sheds at Fort William.

Andrew Carnegie, in the World's Work, points out that the home market of America takes 96 per cent. of all manufactured articles, only four per cent. going to foreign markets. Even Britain's home market takes four-fifths of her manufactures, only one-fifth going abroad. If the people of the United Kingdom could spend one pound per head more per year her home commerce would be increased more than the total value of her exports to Australasia, British North America and China combined. He reasons, therefore, that home conditions should be studied and improved rather than so much attention given to foreign markets.

Owing to the trouble caused by soft coal clogging pipes and chimney flues, the following suggestion is worthy of note: Zinc is a peculiar metal in many respects. It volatizes easily, and the oxide thus produced has a strong affinity for carbon. If one's furnace chimney is clogged up with soot and the owner desires to get rid of it, all that is necessary is to throw a little zinc scrap into the fire. Any old zinc will do, and very little will suffice to keep the chimney clean if used about once a week. The vapor of zinc oxide seizes upon the carbon of the soot and forms a new chemical compound, part of which goes up the flue and part falls to the bottom to be shovelled out as ash. The editor of The Canadian Engineer can vouch for the efficacy of this remedy.

At the annual meeting of the hardware and metal section of the Toronto Board of Trade, it was stated that business had been good during 1902, prices comparatively steady, the demand large and losses from failures small. There had been unnecessary competition, difficulty in obtaining goods owing to limits of manufacturers and shortage in raw material. Congestion of freight and shortage of rolling stock had caused slow delivery by the railways. The outlook for 1903 is regarded as bright.

The prospectus of the Canadian Steel and Coal Company, with a capital of $6,000,000, is being extensively advertised in the United States papers. It was organized for the purpose of utilizing the iron deposits of Natashquan, Quebec, and the coal measures of Cape Breton. Natashquan is on the north shore of the St. Lawrence, opposite Anticosti. The iron ore runs from 68 to 72 per cent. metallic iron. The company owns 9,600 acres of coal property in Cape Breton, known as the New Campbellton Colliery. The officers of the company are: President, Louis B. Jennings; vice-president, F. S. Ashley; treasurer, James C. Sinclair; secretary, John G. Pearse, and a long list of directors.

Alexander Graham Bell denies that he has been trying to make a flying machine. He is interested in the problem and has come to the conclusion that a properly constructed flying machine should be capable of being flown as a kite if anchored to the ground, and that conversely a properly constructed kite should be capable of use as a flying machine if provided with suitable means of propulsion. His experiments have had as their object the building of a kite of solid construction, capable of carrying up, in a moderate breeze, a weight equivalent to that of a man and engine and so formed that it could be suitable for use as the body of a flying machine, and with supporting surfaces so arranged that when the kite is cut loose it would come down gently and steadily and land uninjured. He has successfully accomplished this, he says, but does not care at present to make public the details of construction.

The following fires have occurred in industrial works: Villeneuve & Hardy's piano factory, Montreal, damaged.——Stony Creek basket factory, burned.——McClary's stove foundry, London, seriously damaged.——Small roasting building of London coffee and spice mills, burned.——Municipal acetylene gas plant at Birtle, Man., burned.——Delhi, Ont., canning factory burned.——Peck, Benny & Co.'s cut nail and horseshoe factory, Montreal, burned. Rolling mill saved. Loss, $50,000.——Shannon & Co.'s sawmill, near Prince Albert, N.W.T., burned.——Beamsville brick works damaged.——Tweed, Ont., electric plant burned.——Chadwick Bros. brass works, Hamilton, damaged.——Propeller Myles, lying at Toronto, damaged to the extent of about $2,000.——Kerr & Coombe's foundry, Hamilton, damaged.——Defective acetylene gas generator exploded at Manitou, Man., and caused loss by fire of $20,000.——Robt. Muir & Co.'s mill and elevator at Gladstone, Man., burned.

At the municipal election of Jan. 5th, Brussels voted a loan of $5,000 to Lottridge Bros., to put in operation the woolen mills there; Windsor, Ont., defeated a by-law to aid the Erie Tobacco Co.; Waterloo, Ont., carried a by-law to aid the Schierholtz & Co. in establishing an upholstering factory; Dunnville carried a by-law to lend J. D. Pennington, of Dundas, $15,000 to establish a refrigerator and wood working factory; Port Hope, carried a by-law to assist the Standard Ideal Sanitary Co's. works; Markham voted to exempt the Lount Brush Handle factory; Goderich voted exemption for a mill and knitting factory; Belleville voted to give the balance of a bonus voted to Abbott & Mitchell, for a rolling mill, to T. M. Kirkwood, for the same industry; Collingwood, to bonus a wire and nail factory, and to buy the Toner & Gregory factory; Fort William voted a site and exemption from taxes for 35 years to the Ogilvie Flour Mills Co. who are to build a 1500 barrel mill and 500,000 bushel elevator; Pembroke voted free water and exemption to the Delahay scale factory; Peterboro defeated a by-law to give J. J. Turner & Sons exemption on their tent and awning factory; Smith's Falls refused exemption and to fix the assessment for ten years of the Gould Stove Mfg. Co.

Mackenzie & Mann, of Toronto, have secured an important concession in Venezuela, covering 11,000,000 acres, rich in gold, iron, copper and other minerals, also asphalt, which they will develop.

In these days of burning soft coal, various devices are employed to mitigate the smoke nuisance. One of these is kolawitch, a chemical compound, which when dissolved in water and mixed with the coal, is said to have a refining effect. It is claimed to be both a coal economizer, to the extent of 20 per cent., and a black smoke consumer. The Kolawitch Co., Limited, Nottingham, England, have published a little booklet, called Eighteen Points, containing particulars, and an extract from a lecture by Combe Stewart, F.C.S., on the merits of Kolawitch. The booklet will be sent to those interested on mentioning the Canadian Engineer.

Personal.

Captain Dawe has been appointed Minister of Mines for Newfoundland.

Samuel Wake, engineer for the Wm. Kennedy & Sons Co., Owen Sound, is dead.

James O'Lagan, one of the oldest engineers on the C.P.R., died recently at Fort William.

George E. Drummond has been elected by acclamation as first vice-president of the Montreal Board of Trade.

R. H. Gilmore, formerly superintendent of the Canada foundry, Toronto, has been appointed superintendent of the Brooks Locomotive Works at Dunkirk, N.Y.

T. H. Macdonald, a former Gananoque man, but for some time past residing at Worcester, Mass., has been appointed manager of the Albion iron works, Victoria, B.C.

T. N. Woodgate, C.E., in charge of works at the Esquimalt, B. C., navy yard, has returned to England, his term of service on that station, where he has been for six years, having expired.

Thomas H. Knox, for years with R. G. Dun & Co., Toronto, is appointed manager of the Dominion Wrought Iron Wheel Company, which will remove from Toronto to Orillia next month.

John Kennedy, chief engineer of the Montreal Harbor Board, has gone to Europe, and though on a holiday trip has been authorized to visit the shipbuilding yards to enquire about a lifting crane and a new harbor tug.

J. T. Arundel, superintendent for the C.N.R. at Winnipeg, who formerly occupied a similar position on the C.P.R., has returned to the latter company. W. A. Brown, superintendent of the C.P.R. at Moose Jaw, has resigned, and is succeeded by Frank Dillinger, superintendent at Winnipeg. Mr. Brown goes to the C.N.R.

John Kerr, superintendent of the gas plant of the Kingston Light, Heat and Power Company, has asked to be relieved of further service. This the company would not do, but it relieved him of some of his duties, and he is retained as consulting superintendent of the gas plant. Mr. Kerr installed the plant 53 years ago, and has been connected with it ever since.

Dr. Henry Ami, of the Geological Survey, has been awarded the Bigsby gold medal by the Geological Society of London, for researches in geology. The medal is awarded every two years to the geologist having the best known record. Dr. Ami is the second Canadian to win the distinction, it having been awarded in 1891 to Dr. Dawson.

Captain Adams, R.E., is given great praise for his management of the Egyptian Delta light railways. His work resulted last year in an increase of 25 per cent. in business and only 7.2 per cent. in working expenses. The working expenses were 61.46 per cent. of the gross receipts, over 10 per cent. below the previous year. Capt. Adams is a graduate of the Royal Military College, Kingston.

H. E. Vautelet, who was acting chief engineer on the C.P.R. for some months, in succession to Mr. Peterson, and who was subsequently appointed engineer for bridges, has resigned, and is succeeded by C. N. Monsarrat, who has been on the bridge-engineering staff for some years. He has done a lot of bridge work in British Columbia. His father is president of the Hocking Valley railway. Mr. Vautelet, who retires, is a Belgian, and is considered one of the ablest experts on structural and bridge work in Canada. He was at one time in the service of the Public Works Department at Ottawa, and will now probably go into private business.

Captain Francis Henry Vercoe, of Toronto, who was during the late war attached to the Imperial army in South Africa as military engineer, died recently at Bloemfontein. After graduating from the Royal Military College, Kingston, in 1892, he went to British Columbia. Shortly after he returned to Kingston and became mathematical instructor at the Military College. In 1890 he accepted an appointment as engineer of one of the largest gold mines in the vicinity of Johannesburg, but when he got to Cape Town Sir Percy Girouard prevailed upon him to accept an appointment in the Imperial Army Railway Corps. He served with distinction through the war, and at its close was placed on the civil staff.

CANADIAN ASSOCIATION OF CIVIL ENGINEERS.

The 17th annual meeting of the Canadian Society of Civil Engineers was held at the society's headquarters, Montreal, on the 27th, 28th and 29th ult., the president, Dr. Martin Murphy, in the chair.

Among those present were the following:

Dr. Martin Murphy, K. W. Blackwell, P. A. Peterson, C. H. McLeod, L. G. Papineau, H. Irwin, C. deB. Leprohon, Robt. Surtees, J. W. Heckman, R. B. Rogers, Henry O'Sullivan, C. E. W. Dodwell, Wm. Kennedy, James C. Kennedy, W. McLea Walbank, J. H. Sullivan, Geo. Holland, R. Bickerdike, jr., J. M. Nelson, E. G. M. Cope, John R. Barlow, Frank Simpson, C. S. Leech, Thos. Breen, Wm. McCarthy, A. R. Davis, W. D. Harris, N. B. MacTaggart, J. S. Armstrong, J. L. H. Bogart, R A Ross, A. W. Robinson, G. Grant, J. G. MacGregor, T. W. Lesage, Edw. Alvans, H. J. Lamb, W. T. Jennings, A. T. Genest, N. H. Greene, Donald J. Carter, Geo. E. Bell, A. A. Bowman, Geo. A. Mountain, J. G. G. Kerry, Ormand Higman, Col. W. P. Anderson, E. A. Hoare, Stuart Howard, C. H. Pinhey, E. Marceau, Prof. H. Bovey, Major H. A. Gray, C. H. Rust, F. X. Berlinguet, L. Skaife, P. W. St. George, H. A. F. McLeod, W. J. Sproule, Marshall Hopkins, Geo. Janin, H. W. Weller, L. R. Flint. H. D. Lumsden, G. H. Webster, F. C. Laberge, G. H. Garden, A. S. Baulne, W. D. Baillairge, J. D. Black, F. L. Fellowes, R. S. Lea, C. H. Vogel, G. Legrand, Jas. R. Wainwright, S. J. Allan, H. R. Lordly, W. V. Taylor, E. A. Rhys-Roberts, H. D. Bush, H. R. Ives, W. Bell Dawson, John S. Metcalf, W. Chase Thompson, J. F. Tremblay, A. E. Smaill, Thos. Kirk, G. R. MacLeod, M. Beullac, M. J. Butler, A. Dedman, L. A. Desy, Ernest Belanger, Alcide Chausse, A. E. Dubuc, J. T. Markill, A. H. N. Bruce, R. F. H. Bruce, Alex. J. Grant, Frank Simpson, C. B. Brown, J. D. MacKerras, R. J. Durley, L. A. Herdt, J. F. Murphy, Owen O'Sullivan, L. R. Ord, John W. Aston, Stephen Burgess, Chas, Robertson, Jas. L. Smith, A. L. Killaly, W. Dale Harris, Wm. McNab, E. C. Amos and Jas. Ewing.

After the reading and confirmation of the minutes of the last annual meeting, the president nominated the following scrutineers for the ballot for election of officers:

For Officers and Members of Council: J. M. Nelson, E. G. M. Cape, L. G. Papineau, D. J. Carter and E. E. Gagnon.

For Nominating Committee: J. Ewing, C. S. Leech and G. Grant.

For Committee for Amendment of By-Laws: J. S. Armstrong and R. Bickerdike, jr.

The secretary, Prof. C. H. McLeod, read the report of council and report of the Library Committee, and the treasurer, H. Irwin, read the treasurer's report, which were adopted. The following is the substance of these reports:

REPORT OF COUNCIL.

The report of council showed that during 1902 there had been elected 14 members, 27 associate members, 3 associates and 72 students, while one had been re-instated into membership. Two members had resigned; while there had been struck off for non-payment of dues 4 members, 11 associate members and 6 associates. Four deaths had occurred: E. P. Hannaford, past president; R. Forsyth and J. E. Rosamond, members, and H. A. Gauthier, associate member. The membership now stands as follows:

	Res.	Non-Res.	Total.
Honorary Members	2	6	8
Members	67	271	338
Associate Members	91	250	341
Associates	15	18	33
Students	102	160	262

This showed an increase over the previous year of 15 members, 20 associate members and 58 students, and a decrease of 3 in associates. The net total increase over 1901 was 90, the present grand total being 982.

After giving a list of the papers read last year, the report stated that the committee in charge of legislation in Ontario, with the approval of the University of Toronto, presented a bill to the Provincial Legislature, which passed its first reading on the 19th February last. Owing to opposition from various quarters, however, the bill was withdrawn before its second reading. The amendment to the Quebec Act, 2 Ed. VII., Chap. 25, became law on March 26th, 1902. In Manitoba, some gentlemen sought incorporation for a society to be known as "The Manitoba Institute of Engineers and Architects," and asked exclusive rights in regard to the profession of engineering in that province. On the representation of this society and others interested, the bill was rejected. During the same session of the Manitoba Legislature, the Land Surveyors' Act was amended in such manner as to permit engineers to become provincial land surveyors upon passing an examination before the University of Manitoba.

At the last annual meeting it was announced that a prize of $25 would be given by the publishers of The Canadian Engineer for the best student's paper presented during the year. Three additional prizes for a like amount were added by the council on the suggestion of the meeting. These four prizes have been awarded as follows: G. H. Blanchet, for his paper on "The Montreal, Ottawa and Georgian Bay Ship Canal;" K. M. Cameron, for his paper on "The Practical Use of Extensometers;" Fraser S. Keith, for his paper on "A Modern Machine, its Manufacture and Test," and F. A. McKay, for his paper on "Friction on Lubricated Surfaces."

In reply to a circular letter, sent out to members requesting them to send in names of engineers practising in Canada, who were not members of the society, 115 names were sent in. A number of those so reported have since joined the society, and some are under consideration. The majority, however, were found to be persons who did not have the necesary qualifications for membership.

A course of illustrated lectures for engineering students, and a series of meetings for the reading of students' papers have been arranged for. The first lecture of the series was delivered by J. W. Harkom on the 9th January before a largely attended students' meeting.

After giving an account of the summer excursion to Cape Breton the report concluded with a memorial notice of the late E. P. Hannaford.

LIBRARY COMMITTEE'S REPORT.

The report of the Library Committee acknowledged the gift of a number of books, maps, photographs, etc., from A. F. Stewart, J. M. Nelson, A. Chausse, E. A. Bond, Geo. Brush, H. D. Bush, Boston Transit Commission, International Engineering Congress, Canadian Pacific Railway, Collingwood Shreiber, D. Weatherbe, M. Murphy, J. S. Dennis, E. L. Corthell, H. R. Lordly, W. Murdoch, C. H. Rust, F. W. W. Doane, W. Bell Dawson, New Brunswick University, City Engineer of Providence, R.I., New York State Engineer, Adjutant-General U. S. Army, Canadian Patriotic Fund Association, and others.

Extra shelf room has been provided for library purposes in the basement, and a projection lantern has been purchased for use in the assembly hall.

THE TREASURER'S REPORT

showed the finances of the society to be satisfactory. The balance carried forward to this year in the general fund amounts to $1,024.06 as compared with $941.48 last year, being an increase of $82.58. The report then went on to state: "The balance to credit of building fund at the end of 1902 is $742.51 as compared with $211.20 at the end of 1901, showing an increase of $531.31, the increase for the two accounts being $613.89. This increase is principally made up from arrears and entrance fees, and the credit for this is entirely due to the able manner in which our secretary has conducted the thankless task of collecting the arrears, and to his good judgment in getting engineers practising in Canada to join our society."

The financial statement showed that current receipts from fees were $3,416, from arrears of fees $994.50, fees in advance $95 and entrance fees $800. Receipts from rent of bedrooms were $93.54, from sales of periodicals, $17.06, and sales of transactions $29.25. The total receipts were $5,686.13, and the total expenditure was $5,603.35. Among the items of expenditure were the following: Transactions and advance proofs, $750.65; printing, stationery, binding and diplomas, 756.86; books, magazines and library expenses, $110.33; postage, postcards and telegrams, $365.22; examiners' fees and expenses, $118.50; secretary's salary, $300; assistant secretary's salary, $480; caretaker's wages, $360; electric light, $131.91; gas for cooking, $26.40; fuel, $94.95; furniture and permanent fitting, $263.96; expenses during annual meeting, $172.35; expenses during summer convention, $91.42; legistion, $412.96.

C. E. W. Dodwell commended the idea suggested by the treasurer of charging interest on the arrears due by members. Whether this could be done without conflicting with the by-laws he could not say.

The secretary said it did not appear to be in conflict with the by-laws and the change might be made by resolution of the meeting.

Further discussion of the subject was deferred.

C. deB. Leprohon asked if those members reported by the secretary to have been struck off the list for non-payment of fees and other causes were still in practice?

The secretary replied that in some cases they were. There were also one or two cases where individuals had come into this province on temporary work, and had left again when the work was completed.

In reply to questions as to whose duty it was to notify these people that they were illegally practising the secretary said that no provision was made for the prosecution of such cases by the society, and it would appear that it rested with some individual member to take action.

C. E. W. Dodwell thought the legislation in this matter was a farce if there was no machinery within the society by which illegal practising could be dealt with.

W. McLea Walbank agreed with Mr. Dodwell, and thought that an officer should be appointed whose function was to notify persons who were illegally in practice, and if necessary prosecute them in the name of the society. Such was done in the medical and the dental associations as well as the land surveyors.

The president thought the society ought to move cautiously in this matter, and that it would be well to have the advice of a solicitor before taking action.

H. Irwin said the question of illegal practising in this province had not been neglected, and quite a number of persons had joined the society as the result of being notified that they were contravening the act.

The secretary added that everybody whose name had been reported to him for illegal practice had been notified of their position. In the case of those in the province of Quebec whose membership had lapsed, they had the right under the act to rejoin on payment of the fees.

The meeting then adjourned till 3 p.m., when the members assembled in the Physics Building of McGill University, where a large number listened with intense interest to a short

talk by Prof. Cox on liquid air, the mysterious properties of which were demonstrated by a number of experiments such as those already mentioned in the Canadian Engineer.

The evening was profitably taken up with the instructive annual address of the president, which will be dealt with in next issue. The address was followed by a paper by H. D. Bush on the Miramichi Bridge, illustrated by lantern views, which will be referred to later on.

The first business brought up on the second day was the consideration of the report of the committee on cement specifications.

Prof. Bovey, as chairman of the committee, said that these specifications were based largely on the report of a committee of German cement manufacturers with whom several German experts in cement were called in consultation. These specifications were not binding on anybody, and any engineer could vary them to suit the special conditions of his work.

W. T. Jennings suggested the transposition of the report so that the proposed standard would appear first, and the conditions would follow as notes in explanation. This suggestion was adopted, and some change was made in the paragraphing of the report, while the first line of the proposed standard was altered so that the term "slightly burnt" was made to read "well burnt."

During further discussion by Messrs. Pinhey, Armstrong, Kerry, Jennings, Anderson, Rust and Marceau, it was made clear that this report was intended as a general guide or base for specifications without defining all conditions, which would vary according to the character of the cement, and the nature of the work to be done.

An amendment moved by J. G. G. Kerry, referring the report back to the committee, was lost and the report adopted, and the committee discharged. (This report appeared in The Canadian Engineer of March, 1902.)

R. B. Rogers presented the report of the committee appointed to consider the question of the change of the society's name. The committee had sent out a circular asking the opinion of each member as to whether the word "civil" should be dropped, and a very large majority voted for retaining the title of the society as it is. The question appeared to the committee to have arisen out of a misconception of the term "civil engineer," and they would urge that every means be taken to enlighten members and others as to the inclusiveness of the term. It also appeared to the committee that any change by dropping the word "civil" might be prejudicial to legislation that might be asked in future by the society, as it would render the name almost identical with some existing organizations.

Prof. Bovey referred to the changes in the scope of engineering in the last ten years, largely brought about by the specialization now going on in universities and technical schools. Those who were taking up electrical engineering, for instance, as a specialty, could not be expected to join the societies and associations representing all the other branches of engineering, and the question was how to retain within such a society as this all those engaged only in a particular branch.

O. Higman mentioned that he had recently received a communication from a gentleman connected with the Institution of Electrical Engineers of Great Britain, suggesting the establishment of a branch in Canada.

W. McLea Walbank suggested that this society should be divided into sections, such as an electrical section, a mining section, a mechanical engineering section, etc., each having its own officers and a different night of meeting.

The report was adopted and Mr. Walbank's suggestion was referred to council for consideration.

ELECTION OF OFFICERS.

The election of officers resulted as follows:

President, K. W. Blackwell. Vice-presidents. G. H. Duggan, Sydney, N.S.; Ernest Marceau, Montreal, and G. A. Mountain, Ottawa. Secretary, Prof. C. H. McLeod. Treasurer, H. Irwin. Librarian, E. G. M. Cape. Council, C. H. Keefer, John Kennedy, Montreal; C. E. W. Dodwell, Ottawa; W. B. Mackenzie, Moncton; D. MacPherson, Montreal; Cecil B. Smith, Niagara Falls, Ont.; R. B. Rogers, Peterboro; E. Mohun, Victoria, B.C.; Prof. John Galbraith, Toronto; Prof. W. R. Butler, Kingston; Stuart Howard, Montreal; W. McLea Walbank, Montreal; St. George Boswell, Quebec; R. A. Ross, Montreal; L. A. Vallee, Quebec.

The following were elected as Nominating Committee:

For Maritime Provinces—C. E. W. Dodwell.

For Quebec.—L. A. Vallee and W. McL. Walbank.

For Ontario.—Geo. A. Mountain, W. P. Anderson and C. H. Rust.

For Northwest Territories.—H. J. Cambie.

Outside of Canada.—R. A. Ross.

On motion of A. W. Robinson, seconded by Geo. Holland, a resolution was passed calling attention to the defects of the present patent law of Canada, and referring the matter to council with the object of asking the Government to do away with present abuses.

On motion of Col. Anderson, seconded by C. H. Rust. the following resolution was also passed: That the council be requested to ask the members of the society to see that their lines of levels are in all cases connected with permanent "bench marks," and that these, where possible, be connected with sea level datum; further, that the council take into consideration the best method of securing permanent records in regard, not only to levels, but also to all trigonometrical surveys.

The President-elect having taken the chair, the afternoon session was devoted to the reading and discussion of papers, those presented being one on "Tide Levels," by Dr. W. Bell Dawson; one describing a modern dredge, by A. W. Robinson, and one on Gas Engines, by H. M. Jaquays, of McGill University. These will be reported in next issue.

The evening was taken up with the annual dinner at the Windsor, which was attended by about 100 members, and was the most successful yet held. The retiring president was in the chair. Among the toasts was that of "Our Guests," proposed by W. T. Jennings and replied to by F. H. McGuigan, of the G.T.R., C. J. Smith, of the Canada Atlantic, Prof. Cox, of McGill University, and J. T. Knight, of the Stock Exchange. "The Sister Societies," was replied to by R. S. Buck, of the American Society of Civil Engineers, W. E. Doran, of the Association of Architects of Quebec, C. H. Rust, of the Engineers' Club, of Toronto, and M. Gastonguay, of the Quebec Association of Land Surveyors. The toast of "Our Society" was acknowledged by the newly elected president, who announced that the membership of the society had just passed the 1,000 mark. The "Retiring President" was replied to by Dr. Murphy. Mr. Kerry was chairman of the dinner committee.

The morning of the closing day was occupied by the reading of a paper by E. G. M. Cape, on the "Industries of the Consolidated Lake Superior Co." at Sault Ste. Marie, and a paper by R. S. Lea on "Flow of Streams."

In discussing the latter paper, Messrs Jennings, Robinson, Kerry and Rogers, urged the importance of gathering data on the average flow of rivers and streams in Canada as the subject was becoming of practical value in this country. On motion of Prof. McLeod, seconded by R. B. Rogers, a resolution was passed to the effect that in view of the insufficiency of the existing data on the flow of streams a committee consisting of R. S. Lea, C. H. Rust, J. G. G. Kerry, Cecil B. Smith and C. H. McLeod, be appointed to consider the practicability of a more complete series of measurements, reporting to council on the cost of such work, and that the council be requested to co-operate either directly or by memorial to Government.

The secretary stated that the report of the Gzowski medal was not ready.

The question of charging interest on arrears of fees was left to council.

On motion of P. W. St. George a resolution was passed calling attention to the fact that a number of engineers were illegally practising in the province of Quebec.

The reading of Mr. Baillairge's paper on the "Construction and Failure of Dams in the Last 30 Years," was deferred.

It was decided to leave the question of a summer convention and excursion to a vote by letter, the council being instructed to suggest two or three alternative towns, such as a trip to Sault Ste. Marie or an excursion up Lake Erie.

The convention closed with votes of thanks to the railways, etc.

Kivas Blackwell

President Canadian Society of Civil Engineers.

Municipal Works, Etc.

Robt. D. Grant, of Toronto, has been awarded the contract for a wharf at Sturgeon Falls.

The advisability of a bridge between East and West St. John, N.B., is being discussed.

In Brantford 9,369 feet of cement walk was put down last season, and only 631 feet of board walk.

C. H. Rust, city engineer, Toronto, has recommended the purchase of an asphalt plant. It will cost about $23,000.

Dupont & Leduc, C.E., of Montreal, have completed plans for waterworks for Plessisville, Que. The cost will be about $34,000.

The Toronto Board of Control will apply for authority to proceed with a bridge over the railway tracks at the foot of Yonge street.

About $7,000 was expended last year on improvements to the Berlin, Ont., waterworks. The profits of the works, which are under municipal management, were about $7,500.

A new 5,000,000 gallon engine, to cost about $30,000, is recommended for the high level station of the Toronto waterworks, the present engines not being equal to the work required.

The contract for the construction of the waterworks at Marieville, Que., has been let to Jno. F. Connolly, of Toronto. It amounts to $40,000. Dupont & Leduc, of Montreal, are the engineers.

Wighton & Co. have been awarded the contract for alterations to the Bank of Montreal building in Montreal. It is one of the largest contracts given out in that city in recent years.

The Victoria Machinery Co. has the contract to build the superstructure of the new Point Ellice bridge at Victoria, B.C. The figure is $65,000 and the bridge is to be completed in ten months.

Anchor ice is causing serious difficulty at the Peterboro waterworks. The Otonabee Power Co. has no difficulty, and offers to supply auxiliary power to run the works, the water commissioners to put in their own generator.

The extensions to the Sydney, N.S., waterworks have been completed, and in describing them The Record pronounces the works to be one of the best in the Maritime Provinces. W. T. Jennings, of Toronto, reported on the system, and it has been carried out under the direction of W. G. Yorston, C.E.

A gigantic gas trust is reported to be in process of formation, which will include the companies in London and nearly all the important cities of Europe. The capital will be nearly a billion dollars, of which John D. Rockefeller is said to be down for $300,000,000.

A change from complete gravitation to a combined gravity and pumping system has been made in the Glace Bay, N.S., waterworks, thus providing for a supply of water from McDonald's Lake if necessary, giving more head, and reducing the cost. C. M. Odell is continued as engineer in charge of construction.

The Northwest Land Co. has purchased from the Government 500,000 acres of land in Southern Alberta for $3 an acre, which is to be brought under cultivation by irrigation. The C.P.R. will irrigate 2,500,000 acres at a cost of $7,500,000, taking the water power from the Bow River. The land when reclaimed will be worth $10 an acre.

Frozen water pipes at Sault Ste. Marie are thawed by electricity, a transformer being mounted on a sleigh for the purpose. Connection is made with a primary street wire, and the current led to the transformer through a water rheostat, and thence to the frozen pipe. Attachment is made at two places, and the current passes directly through the section of pipe which is frozen. The charge is $3.

T. S. Rubidge, chief engineer of the Galops Canal, and L. K. Jones, secretary to the Minister of Railways and Canals, have been consulting Major Thomas W. Symons, United States engineer for the Buffalo district, with reference to building a dam in the St. Lawrence, between Adam's Island and Galops Island, to raise the water in the Galops Canal. It will be 800 feet long and 15 feet high.

C. H. Rust, city engineer, Toronto, anticipates great difficulty in getting material for road and sidewalk construction the coming season. Cement is scarce and stone hard to obtain. The railways are so busy with grain and lumber freights that they do not care to haul stone. Sixty local improvement works have been held over from last year, only twenty of which were begun. Concrete for the island sidewalk is being taken over on the ice.

The Good Roads Machinery Co., of Hamilton, Ont., have added new machinery to their plant during the past year, and have opened a new department—the manufacture of granolithic culvert and pipe moulds, which will enable municipalities to construct their own concrete and granolithic drains and culverts. These moulds will be made in eight sizes, and will be a great convenience to municipalities in carrying out their own work economically. Full directions for use are sent with these moulds.

During the year 1902 the city of Winnipeg laid 64 miles of sewers, 27 miles of macadam pavements, 9¼ miles of asphalt pavements, 16¼ miles of cedar block pavement, 44 miles of boulevards, 10 miles of granolithic sidewalks, 176 miles of plank sidewalks and 74 miles of water pipes. The cost was as follows: Sewers, $1,344,000; macadam pavements, $481,000; asphalt pavements, $520,000; cedar block pavements, $330,000; boulevards, $44,600; granolithic sidewalks, $130,000; water pipes, $352,000.

The following by-laws were voted on and carried at the municipal elections: Guelph, to buy out the Light and Power Co. by the city; Listowel, to take over the electric light and waterworks; Belleville, to place the management of the water works in the hands of the council; New Hamburg, to build a bridge; Orillia, to put in force the county road system; Collingwood, to put in force the good roads by-law and to expend money in improving the harbor; Strathroy, to take over the electric light system by the town, and to build waterworks; Fort William, to improve the electric light system, and to raise $5,000 for sewers and sidewalks; Owen Sound, to purchase the electric light and gas plants; Sault Ste. Marie, to give a 25 year franchise to the Tagona Water & Light Co.; Sandwich, to abolish water commissioners; Gananoque, in favor of waterworks. The following by-laws were defeated: Merritton and Grimsby, to build granolithic sidewalks; Peterboro, for permanent improvements; Lindsay, to spend $40,000 for good roads.

MARINE ENGINEERS.

The National Association of Marine Engineers held their annual meeting in Montreal on the 27th to 29th ult, when the following were elected officers for the ensuing year: Grand president, Thos. J. S. Milne, Kingston, Ont.; grand vice-president, Alex. L. deMartigny, Sorel, Que.; grand secretary-treasurer, Neil J. Morrison, St. John, N.B.; grand conductor, F. S. Henning, Toronto; grand doorkeeper, Fred. Henning, Montreal; grand auditors, Robert Craig, Toronto, and James Gillie, Kingston, Ont. The chief subject of discussion was the amendment of the Steamboat Act in regard to the trading of foreign and British built vessels engaged in the coasting trade on the inland waters of Canada to the detriment of Canadian builders and engineers holding certificates from the Canadian Government. Resolutions were framed and will be presented to the Minister of Marine looking to the rescinding of the clauses complained of. A representative from the Labor Congress of Canada was heard before the convention regarding the affiliation of the marine engineers with the Labor Congress. The delegate was cordially received by the marine engineers, and the matter of affiliation was favorably considered. The next annual meeting will be held in Kingston, Ont., the last week in January, 1904.

Waterworks and electric light are to be installed at Pincher Creek, N.W.T.

Mining Matters.

British Columbia is coming to the front as a zinc producer.

The Rossland Board of Trade wants the School of Mines re-established there.

An immense ore crusher, driven by electricity, has been installed at the Granby mine, B.C.

A company is being formed at Rat Portage to develop a deposit of mineral paint near there.

Four furnaces are now in operation at the Granby, B.C., smelter. This means 500 tons a day.

Rossland's ore production for 1902 was almost 60,000 tons larger than in any preceeding year.

Tests for oil are to be made at Elgin, N.B. Years ago shafts were sunk for coal but nothing found.

The manganese deposits, on the Magdalen Islands, have been disposed of to the Dominion Iron & Steel Company.

A rich seam of manganese has been discovered at Sheet Harbor. It is pronounced by an expert to be of good quality.

The Wilbur iron mine, at Lavant, on the line of the Kingston and Pembroke Railway, has been sold to a United States company. It will be worked at once.

The Cobbledick dredge, built at Lytton, on the Fraser river, in 1899, and used for gold dredging, has sunk in ten feet of water, where the current is very swift, and cannot be raised.

The recently discovered iron range in Hutton Township, near Sudbury, consists of magnetite, imbanded with silica, and is rich enough to be described as an ore. It is comparatively free from pyrites.

The British Columbia Institute of Assayers met recently at Rossland. Herbert Carmichael, provincial assayer, was elected president, and Arthur A. Cole, of the War Eagle Mine, Rossland, secretary-treasurer.

A Japanese Klondyke is said to have been discovered.

Herbert Wemyss, a mining engineer, claims to have found three or four diamonds in the Similkameen district of British Columbia. He says the conditions are in some respects very similar to those in South Africa.

Alaska coal is now used at Dawson. It comes from a 6ft. vein at Forty Mile Creek. It is really a gold mine, though not in the ordinary sense. There is both bituminous and anthracite coal in Alaska. Oil wells also exist at Cook's Inlet, and are being developed.

A good quality of anthracite coal is said to have been found in Victoria County, N.S. Mining will be commenced next May by a company of prominent Toronto, Montreal and Ottawa capitalists. In a few weeks the company will commence to connect the mine by rail with Baddeck.

A copper refining plant is to be put up at Shawinigan Falls, if the co-operation of firms interested in the copper trade cannot be secured in order to have the works established in Montreal. This is the determination of C. K. Milburne, who is backed by English and American capital.

The Fairview Corporation is sinking the main shaft 60 feet below the present level. Other work in the mine is shut down until the cyanide plant, now in course of erection, is completed. This plant will have a capacity of 200 tons per diem. The company gave a dance on the 14th inst. in two of the finished cyanide tanks.

The Engineering News, of New York, speaking of mining developments in the Yukon, refers to them as being in Alaska. The Klondyke river and the Atlin District are not in Alaska, although we have no doubt our cousins over the way would like to annex them. But the Engineering News might devote a little attention to the study of geography.

The Morning Star mine, owned by Mangott & McEachren, has been bonded by Dr. Wells, of Columbia University. Dr. Wells has started a force of men continuing the main shaft, now 140 feet deep, to a further depth of 100 feet, and if the ore continues to hold its value, the shaft will be sunk another 100 feet, and the necessary milling machinery will be installed.

A change of management has taken place at the Bullion Extraction Works, at Silica, where the War Eagle and Centre Star companies are experimenting with their new concentration system, Gerald Voss Hopkins, who has been in charge of the works since the experiments were started, having resigned to go to England. He is succeeded by C. M. Eye, who has been connected with the assay office of the companies, previous to which he resided at Aspen, Col. Several additional agitating tanks will be installed.

A new company, the Dominion Power and Irrigation Company, Limited, is being formed, with a capital of $250,000, to buy the water rights held by the Dominion Consolidated Mines Co., Limited, and to develop the water power. The necessary capital is subscribed partly in Montreal and partly locally. The company intend to develop the water power of Okanagan Falls to the extent of 1,000 or 1,500-h.p., and the company is asking for tenders for the supply of the necessary turbines, dynamos and motors. R. H. Parkinson, C.E., of Fairview, B.C., is in charge of the construction works.

A new milling plant is being installed at the Victory-Triumph mine, Rossland, of the High-Speed gravitation type, the first of its kind on the continent. The mill is a new design evolved after years of investigation and experimenting by a practical mechanical engineer. A description of the apparatus states that in ordinary practice the best results obtained from the usual cam stamp with a drop of 7½ inches effective height is about 95 drops per minute, while the weight of each stamp rarely exceeds 1,250 pounds, in the High-Speed mill, the mean velocity at which the stamp is raised by the cylinder so far exceeds the limit velocity imposed by the essential features of the cam mechanism that from 132 to 135 drops per minute, each of 7½ inches effective height, can be obtained. It is, therefore, much more effective and economical.

The students of the School of Mining at Kingston have done well in the competition of the Canadian Mining Institute for 1902, the president's gold medal having been won by O. N. Scott, for his paper "On the Ore Deposits of Copper Mountain, Similkameen District, B.C.," and a cash prize of $25 goes to L. P. Silver for his paper on "The Sulphide Ore Bodies of the Sudbury District." The other $25 prize went to H. W. DePencier, of McGill College, Montreal, for a paper on "Mine Timbering in the Old Ironsides and Knob Hill Mines." In future, in addition to the president's gold medal, three cash prizes will be given for papers by Canadian mining students under three groups of subjects: (1) Ore Deposits and Mining Geology; (2) Mining Practice; (3) Ore Dressing and Metallurgy.

Electric Flashes.

The Red Falls Electric Co., of Lyster, Que., is asking for incorporation.

The electric light works at Woodstock, Ont., have had to close for want of coal.

The Southampton Traction Co. is seeking an entrance for its lines into London, Ont.

The city of Dawson has closed a contract for lighting the streets of the town with 100 22-candle incandescent lamps for $7,800.

The Kingston Light, Heat & Power Co. will appeal to the Privy Council against the award giving them only $80,000 for their franchise.

A system of heating the cars by means of a stove in the vestibule is being tested on the Toronto street railway. It has been tried also in Montreal.

The contract for the switch-board of the new Montreal Board of Trade building has been awarded to the Hill Electric Switch Co., of Montreal, the price being about $2,500.

Wireless messages have been exchanged across the Atlantic between King Edward and President Roosevelt. It is announced the system will soon be ready for commercial business.

Work will soon be begun, according to John Bottomley, general manager for the Marconi Wireless Telegraph Company of America, in installing wireless stations to cover pretty much all the world.

The incandescent lamp trust of the United States has bought the factory building at St. Catharines, formerly occupied by the McBurney & Beattie Co., bicycle manufacturers, and intend to establish a Canadian branch factory for making electric lamps.

The Toronto Railway Co. has a number of small cars which they are splicing, making two into one. Two men only will be necessary for operating where four are now required. The capacity of the cars will be 30 per cent. greater than any now in the company's service.

The arbitrators have made their award as to the price to be paid by the town of Midland for the electric light plant. The company asked $18,000, the arbitrators have awarded them $9,629.97, the costs of arbitration, $1,800, to be paid half by each and each to pay their own costs.

New Glasgow, Trenton, Stellarton and Westville, N.S., are to be connected by tramway and a ferry service established from Abercrombie Point to Pictou. Dams are to be built on the East River above New Glasgow to supply water power to generate electricity for the operation of the tramway, and also for lighting the towns which it connects.

The Metropolitan Railway Co., operating the line up Yonge street from Toronto, is placing a number of new passenger and freight cars on the line, not before they are needed, the accommodation having been notoriously bad. The new cars will be handsomely equipped, and have every appliance to guard against accident, including air whistles, as well as the usual gong.

The St. Georges Electric Co., of St. Georges de Beauce, Que., is applying for incorporation.

Marconi is working on a wireless telephone which can be carried in the pocket and used anywhere.

Electricians have gone west to locate a station in the Rocky Mountains for wireless transcontinental transmission.

The Electrical Contractors' Association of the province of Quebec, recently held their first annual meeting and banquet.

It is not likely daily newspapers will be published on the ocean steamers yet as a result of Marconi's discoveries, but the news will be supplied to the vessels, and bulletins posted on board.

The electric power system in Yarmouth, N.S., is not a success, and is to cease. The electric cars will stop, and steam will be resorted to for power for the industries which have been using electricity.

On January 1st, which was the second anniversary of the signing of the agreement for the construction of the British Pacific telegraph cable, Sir Sandford Fleming sent a New Year's greeting from Ottawa to Premier Barton, of Australia, and received a reply.

J. H. McClellan and G. L. Gowland, of Peterboro, are placing before the public a nickel-in-the-slot electric meter invented by the latter. All the operator desiring light has to do is to go to the metre and deposit therein 25 cents or any number of quarters, which will be used consecutively as the light is consumed.

A fatal accident from electricity is reported from Grand Forks, B.C., by which Thos. Begley, of Toronto, was killed. He slipped while standing on a high platform, and in falling grabbed a telephone wire, receiving a fatal shock. As the wire did not cross and was 15 feet from a power line which carried 20,000 volts, the fatality has been attributed to induction, but such a thing is practically impossible under the circumstances. If a distant wire could thus become charged by induction an extreme element of danger would exist.

The object of the Cataract Auxiliary Co., incorporated by the Hamilton Electric Light and Cataract Power Co., is to manufacture, sell or purchase electric power, whether generated by waterpower, steam, or other force, and in short to have the benefit of all powers given, in the act respecting companies for supplying steam, heat, electricity or natural gas for heat, light or power. The auxiliary company will double the power capacity at DeCew's Falls, the idea being to supply all the power the Deering Company may need, as well as power required by any other company.

Marine News.

Only one vessel is being built at Victoria, B.C., this winter, and there is little repairing going on at the shipyards. In the spring a busy time is anticipated.

The dredge King Edward, while working at Hope Slough, B.C., became a prisoner by the bank caving in behind her. She was relieved after much work.

The steamer Victoria, in winter quarters above Brockville, has been sunk by a muskrat gnawing a hole in her hull. River men say such an incident is not uncommon.

The Central Canada Coal Co., of Brockville, has purchased from Edward Smith, of Buffalo, the steamer Samuel Marshall. The price is stated to have been $25,000.

The Calvin Co. is building the largest steam barge that has ever been constructed at Garden Island. It is full canal size, and will be engaged in the Upper Lake timber trade.

The Dominion Motor and Machine Co., Limited, Toronto, have booked an order, from a manufacturer of launches, for thirty-five of their gasoline engines, ranging from 1½-h.p. to 6-h.p., with the understanding that if prompt delivery is given the order will be duplicated.

A correspondent wishes to know the address of the British American Dredging Company. Any of our readers knowing of such a firm will oblige by dropping a card to our Toronto office.

The first free marine postal delivery has completed its first season on a New Hampshire lake. The mail is taken on a steamer constructed for the purpose and delivered at the summer cottages along the shore.

A Kentucky inventor has provided a novel means of securing the rapid turning of stern wheel river steamers. He sets a second wheel at right angles to the propeller, between the stern and the paddle wheel, which being turned in either direction causes the stern of the boat to move as required.

The Richelieu & Ontario Navigation Company has purchased a fine steamer, the Virginia, and will place her on the Saguenay route next summer. She was built at Baltimore, and has been running on the Potomac. She is a side-wheeler. Her speed exceeds that of either the Kingston or Toronto.

The Bannockburn, of the Montreal Transportation Co., which disappeared recently in Lake Superior, will be replaced next season by another large steel grain freighter, similar to the Bannockburn or Rosemount. Mr. Cuttle, manager of the company, has gone to Scotland to arrange for the new vessel.

Pintsch gas-lighted bell buoys have been successfully tested, off Chicago and other points on the Great Lakes. A fixed or flash light is shown, and the gas passing to the burner from the body of the buoy, which forms the receiver, is led through a mechanical device, which rings the bell. The sound intervals may be predetermined. In the old-fashioned bell buoy, the ringing of the bell depended on the movement of the water, and as it is generally calm during a fog, the bell did not sound when it was most needed. There are two methods of filling the buoys with gas, by taking them at intervals to a Pintsch gas-making plant, or by equipping a boat with compressors and holders, which being filled at the works is pumped by the compressor into the buoys. The buoys hold enough to last for a year.

Railway Matters.

The Reid Co. has built a handsome new station at St. John's, Nfld.

Tests of cattle guards are being made at Ottawa. About 70 have been submitted.

The C.P.R. is experiencing much difficulty with their locomotives in the west on account of the bad quality of the water.

J. Smith, of the C.A.R., and Mr. Ogilvie, of the mechanical department of the same company, are said to have netted $25,000 from a new car-coupling device.

From the large number of railway bills of which notice has been given, the coming session of the Dominion Parliament bids fair to be known as the railway session.

C. E. Perry, C.E., of Montreal, with a party, has gone to Norway House, to make a survey of the country, where the proposed trans-continental railways will pass.

Tests for two years on the Pennsylvania Railway show that nickel steel rails, though they cost nearly three times as much as standard steel rails, are more than three times as durable. They are to be laid by the Pennsylvania road on its sharp curves through the Alleghany Mountains.

In consequence of the numerous accidents, arising largely from the failure of operators, it is probable the Grand Trunk will appoint an inspector of telegraphs, who will have supervision of the whole telegraph system. If operators are found to be physically or mentally unfit for their work, they will be relieved temporarily or permanently.

Mexico is to have a transcontinental railway.

Rhodes, Curry & Co., of Amherst, N.S., have a large number of orders for cars from different railways.

The preliminary survey of the new railway from Brockville to Ottawa has been completed.

A new and well equipped roundhouse, to hold 18 engines, has been built for the I.C.R. at Sydney.

The Newfoundland Railway has been tied up by snowdrifts, the fall having been the heaviest in that colony for years.

A charter is being asked for a railway to connect Quebec with the mouth of French River, there to connect with lake carriers. The distance is 465 miles.

A railway is projected from Winnipeg to Seven Islands, on the north shore of the St. Lawrence below Quebec, where there is said to be a good harbor.

Twenty-two miles of the Chateaguay Railway was changed from narrow to broad gauge in 24 hours on Dec. 28; 600 Italians were engaged to assist the section men.

Operations on the Cape Breton Railway are to be suspended till the spring. The track is now laid to within a few miles of St. Peters, and most of it is ballasted.

Mackenzie and Mann, proprietors of the Canadian Northern Railway, have placed an order for nineteen new locomotives with the Canadian Locomotive Company, Kingston.

A man named Foster has recovered $1,999 from the C.P.R. for loss of his right eye in their shops at Montreal. He was working inside a boiler when the steel drift pin broke off and penetrated the eye.

In a lecture on the compound locomotive, delivered in Montreal by Thomas McHattie, master mechanic of the Grand Trunk, he showed the advantages of the compound locomotive over what is known as the mogul in the saving of coal by using the steam twice. Another advantage was their hauling capacity, as they are capable of hauling more than double the number of cars of the old style mogul.

The Brockville, Westport & Sault Ste. Marie Railway was sold by order of the Court, at Brockville, on Jan. 20. It was started at $150,000, and the second bid raised it to $160,000, at which it was knocked down to Chas. F. Hohn, representing a New York syndicate, which it is understood had secured the claim of the Knickerbocker Trust Co., at whose instance it was sold. The road is running from Brockville to Westport, some 44 miles, and it is the intention of the purchasers to extend it and make it a trunk line. With that object they are seeking incorporation as the Brockville and Western Railway Co. Several creditors who hold judgments against the road threaten to take action to enforce their claims.

GIGANTIC MEXICAN POWER PROJECT.

A company, composed of Canadian financiers, has secured from the Mexican Government a valuable franchise and will develop electric power for the city of Mexico at a vast outlay, the capital of the company being $12,000,000, of which $7,500,000 is already subscribed. The company includes James Ross, who is the most largely interested, having become responsible for a million dollars; J. H. Plummer, assistant manager of the Canadian Bank of Commerce; F. S. Pearson, Hon. George A. Drummond, vice-president, and E. S. Clouston, general manager of the Bank of Montreal; F. L. Wanklyn, manager of the Montreal Street Railway; E. R. Wood, manager of the Central Canada Loan & Savings Company, Toronto; Sir William Van Horne, chairman of the board of directors of the Canadian Pacific Railway, and president of the Cuban Railway; Hon. G. A. Cox, president of the Canadian Bank of Commerce, and William Mackenzie, of Mackenzie & Mann. Mr. Ross is to be president, Mr. Plummer vice-president, and Mr. Pearson consulting engineer. The latter is credited with being the originator

of the enterprise, and it will be carried out under his personal direction. The company will be known as the Mexican Light and Power Company, and, though incorporated in Canada, has also been sanctioned by the Federal Government of the Republic of Mexico. The head offices will be at Montreal. The task of securing the franchise from the Government of Mexico was accomplished by Charles H. Cahan, ex-M.P.P., of the law firm of Harris & Cahan, of Halifax. The company is granted exclusive use of three rivers, and all privileges necessary to transmit the power to the City of Mexico. The amount of power that will be available will be eighty thousand horse-power, forty thousand of which will be ready for use at the end of two years, and the entire amount at the end of four years. The distance is 94 miles and power is derived from the Caxa and Tenango rivers which at one drop near their junction give a head of 1,235 ft., and a few hundred yards from this another drop with an equal head. P. A. Peterson, C.E., of Montreal, has reported on the project and confirms the estimates of the engineers who made the first report.

A THIRD NIAGARA POWER DEVELOPMENT.

The Ontario Government has granted a franchise to the Toronto-Niagara Power Co., of which W. Mackenzie, H. M. Pellatt and Fred. Nicholls are the chief promoters. Their plan is to develop power and bring it to Toronto, and from the energy and wealth at the command of these men it may be anticipated that the project will be pushed to a successful completion at an early date. The city council of Toronto had also determined to apply for a franchise, but whether, in view of the privilege given to the Toronto-Niagara Power Co., they will press the matter, remains to be seen. The generating station, which will provide 40,000 h.p, will be located at a point between that of the Ontario Power Co.'s and the Canadian Niagara Power Co.'s stations and will be ready for operation within two years. Work on the development will be commenced at once.

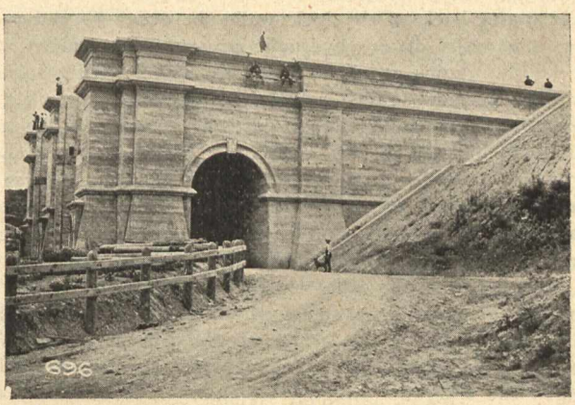
THE TRENT VALLEY WATERWAY.

BY R. B. ROGERS, C.E., CHIEF ENGINEER, TRENT CANAL.

The term "Trent Canal" is applied to a projected waterway for barges through central Ontario, to connect Georgian Bay, on Lake Huron, with Lake Ontario, at Trenton, the head of the Bay of Quinte. The distance between these two lakes by the proposed route is about 200 miles. Where canalling is necessary the prism has a width of 50 feet on the bottom, with side slopes of 2 to 1 in earth, and ¼ to 1 in rock.

The locks are 134 feet in length by 33 feet in width. The depth of water at present over the sills is six feet, but all the works are being constructed so that a draught of 8 feet can be obtained at very little extra expense. The capacity of barges drawing 8 feet will be about 800 tons. The water supply is obtained from an immense system of lakes to the north, most of which have regulating dams at their outlets. It is a misnomer to call it a canal, as out of the whole distance of 200 miles not more than 15 or 20 miles will be actual canal—in the remaining part the beautiful lake and river stretches are utilized for the navigable channel. The general line of this canal was that chosen by the Imperial Government for the purpose of opening up a transportation route between the Great Lakes as far back as the year 1825. Large sums of money were spent by the Imperial Government in opening up this route—in fact the Imperial Government actually voted a sufficient sum to complete the route as far as Balsam Lake, but immediately after they had done so the McKenzie rebellion broke out, and the money thus voted was appropriated to quell the rebellion.

Every advantage was taken of the natural features of the river, and the land lying along the route, in order to reach a navigable channel, either by canalizing the river or making flooded reaches. The river with its high rocky banks, from its entrance into the Bay of Quinte at Trenton as far as Frankford it was proposed to canalize by a system of dams and locks, of which there will be seven, by which means a beautiful, wide and deep navigable channel will be obtained. The route then passes through the river for about four miles to Chisholms Rapids lock. This lock is of masonry, and was built about seventy years ago, but is still in good condition. The route still passes through the river to a point known as Hoard's Creek. From Frankford to Hoard's is at present navigable. From this point it is proposed to strike across the country for a distance of ten miles to Crow Bay A greater part of this section will be flooded reaches. From its entrance into Crow Bay the route crosses Crow Bay to the river below Heeley's Falls. It is proposed to canalize



Hydraulic Lock, Showing Subway for Road Traffic.

part of this river as far as the Falls, and to surmount the Falls with an hydraulic lift for a height of 53 feet. This brings us into a navigable reach of about 54 miles, at the north end of which is the town of Peterborough. This stretch includes fourteen miles of river navigation as far as Hastings, where there is a masonry lock and dam built by the Imperial Government. The route still follows the river for about six miles, and then about twelve miles through the beautiful Rice Lake, and then about twenty-two miles of as fine river navigation as can be found in any part of Canada to the town of Peterborough, where there is another masonry lock which was built by the Imperial Government. From this point the route stretches across the country to Nassau, on the river Otonabee, a distance of about four miles. The difference in level between these two points is 78 feet, which is overcome by means of an hydraulic lock, of 65 feet, and an ordinary lock of 13 feet. About two-thirds of this section is a flooded reach. From Nassau to Lakefield—a distance of about 5½ miles—the river is canalized by means of five locks and dams. The section from Peterborough to Lakefield is all completed with the exception of the steel superstructure of the hydraulic lock, which is, however, under construction. and it is expected will be completed about the middle of the coming summer.

From Lakefield the route passes through a succession of beautiful lakes to the entrance of the canal at Balsam Lake, a distance of about 65 miles. The lakes passed through are Katchawannoe, Clear, Stony, Lovesick, Deer, Buckhorn, Pigeon, Sturgeon, Cameron and Balsam. The difference in level between Lakefield and Balsam Lake is about 85 feet. which is overcome by nine locks which are generally placed between the different lakes. From Balsam lake the route strikes across the country for about five miles on a level stretch, when it drops 50 feet into the valley of the Talbot river by means of an hydraulic lock. From this point the route follows the valley of the Talbot river—which is raised some 21 feet—to about the boundary between the townships of Eldon and Thorah. At this point a succession of five locks are met with, which brings us to the level of Lake Simcoe, at a point about three miles north of Beaverton. The sections between Balsam Lake and Lake Simcoe are under contract, and will be completed next year. The route then passes through Lake Simcoe and Lake Couchiching, which are of course navigable, and it will either pass across the

country to Matchedash Bay on Georgian Bay, a distance of 13 miles, or follow the River Severn to its entrance into Georgian Bay.

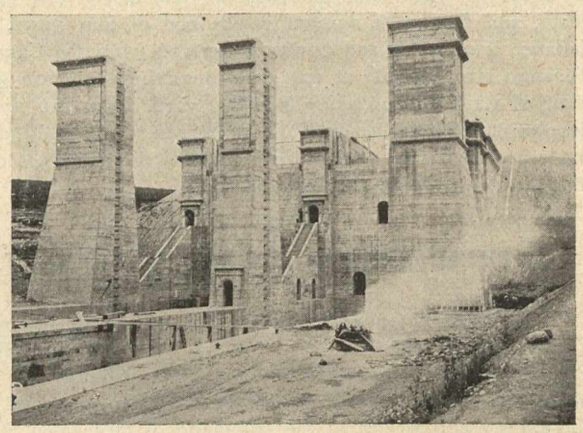
STRUCTURES.

All the structures recently constructed are built of concrete. No more suitable material for the construction of locks and dams could be wished for. The locks are of the ordinary type, with the exception of the hydraulic locks. The valves for filling and emptying the locks are placed in the gates. The apparatus for opening and closing the gates consists of a stiff steel beam fastened to the top of the gate. To either end of this beam is fastened the ends of a wire cable which passes around the corrugated drum of a capstan which is let into a void below the coping of the lock. Tile drains, encased in stone, are placed below the floor and at different levels at the back of the lock walls, in order to relieve the floors and walls of any hydraulic pressure that might arise. The hollow quoins are lined with cast-iron in order to make a smooth surface against which the gates may work. The gates are of the solid timber pattern. Owing to the great amount of lockage to be overcome hydraulic locks were introduced in order to save time. The smaller streams are carried below the prism of the canal where necessary by means of pipe culverts, and the larger streams by concrete culverts. Where at all possible the highways and railways are carried across the canal on high level bridges, which it is proposed in future to construct wholly of concrete. The head room allowed below the bridge to the surface of the water is 25 feet. Where it is not convenient to use high level bridges the highways are carried across the canal on steel swing bridges—the abutments and piers of which are of concrete. The first dams constructed were of timber with a wall or "cut off" of concrete on the upper side. Stop log openings are left in the dam in order to be able to regulate the spring freshets, which sometimes rise to ten times the ordinary flow. A timber slide is left in each dam for the passage of sawlogs and timber. All dams at the present time are built wholly of concrete.

HYDRAULIC LOCK.

A short description of the hydraulic lock at Peterborough may be interesting. There are two water-tight steel boxes, or chambers, 33 feet in width by 140 feet in length, with 8 feet of water in the clear, and closed at the ends by means of gates hung on the lower edge. Similar gates also close the ends of the reaches. These chambers are carried by means of heavy trusses supported on top of two rams 7 feet 6 inches in diameter, which work in two steel water-tight presses, one under each chamber. The presses are connected with each other by a pipe 12 inches in diameter, in the centre of which a valve is placed for the purpose of regulating the motion of the chambers. For the purpose of making up for the small quantity of water lost in the working of the main presses an accumulator is installed in one of the side towers. This accumulator has a ram 20 inches in diameter, with a stroke of 30 feet 6 inches, working at a pressure slightly greater than that of the main presses. Its pressure is also utilized to operate the gates, capstans and small pumps. The junction between the ends of the movable superstructure and the ends of the reaches is made water-tight by means of a continuous rubber hose, placed on the outer side of the ends and bottom of the gate of the reach. This hose is inflated with compressed air from a Taylor air compressor installed in the main wall.

The mode of operating the lock is as follows: Supposing both chambers are at a standstill, one up and the other down, both gates towards the reach open ready for the vessel to enter. When the chambers are thus, the bottom of the upper chamber will be about 10 inches lower than the bottom of the canal above, and has say 8 feet 10 inches of water on the sill. The bottom of the lower chamber will be just level with the bottom of the canal below, and will have 8 feet of water on the sill. Thus the upper chamber has 10 inches more water in it than the lower chamber, and consequently is so much heavier than the lower one (approximately 100 tons.) The valve in the connecting pipe between the two presses is closed. When it is desired to operate the lock gates at the end of each chamber, and the gates at the ends of the reaches are closed, the air is allowed to escape from the air hose—making the water-tight seal between the lock and the end of the reach—and the operator, who stands in his cabin on the top of the central tower, opens the valve in the connecting pipe between the presses. The upper chamber then commences to descend and the lower chamber to ascend till both chambers reach their new positions, the upper chamber being now level with the lower reach, and the former lower chamber being opposite the upper reach. The operator now closes the main valve in the connecting pipe, and inflates the air hose forming



End View of Hydraulic Lift Lock.

the water-tight seal at the end of the lock. When the chambers are in their new positions, the surface of the water in the lower chamber is ten inches above the surface of the water in the reach below, and the surface of the water in the upper chamber 10 inches below the surface of the water in the reach above. Communication between the water in the chambers and the reaches is now made by opening the valves in the gates nearest the reaches, and the water in each chamber is allowed to find its own level. The gates are then opened. When this is done the chambers are then in the condition they were on starting. Vessels are hauled in and out of the chambers by means of hydraulic capstans. The time allowed to lock and pass one or two vessels in and out of the lock will be from 12 to 15 minutes. The time required to raise or lower the lock chambers will be about three minutes. On the upstream side of the lock a guard gate will be placed which will be operated by hydraulic power, and will be closed when a vessel enters the lock. The substructure of the hydraulic lock is built of concrete. A general idea of the masonry can be formed from the drawings annexed. The natural surface of the limestone is at such an elevation that very little expense is necessary for the finishing of the floors at the lower reach level. The main retaining wall, 126 feet long by 40 feet thick, rests upon the limestone formation. Its height will be about 83 feet. The sides are carried up plumb for their whole height, the bearing pressure upon the rock being only about 6 tons per square foot. The steel superstructure is being built by the Dominion Bridge Company of Montreal.

NEW CATALOGUES.

Copies of these catalogues and booklets will be sent to persons interested by mentioning The Canadian Engineer.

Chas. L. Seabury & Co., Gas Engine & Power Co., Consolidated, 11 Broadway, New York. Launches, yachts, boilers, marine engines, etc.

Robert Bell, Seaforth, Ont. (1) Sawmill machinery. (2) New Bell automatic engine. (3) Traction engine, road roller, gasoline engines, saw and flax mill machinery, etc.

The Billings & Spencer Co., Hartford, Conn. Machinists' tools, drop forgings, etc.

The Winkley Co., Hartford, Conn. Oiling devices.

The Niles Tool Works Co., New York. Grinders.

J. H. Williams & Co., Brooklyn, N.Y. Drop forgings.

Pratt & Whitney Co., Hartford, Conn. Thread milling machine.

Stevens Cast Stove Co., 100 Washington street, Chicago. Cast stone.

Pittsburg Meter Co., East Pittsburg, Pa. Keystone water meter.

American Tool Works Co., Cincinnati, Ohio. The American lathe.

Edson Manufacturing Co., Boston, Mass. Prospecting and mining outfit.

Hamilton Motor Works, Hamilton, Ont. The Triton marine gasoline motors.

International Telephone Mfg. Co., Harrison & Clinton streets, Chicago. Telephones.

Massachusetts Fan Co., Waltham, Mass. Heating, ventilating and drying apparatus.

Robey & Co., Ltd., Globe Works, Lincoln, Eng. Treatise on the compound engine.

New Britain Machine Co., New Britain, Conn. The Case automatic high-speed engine.

Canada Foundry Co., Toronto. Rolled steel beams; also iron fences, gates, stairways, etc.

The Fairbanks Co., Montreal. Dart's stop and waste cocks, glue heater, couplings, etc.

Buffalo Forge Co., Buffalo, N.Y. Fan system of heating, ventilating and drying. Mailing card.

Joseph Dixon Crucible Co., Jersey City, N.J. A tool for Dixon's graphite. Graphite facings.

Keystone Mfg. Co., Buffalo, N.Y., Ratchet drills, stud drivers, socket wrenches, nail sets, etc.

The Pond Machine Tool Co., Plainfield, N.J., and 136 Liberty street, New York. Machine tools.

Port Huron Air Tool Co., Port Huron, Mich. Compressed air motors, hoists, hammers, riveters, etc.

Dudbridge Iron Works, Stroud, Glos., England. Dudbridge gas and oil engines and gas producing plants.

The Berliner Telephone Manufacturing Co., 117 Queen Victoria street, London, Eng. Illustrated pamphlet of telephones.

The Jones Underfeed Stoker Co., 20 King street east, Toronto. The Jones Underfeed Stoker at the Royal Victoria Hospital, Montreal.

Canada General Electric Co., Toronto. S.K.C. type A.O. lighting transformers, oil insulated, Diamond H. standard switches, track brooms.

The McEachren Heating and Ventilating Co., Galt, Ont. Medium blowers and exhausters, steel plate planing mill exhausters, steel plate fans.

Fuller-Wenstrom Electrical Manufacturing Co., 110 Cannon street, London, E.C. Price list of polyphase motors, and of continuous current motors, and of alternators.

The Westinghouse Air Brake Co., Pittsburg, Penn. Westinghouse electro-pneumatic system for controlling railway and other motors. Westinghouse multiple train control system for electric railways.

—We are indebted to the Newhall Chain Forge & Iron Co., New York, for a handsome little calendar.

Popular Mechanics, published in Chicago, has had phenomenal success. It is just a year old, and claims to have a circulation of 20,000 a week. And it deserves it.

NEW COMPANIES.

The Manitoba Windmill & Pump Co.; capital, $20,000; Brandon. Dr. John McDiarmid and others. Manitoba charter.

The Waterford Oil and Gas Well Co.; capital, $50,000; Waterford. R. S. Robinson, and others. Ontario charter.

The Ontario Linseed Oil Company; capital, $100,000; Owen Sound. F. G. Sanderson, of St. Mary's, and others. Ontario charter.

The John Inglis Co.; capital, $250,000; Toronto; to take over the foundry and iron business of John Inglis & Sons. Wm. Inglis, and others. Ontario charter.

The Hutton Mining Company; capital, $100,000; Sault Ste. Marie, Ont. C. S. Osborn, of Lansing, Mich., and others. Ontario charter.

J. A. Patterson Lumber Co.; capital, $20,000. J. A. Patterson, of Grand Falls, and others. N. B. charter.

The Princess Steamship Co.; capital, $15,000; to acquire the steamer Queen. H. A. McKeown, of St. John, and others. N. B. charter.

The Manitoba Frost Wire Fence Co.; capital, $40,000; Winnipeg. Manitoba charter.

The Manitoba Hardware & Lumber Co.; capital, $150,000; Brandon. John Hanbury, and others. Manitoba charter.

The Vulcan Iron Works Company; capital, $300,000; Winnipeg. John McKechnie, and others. Manitoba charter.

The Red Deer Lumber Co.; capital, $500,000; Winnipeg. O. A. Robertson, and others. Manitoba charter.

The Manitoba Iron Works; capital, $150,000; Portage la Prairie. T. R. Deacon, and others. Manitoba charter.

The Canadian-Port Huron Co.; capital, $100,000; Winnipeg; for the purpose of manufacturing implements, tools, etc. Manitoba charter.

Alberta Coal and Coke Co. N. W. T. charter

Lethbridge Electric Co.; Lethbridge. N.W.T. charter.

Western Telephone Co. N. W. T. charter.

Ashnola Smelter; capital, $2,000,000. B.C. charter.

The Cuassum Non-Fouling Composition Company of Canada; capital, $50,000; to manufacture anti-fouling paint for the bottom of steamships. B. C. charter.

Denoro Mines; capital, $1,000,000. B. C. charter.

The Mount Royal Foundry Co.; capital, $45,000; Montreal. Robt. Dunn, and others. Dominion charter.

National Light, Heat & Power Co.; capital, $1,000,000; Quebec. Hon. Pierre Garneau, and others. Dominion charter.

The Simplex Railway Appliance Company of Canada; capital, $500,000; Montreal. R. D. McGibbon, and others. Dominion charter.

—Extensive submarine coal mining operations are to be entered upon at Port Morien, C.B.

—Another gusher has been struck near Chatham, Ont. The oil spouted 60 feet into the air when the vein was struck.

—The Rocky Mountain Development Co. has decided to proceed with the development of its oil properties in Southwestern Alberta, and will purchase a new operating plant.

—Jas. Bennett, of Westport, Ont., is said to have made a rich find of graphite in North Crosby township. The vein varies from fourteen inches to two feet in width, and is very rich, being almost pure.

—The Nickel Plate Mining Co., of Penticton, B.C., are about to put in a forty-stamp mill, as well as large reduction works.

—An electric heating plant is being installed in the large new flour mill at Renfrew. Conley & Derry, of Renfrew, have the contract.

—To make their street cars pay, the city of St. Thomas has sent a canvasser out to sell tickets.

—A molybdenite property in Methuen has been sold to the International Mining Co., of Buffalo.

—The Cordova mine and power plant, near Marmora, is pronounced by experts to be one of the finest examples of engineering skill in Canada.

—A provincial mining association has been formed in British Columbia to be known as the Miners' Association of British Columbia.

—The McGill College authorities object to a wireless telegraph station being placed on Mount Royal, as they fear it will affect their instruments.

—Work has been commenced on the Winnipeg power plant to supply 10,000-h.p. to the city from the Winnipeg river, near Lac du Bonnet, 55 miles distant.

—The Mineral Range Iron Mining Co., in Hastings, intends building an electric railway from L'Amable on the Central Ontario Railway. They will also erect a large concentrator at the works.

—Canada is to make a mineral exhibit at St. Louis in 1904. A. K. Stuart, who was on the staff at the Glasgow and Wolverhampton exhibitions, has been instructed to prepare it.

—The report of the commission on the Fernie coal mines explosion has been issued. As to the cause of the explosion, Mineralogist Robertson says the most tenable theory is, it was an explosion of gas or of gas and dust.

—The city hall at Hamilton has had to fall back on coal oil lamps, George Black, electrical inspector for the Canadian Underwriters' Association, having sent word to the city clerk that the wiring was defective and unsafe.

—A report from Vancouver states that the New Vancouver Coal Company has sold its whole plant to the Western Coal Company of San Francisco. The price named is $1,500,000. The new company intend to increase the output.

—The Dominion Coal Co. is testing the Emery seam at Glace Bay with the calyx drill, and if the thickness warrants it will sink another shaft. They are also considering the building of a coke oven at Montreal to supply the city with coal gas by-products.

—The Belmont gold mine in Hastings County is showing an improved quality of ore on the lower levels. The company proposes doubling its present output, and putting in thirty more stamps, thus utilizing the whole of the 1,300-h.p. at its disposal.

—In artesian wells at Dawson, water has been struck at a depth of 216 feet, and flowed at the rate of 900 to 1,000 gallons per minute. By elevating the water a hundred feet or so, a supply sufficient for the whole district could be obtained.

—A new copper line has been put up between Seattle and Vancouver, which will give a telephone communication exclusively devoted to the British Columbia service. It is 1,160 miles in length, weighs something like 172 pounds to the mile, and cost about $48,000.

—The Canadian Northern has absorbed the Great Northern Railway, which runs from Quebec to Hawkesbury, 225 miles, with branches built, under construction (including that from Joliette to Montreal 30 miles), or projected, bringing the total mileage up to 370 miles.

—Along the Canadian Government telegraph line to the Yukon the poles and wires will be replaced by an insulated cable, which will stand the rigors of a severe winter better than the poles and wires.

—The Dominion Government is to be asked to place a lighthouse on the Main Duck and a fog signal on False Duck at the eastern end of Lake Ontario. Magnetic attraction, which is said to be greater here than at any other point on the Great Lakes makes steering by the compass dangerous, and has led to several disasters.

—The Montreal Transportation Company has placed an order at Newcastle-on-Tyne, England, for a steel freight steamer to trade between Kingston and Fort William, to be ready in April. The steamer will be 248 feet long, 48 feet beam with a depth of 23 feet flush decks. The engines will be placed aft, and will be triple expansion cylinders, 22, 35 and 58 inch diameter, with 39 inch stroke. Two Scotch boilers with a working pressure of 180 pounds to the square inch will be installed.

—George H. Gibson has resigned his position with the Westinghouse Companies' Publishing Department, of Pittsburg, Pa., to accept a position with the B. F. Sturtevant Company, of Jamaica Plain Station, Boston, Mass., the well-known manufacturers of blowers, heating, ventilating and forced draft apparatus, electrical machinery and steam engines. Mr. Gibson was formerly a member of the editorial staff of The Engineering News, of New York city, and is a graduate of the Engineering School of the University of Michigan.