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The Canadian Engineer

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The Canadian Engineer.

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

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CONTENTS OF THIS NUMBER :

MORE LESSONS FROM RECENT FIRES.

On referring to the account of the Baltimore fire of February last, one cannot fail to be struck with the marked similarity of many of the features of the Toronto fire of April 19th. This we referred to in the last issue of the Engineer; but there are some points which are worth further consideration.

These two fires have shown how irresistible a modern city conflagration may become when it has once gained headway. The efforts of the best organized fire brigade, with their devices, become puny in comparison with the force against which they offer protection. They also show the exceeding combustibility of the average modern city. In Baltimore there were a number of steel skeleton, supposedly fireproof structures, which succumbed, but these were not totally destroyed, and may be restored without excessive cost, the walls in most cases standing intact, and the destruction being confined to the interior. Where stone was used for facing, or for columns, or decorative work, it was sadly injured by spalling, and stone showed itself equally liable to injury in the Toronto fire. Where steel skeleton construction is employed brick seems to be the only effective facing. In the Baltimore fire there were six large buildings of this form of construction, and in all of them the steel framework is intact, and with a new member in one or two places will be as good as ever. In all of them the walls are structurally sound, and most of the floor arches are intact. In all, however, every window and every item of finish and contents was destroyed. In all, ignition resulted from the flames of adjoining non-fireproof buildings breaking through the windows. In one of the buildings there were shutters of wood covered with steel, but the building ignited from the other side, and with fire on both sides the shutters burst open and became badly warped. There were no steel skeleton buildings in the Toronto fire area, but the experience of the Baltimore fire seems to indicate many advantages of that form of construction. Outside the steel construction the destruction in Baltimore was complete, and as there were no such buildings in the Toronto fire the destruction everywhere was complete.

The advantage of having telegraph and telephone wires underground was shown in the Baltimore fire, where repairs were easily and quickly made. In Toronto a tangled mass was all that remained, and communication was interrupted for some time till the lines were rebuilt.

Many of the Toronto firms which were burned out are pursuing a wise course in rebuilding their manufacturing premises in more isolated positions and having only warehouses or offices in the congested district. This is not, however, altogether on account of the risk, but partly the result of an increase of insurance rates. Certainly the risk of a repetition of their losses will be greatly reduced.

Many of the sites in the burnt district of Toronto are offered for sale, and from present appearances the city is not going to rise from its ashes as rapidly as was first hoped.

SMELTING IRON BY ELECTRICITY.

In the last issue of the Canadian Engineer reference was made to the result of the visit of Dr. Haanel, and those associated with him, who were sent as a commission to inquire into the question of electric smelting of iron in Europe. Dr. Haanel's report has not yet been given to the public, but some of the results of his observations are known, and from these it may be inferred that smelting by electricity can be successfully and economically carried on. As stated already, the most important experiments witnessed were at Livet, in the Pyrenees, where some ninety tons were put through to illustrate the process. The furnace there employed is of the resistance type, and consists of two iron casings of square cross section, forming two shafts communicating with each other at their lower end by means of a lateral canal. The cases are lined with refractory material. The base of each

shaft is formed by a carbon block. These blocks are in electric communication on the exterior of the furnace by means of copper bars. The carbon electrodes to which electric current is distributed pass two-thirds of their length into the shaft. The electrodes are prisms 72 centimeters in diameter and 135 centimeters long. Three sets of experiments were made as follows: (1) Electric reduction of iron ore and obtaining different classes of pig, grey, white and mottled. (2) Electric reduction of iron ore containing a definite amount of carbon in the charge, with a view of ascertaining the amount of electric energy absorbed in the production of one ton of pig iron. (3) The manufacture of ordinary steel of good quality from the pig manufactured in the preceding experiments. The electric energy absorbed per ton of pig was found to be 226 horsepower years. The processes were quite satisfactory to the commission.

Of course the question of cost is an important factor. The following are the figures which make up the approximate cost of producing a ton of pig iron: (1) Ore (hematite) metallic iron 55 per cent., 1.842 tons at $1.50 per ton, $2.76. (2) Coke for reduction .33 tons at $7 per ton, $2.31. (3) Consumption of electrodes at $5 per 220 pounds, 77 cents. (4) Lime, 30 cents. (5) Electric energy 226 horsepower years at $10 per e.h.y., $2.26. (6) Labor at $1.50 per day, 90 cents. (7) Different materials, 20 cents. (8) General expenses, 40 cents. (9) Repairs, maintenance, etc., 20 cents. (10) Amortization (machinery and building), 50 cents. Exclusive of royalty, $10.60.

In his conclusions Dr. Haanel points out that the results obtained at Livet were the results of experiments in furnaces not specially adapted to the work required to be done. With the improved furnaces of which the commission has secured detail drawings, better figures can be obtained. He remarks that the processes of electric smelting must yet be regarded as in the experimental stage, no plant existing at present where pig iron is commercially reduced to pig by the electric process. The more remarkable therefore it appears that experiments made off-hand, in furnaces not at all designed to be used for the production of pig, should give a figure of cost which would enable an electric plant properly designed and managed to compete with blast furnaces.

As experience is gained better and cheaper methods will be introduced, and it is reasonable to suppose that as the electric process is applicable to the smelting of all other ores, such as copper, nickel, silver, etc., it can be successfully applied to the production of iron and steel. The full text of Dr. Haanel's report will be awaited with much interest.

THE ST. LAWRENCE ROUTE.

The St. Lawrence route, which acquired such a bad reputation last season, bids fair to retain its bad name, three disasters having occurred during last month, within a few days of each other. The Allan liner Hibernian went ashore near Cape Ray, Newfoundland, and is a total wreck. The Turret Bay, of the Inland Navigation Co.'s fleet, and one of the best of the coal carriers of the St. Lawrence, went ashore on St. Paul's Island, near Newfoundland, and all her crew but nine were lost. The Vancouver, of the Dominion line, went ashore near Matane, but fortunately got off without injury, after a detention of about 12 hours. All these accidents are attributed to fog. It is to be hoped that the establishment of seven wireless telegraph stations, which the Dominion Government has contracted with Marconi to have in operation by next season,—in fact four of them are promised by August next—will have the effect of preventing such disasters in future, for fortunately the electric current is not interfered with by fog. The four stations to be established at once will be at Fame Point and Heath Point, and at Point Amour and Belle Isle in the northern channel. The three other stations will be at Cape Race, Sable Island and a point near Canso.

—We have to congratulate our esteemed contemporary, the Engineering News, of New York, on having reached its thirtieth anniversary. Commenced as a modest monthly in Chicago, under the name of The Engineer and Surveyor, it soon became a weekly, and it has prospered in every way, and is now one of our most valued weekly exchanges. It was established by George H. Frost, who still remains its active head. We wish it continued success.

NEW CATALOGUES.

Copies of the following catalogues can be had by those interested on referring to the Canadian Engineer:

The Goldie, McCulloch Co., Galt. Heavy Duty Engines.

The Jenckes Machine Co., Sherbrooke, Que. Standard Crushing Rolls.

Sheldon & Sheldon, Galt, Lumber Dry Kilns, Lumber Trucks, Transfer Cars, etc.

The Shawinigan Water and Power Co., Montreal, and Shawinigan Falls, Que. Its Property and Plant.

Canadian General Electric Co., Toronto. Street Fixture, Ceiling Fan, Motors, Noark Fuse and Service Boxes, Noark Single Branch Cut-out Blocks.

H. W. Petrie, Toronto. Monthly Stock List of New and Second-hand Boilers, Engines, etc.

Works of Westinghouse Electric and Manufacturing Co., East Pittsburg, Penn. Their Industrial and Sociological Aspect, illustrated with Camera Pictures.

Fairbanks, Morse & Co., Chicago. Pumping Machinery, Jack-of-all-Trades Engine, Dynamos and Motors.

Browne & Sharpe Manufacturing Co., Providence, R.I. General Catalogue of Tools, etc.; Clamp Ring for Micrometer Calipers.

Hallidie-Painter Tramway Co., San Francisco. Wire Rope Tramways.

Joseph Dixon Crucible Co., Jersey City, N.Y. Wire Rope Lubrication.

Duluth Gas Engine Works, Duluth, Minn. Reversible Speed Propellers.

Thos. G. Grier, Chicago. Advice to Young Men—"Circular Loom" Flexible Conduit

Diamond Saw and Stamping Works, Buffalo. Saws.

Kynoch, Ltd., Birmingham, England. Roller Bearings.

Pittsburg Meter Co., East Pittsburg, Pa. Acme Dry Gas Meter.

John Steptoe Shaper Co., Cincinnati, O. High Grade Machine Tools.

Jeffrey Manufacturing Co., Columbus, O. Conveyers, etc. Coal Cutting Machinery.

DeLano-Osborne Engineering Co., Toronto. Bridges.

James Morrison Brass Manufacturing Co., Toronto. Fairbanks Bathroom Scale.

—The Ontario Association of Stationary Engineers held its annual meeting in Brantford, May 23rd, when the following officers were elected: President, J. G. Bain; vice-president, Geo. Fowler; registrar, W. G. Blackgrove; treasurer, Charles Moseley; auditors, W. J. Webb, H. E. Terry, all of Toronto. The Board of Examiners, of whom there are twelve, were re-elected. The next meeting is to be held in Toronto.

LIGHT, HEAT, POWER, ETC.

The Strathcona Electric Co., N.W.T., has been dissolved.

The Blindman River Electric Power Company has been incorporated in the North-West Territories.

Toronto is considering the advisability of appointing an electrical engineer as a permanent city official.

The Ottawa Council has decided to give the Ottawa Electric Co. a ten-year contract for lighting the streets at the rate of $52 per lamp per year.

J. M. Campbell has been granted leave by Kingston city council to erect poles and wires in the streets to bring power for his own use from Kingston Mills.

St. Catharine Road, the drive around Mount Royal, Montreal, is to be lighted with electricity. The contract has been awarded to the Montreal Light, Heat and Power Co.

The Brandon Electric Light Co.'s dam on the Assiniboine river, nine miles west of the city, was washed away by the high water, and the power house placed in great danger.

It is proposed to supply Midland, Ont., with electricity developed at Port Severn, where Mr. Ackerman proposes to develop water power capable of producing upwards of 3,000 h.p.

The power house for the Sydney Mines lighting plant will be 47 x 38 feet, and will be built of silicate brick. The poles are being shipped from Rimouski. W. A. McKay & Co. are the contractors.

Mrs. Boxer, of Montreal, has recovered $490 damages from the Montreal Water and Power Co. for injury by vibration and smoke from defendants' power houses, which caused her to lose some of her tenants.

W. D. Ross, Toronto, has been added to the board of directors of the Trinidad Electric Co. The company's rails extend over thirteen miles in the city of Port of Spain. Their last year's business shows good results.

After the fire at the Parliament Buildings, Toronto, an electrical expert was called in, and on his recommendation the wires have been re-insulated to reduce the danger of another fire from any defect in the wiring.

Lanark village is about to introduce electricity for street lighting instead of coal oil. The Shelby Co., of Montreal, has agreed to furnish twenty street lights of 50 c.p. for $312.50 a year. The coal oil system costs about $200.

A bill to incorporate the Bathurst Electric and Water Power Co., of Bathurst, N.B., is before the New Brunswick Legislature. The promoters will absorb the Sumner Company, of Bathurst, and will get power from the Tetagouche river.

Motor Age says that leaky joints in gasoline or water pipes may be made tight by means of coarse linen or canvas, covered with a paste of litharge and glycerine. This should be again covered with a bandage of adhesive or sticky tape, such as is used for electrical purposes.

The Nova Scotia and Mexican Mining Co. have had Mr. Frame, a civil engineer from Rhode Island, examine the water power of the North-west Arm Brook, between Sherbrooke and Goldenville, for the purpose of establishing an electric plant for supplying power to their works at Goldenville.

Robert A. Ross, of the engineering firm of Ross & Holgate, Montreal, has been asked to make an estimate of what is required to place the plant of the Kingston Light, Heat and Power Co., taken over by the city, in good condition, not only for ordinary service, but for supplying power to the street railway company.

The Montreal Light, Heat and Power Co. has abolished the office of engineer and superintendent, formerly occupied by P. G. Gossler. W. McLea Walbank, as chief engineer, will have charge of the engineering department, and the staff will be strengthened by the appointment of an electric expert.

R. B. Hamilton, managing director of the Packard Electric Company, of St. Catharines, reports business as particularly brisk, and that the entire plant has just been under the remodelling process to provide enlargements for their lamp, transformer and meter departments. Additional equipment is being placed in all departments. One order recently received by the company was for 1,500 type "G" recording watt meters. This order is believed by the company to be the largest single order ever received by any Canadian electric company. All of the 1,500 meters must be delivered before November 1st of this year.

The Continental Light and Heat Company made an offer to light the streets of Outremont with acetylene gas at an annual charge of $18 per lamp of 25 to 30 candles, on condition that the contract shall extend over a period of not less than ten years.

A deputation composed of W. Y. Soper and A. A. Dion, of the Ottawa Electric Company; J. J. Wright, of the Toronto Electric Light Company; E. A. Evans, of the Quebec Light and Power Company; A. A. Wright, M.P., of the Renfrew Electric Light Company, and C. W. Henderson, of the Canadian Westinghouse Company, Hamilton, recently waited on the Government to press for the enactment of legislation to protect them against the theft of electric current. Many cases have been brought to their notice where power and light was stolen, and such ingenuity employed to cover up the fraud that it was impossible to bring the crime home to the offenders. As a rule, the manipulation of wires, etc., is carried on within the consumer's premises. The electric companies seek an amendment to the law which will make the discovery of any device to deter a meter or to divert current prima facie evidence against the individual in whose behalf it is used. The Government is also asked to establish an electrical standardizing bureau to provide absolute standard for the measurement of electrical quantities.

If the Fort Frances Times is correct the Federal Government should lose no time in nipping the development of the Minnesota Canal and Power Company in the bud. It is claimed that they are at work upon a project which threatens serious damage to Canada's power interests. The facts are briefly as follows: Birch Lake in St. Louis and Lake counties, Minnesota, has a drainage area of 1,103 square miles. The annual run off through the lake is 26,000,000,000 cubic feet of water, which finds its way to Rainy Lake and River. The water shed of Rainy Lake is about 16,000 square miles, of which the Birch Lake water shed is about 7 per cent. The Embarrass River, which flows into the St. Louis, and thence to Lake Superior, rises in a swamp within a few miles of Birch Lake. The company proposes by means of a system of dams, reservoir and canals to gather all the waters of the Birch Lake basin and carry them into the Embarrass River and Lake Superior. If this is done the flow of Rainy River will be lessened by about 7 per cent. Every water power between Rainy Lake and Lake Winnipeg will suffer and navigation will be seriously affected.

* * *

Brantford's special committee will unanimously recommend a municipal telephone system.

The new turbine steamer to run between Hamilton and Toronto is expected to reach Hamilton bay about the middle of this month.

There is a strike on at the Dominion Iron and Steel Co.'s works, at Sydney, C.B., and operations are almost entirely suspended in consequence.

The 27th annual convention of the National Light Association of the United States was held at Boston, May 24th, 25th, 26th and 27th. The total attendance reached over 1,000, among whom were a number of Canadians.

The Chicora, of the Niagara Navigation Co., is running well this season, having been thoroughly overhauled. New plates and two new cylinders have been put in, and the captain's quarters have been moved to the hurricane deck, leaving more shelter for the passengers on the forward deck.

Eight tenders were received for blasting the tunnel for the Orillia power development repairs at Ragged Rapids. If the method proposed is found too expensive, an alternative plan is proposed, namely, to blast out a channel for the river across the narrow but high neck of rock on the west side and divert the river while the concrete dam is repaired. Temporary power to a limited extent could by this means be secured while the work is in progress.

CANADIAN WESTINGHOUSE WORKS.

The advancement of Canada as a commercial nation has been remarkable during the past few years. The new impetus has been felt in development of water powers, in mining, agriculture, transportation and manufacture, and the increment of each has reacted to swell the contribution of others until at present Canada finds herself on a rising tide of prosperity, all the more marked in comparison with the hesitancy and stagnation apparent in many other portions of the business world. Among the various fields of activity, that of manufacturing has more than held its own. Not only have resident Canadians been alive to the opportunities of the period, but also individuals and corporations of other countries have been led to establish manufactories within the country, to aid in supplying the growing consumption of their products.

A highly interesting installation of the latter sort is the new plant under construction at Hamilton, Ontario, for the manufacture of the well-known types of the Westinghouse Electric & Manufacturing Company. From the time when electrical apparatus was first made use of in Canada, the Westinghouse Electric & Manufacturing Company, of Pittsburg, has furnished a large and increasing portion of this apparatus in the Dominion, until now the time has arrived when in justice to their customers it is found advisable to establish a distinctively Canadian factory, to secure that intimacy of relation which is so advantageous alike to the manufacturer and client. Passing in review the various sites suitable for the location of such a factory, it was natural that the choice should fall on Hamilton, not alone from the natural advantages of that city from the standpoint of a manufacturer, but as well from the fact that for a term of eight years another Westinghouse interest, the Westinghouse Manufacturing Company, Limited, had been located in that centre, engaged with marked success in the manufacture of the Westinghouse Air Brakes for the equipment of Canadian rolling stock.

To join under one management the existing air brake business and the electric business to be instituted, a new organization was formed under the name of the Canadian Westinghouse Company, Limited, and, leaving the air brake factory in its present state of efficient equipment, work was at once started to provide a plant of modern excellence and completeness for the manufacture of electrical apparatus. Notwithstanding an unusually severe winter, construction work has been pressed throughout, until at present writing it is safe to say that an operative condition of the plant will be reached this fall. The Canadian company will operate under the enjoyment of an agreement with the Pittsburg companies, by which all designs and processes of the older companies will be at its disposal, and thus fortified with the results of years of successful experience, equipped with a plant than which no better can be found, and aided by the co-operation of many of Canada's most representative citizens, an assured future stands before the company, and the Canadian user is assured of the best obtainable apparatus. The lines of manufacture to be taken up comprise alternating and direct current generators; alternating and direct current motors, including railway motors; controllers, transformers; switchboards and switches; rheostats; instruments; meters; arc lamps, and various subsidiary apparatus included in the general line of Westinghouse equipment.

The new buildings provided consist of foundry, pattern shop, pattern storage, general machine shop, detail machine shop, warehouse, insulation treating building, boiler house and transformer building. On the diagram of the property shown in the illustration, these are lettered from "A" to "I" inclusive, in the order just recited, "L" is the brake plant, and "K" the office building, enlarged to accommodate the increased force of the new company.

In laying out the manufacturing buildings on the property two cardinal points were kept in view—the first, that progress of material from raw to completed state should, as far as possible, be in a continuous direction; and the second, that the plan adopted should lend itself to an initial installation which would constitute a complete unit, and also be capable of reproduction along its own lines to an extent limited only by the total available property. On the latter point it may be said that something less than half of the total installation shown in the illustration is at present under construction, the northern half of the foundry and warehouse, along with corresponding machine shop wings being left for future extensions. Regarding progress of material through the plant, it may be pointed out that with raw material received on track west of the foundry, progress is in general from this point to the warehouse, from which all shipments are to be made over tracks conveniently located within the building for this purpose.

The foundry is of monitor roof construction, with middle and two side bays. In the west bay are located the cupola house, the core room, and the brass floor, while just inside, along the west wall are located the bins for pig, sand, limestone, etc. A portion of the east bay is separated by partition from the foundry space to serve as blacksmith shop. The main bay is served by a 20-ton crane, the length of the building being also traversed by travelling jib cranes, operating at a lower level. A mezzanine floor over a portion of the core room provides suitable toilet facilities without reducing productive floor space. An electrically driven elevator is provided to deliver iron from yard to charging floor, and a coke conveyor, also electrically driven, receives coke from railroad car and deposits it in an appropriate bin on the charging floor.

The pattern shop, located conveniently near the foundry, is three stories in height, besides a basement to accommodate shafting for machinery on first floor. The first floor is devoted to carpenter and cabinet shop uses, while the second and third floors are for pattern making. An electric elevator serves this building from basement to top floor. The pattern storage building adjoining is similar in construction, except the basement, which is unnecessary.

Bird's eye view, Canadian Westinghouse Co.'s new works, Hamilton. The small cluster of buildings around the smokestack represent the present plant of the Westinghouse Air Brake Co.

The general machine shop is arranged with a high bay covered by 20-ton crane, and low bay with 5-ton crane. In the former the heavier machine tools are located, and it is here that mainly the stationary parts of generators and motors will be finished, while the low bay will be devoted to preparation of rotary parts, and the gallery floor above the latter will provide space for the manufacture of commutators, brush-holders, bearings, etc., also for tool room and controller department. Toilet rooms and heating and ventilating fans are placed on a narrow mezzanine floor between high and low bays, the same being reached by stairways from both the ground and gallery floors. The elevators also pass up through this floor and industrial tracks run under the mezzanine, along by the foot of the elevators on the ground floor. After the completed rotary part has received its winding at the eastern end of the low bay it is passed by

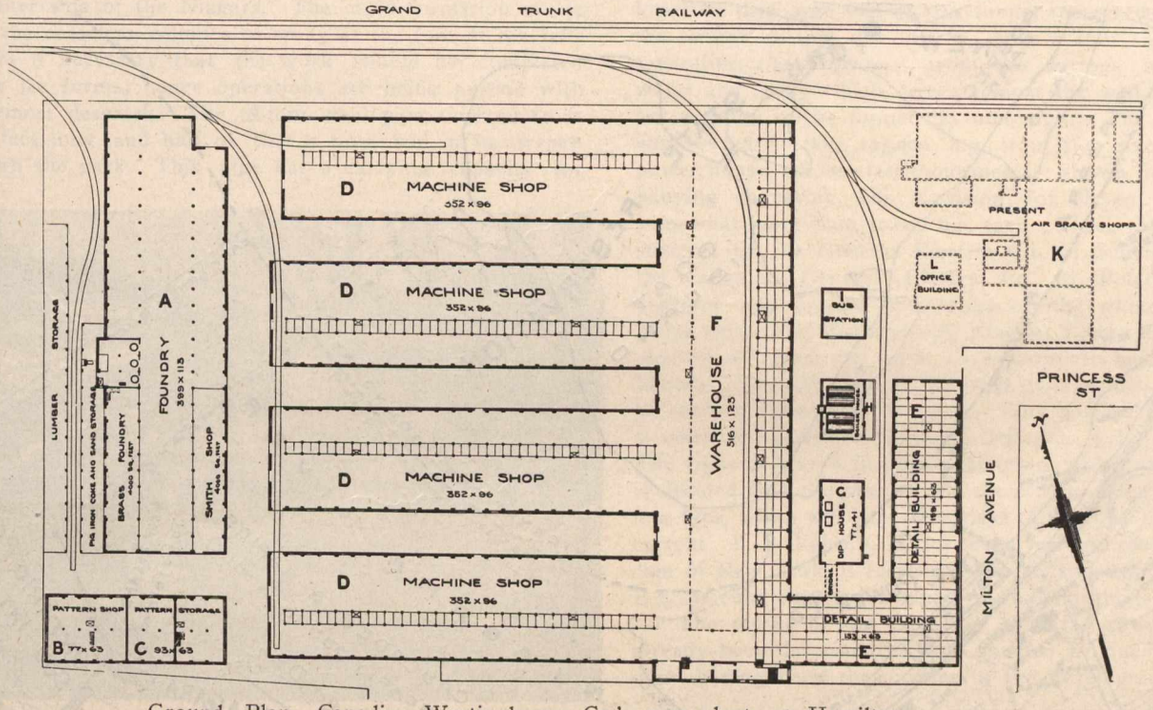
jib crane under the mezzanine floor at this point on to the eastern end of the high bay, where it is placed in its corresponding stationary part, which has been under construction in this aisle, and the auxiliary parts are received at the same point by the elevator from gallery floor. In addition to the crane serving the main portion of the high bay, this eastern end or assembling floor is provided with an additional crane of like span, but at a lower level, so that by it machines can be delivered from the assembling floor, through under west gallery of warehouse into middle bay of the latter building, where the north and south crane can pick up the load for further handling.

The warehouse has a high bay in the middle, with one gallery on the west side and two galleries on the east side. The machines delivered, as just described, from the general machine shop, are passed from the testing floor on the west side of the main bay, and after tests are finished, painted and shipped on cars from the warehouse track. This track also is the means for entry into the plant of the less bulky material and supplies, which are stored in this building for

The boiler house, it will be noted, is small in comparison with the main plant, which is due to the fact that the use of steam will be largely restricted to heating and drying purposes. Most of the steam for drying will be used in insulation-treating building next adjoining, but for heating the buildings it will be piped to nests of coils suitably installed in each building, with fans to distribute the air heated by these coils.

Power for manufacturing and testing purposes, as well as for lighting, is to be obtained from the Local Electric Power Company, which draws its supply from DeCew Falls. Current will be received in the transformer house at 2,400 volts, and distributed at 440 volts for general shop purposes, although lighting distribution will be at 110 volts, and transformation to direct current will be made to supply some of the cranes and machine tools.

The construction of the buildings, which is in the hands of Westinghouse, Church, Kerr & Co., of New York, as engineers and general contractors, is of the most modern approved type. The foundations and walls up to window



Ground Plan, Canadian Westinghouse Co.'s new plant, at Hamilton.

ready distribution to both the general and detail machine shops. The floor east of the tracks is at car floor level to facilitate handling of such material, and elevators are, of course, provided for distributing to the various floors.

The detail machine shop has two floors throughout, beside the ground floor at levels, corresponding to the two galleries on the east side of the warehouse, with which they directly communicate. It should also be noticed that the top floor of this building is at the same height as the gallery in the general machine shop and the west side of warehouse, and that a connection gallery at the same height is carried around the south end of the warehouse building. On the ground floor of the detail shop the coil winding and insulating departments are located, this being convenient both for receipt of wire from warehouse and delivery of completed coils to winding and assembling spaces at east end of general machine shop already referred to. The second floor is devoted to the machine work necessary on switches, rheostats, meters, instruments, arc lamps, etc., and on the third floor are the assembling and testing rooms for these lines of apparatus. No cranes are needed in this building but elevators are provided, securing easy access to various floors.

The insulating-testing building is separate from the main group so that this work, involving the use of inflammable materials, can be isolated. Convenient communication with the detail building is provided by a two-story enclosed bridge cut off at each end by fire doors.

sill line are of concrete, above which the walls are of brick, laid up in cement mortar. Floors and roofs are of reinforced concrete throughout, and in detail machine shop and pattern buildings even the columns are of this construction. The result is a group of buildings, as desirable and as nearly fireproof as it is possible to make them. All roofs are practically flat, with drainage so arranged that the leaders are carried down through the interior of the buildings to avoid stoppage by freezing in cold weather. Floors are top dressed with 1-inch maple, and roofs with tar and gravel.

Transportation between the foundry and all buildings, including the air brake plant, will be by industrial railway, operated by storage battery locomotive. The standard gauge tracks on the property are directly connected with the main line of the Grand Trunk Railway for receipt of material and shipment of product. The main entrance to the plant, for employees, is at the south end of warehouse building, a central point at which will be located time checking devices, and from which stairways lead directly to the various floors. Entrances for teams from the city streets are provided near west end of machine shop and in front of the office building. The equipment of the plant will be on the most modern approved lines as developed by experience of the Pittsburg factories.

The directors of the company are;—George Westinghouse, H. H. Westinghouse, George C. Smith, Frank H. Taylor, L. A. Osborne, Thos. Ahearn, W. Y. Soper, Paul J. Myler, C. F. Sise, Hon. J. M. Gibson; and the officers are:—

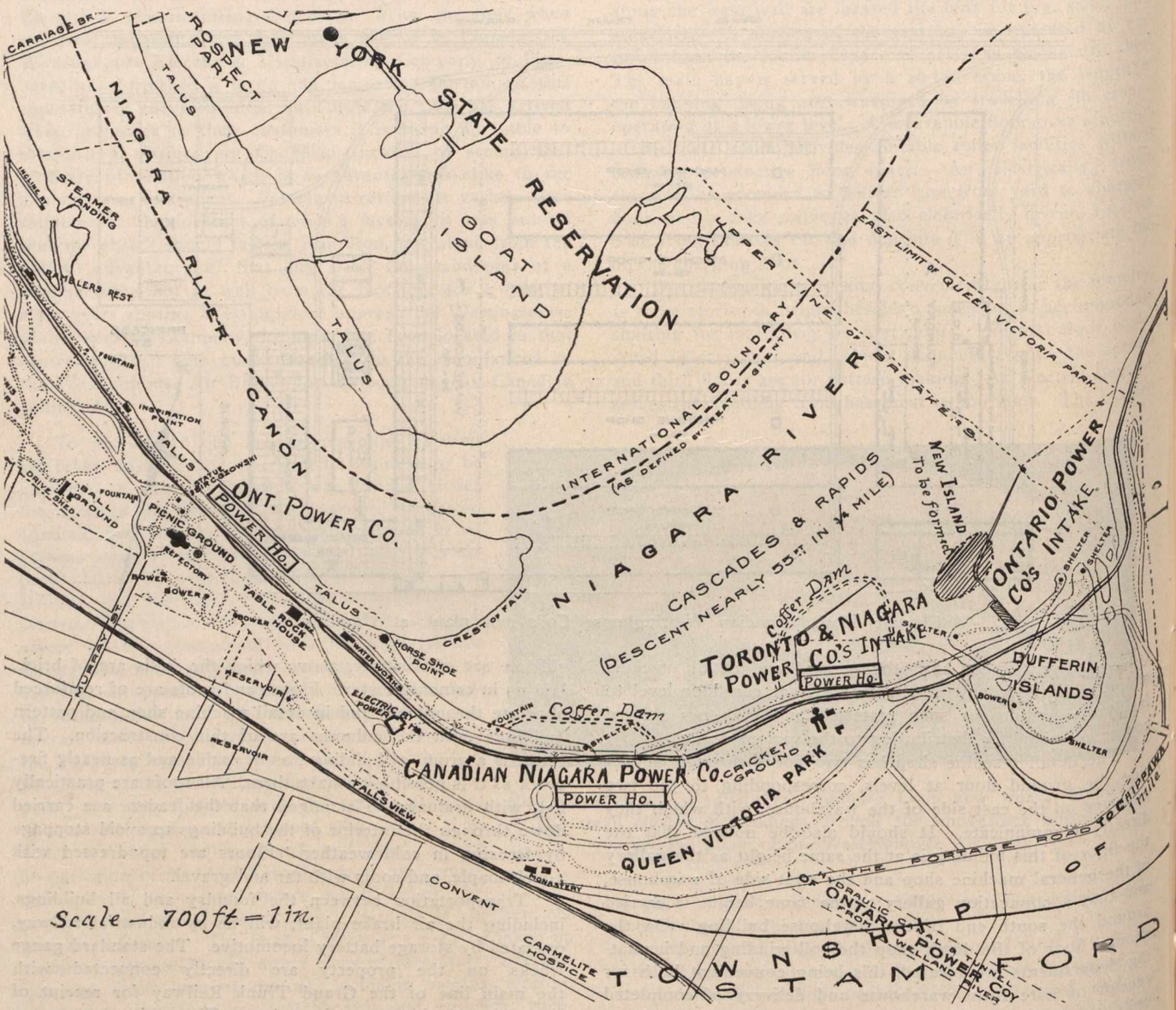
President, George Westinghouse; vice-presidents, H. H. Westinghouse and Frank H. Taylor; general manager and treasurer, Paul J. Myler; secretary, John H. Kerr; sales manager, N. S. Braden; superintendent air brake department, Percy Domville; superintendent electric department, F. A. Merrick. The head office of the company is at Hamilton, and district offices have been established at Montreal, Toronto, Halifax, Vancouver and Winnipeg.

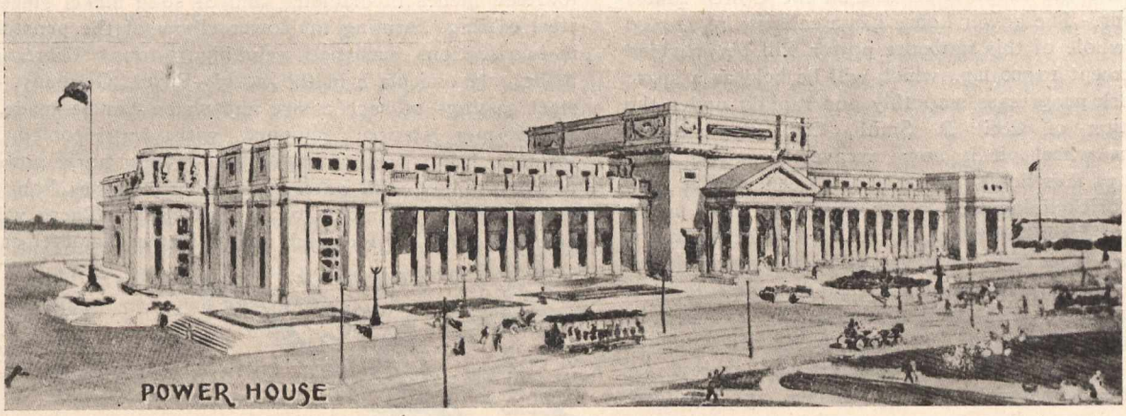
* * *

ELECTRICAL DEVELOPMENTS AT NIAGARA.

In anticipation of the visit of the Canadian Electrical Association to the Falls this month it will be interesting to know the present condition of the three great power developments now being carried out on the Canadian side of the Niagara river. Our last general survey of these works appeared in July of last year, when all the developments were in progress. Notwithstanding the past severe winter, which rendered operations very difficult, work was kept going, and the scene to-day is busier than ever. The face of the beautiful landscape of Queen Victoria Park is more disfigured than ever, but this condition was to be expected, and will continue till the works are completed, when the handsome architecture of most of the structures will be an attraction rather than an eyesore to most of the visitors who flock here from all parts of the world. At present derricks grow in the place of shrubs in many portions of the park, and the forest of spars and hoisting tackle looks like a busy seaport, while the Ontario Power Co.'s long line of 18-foot conduit, stretching in one great curve from one forest of derricks to another, and as yet only half buried in the earth, looks like a colossal sea serpent that has become stranded here, mistaking the place for a harbor. Looking down the vast wheel pits or the perpendicular banks of the river below the cataract one sees hoisting engines by the dozen, and batteries of rock drills and rock-channelling machines, while from the depths, where men appear scrambling about at their work like ants, there arises a babel sound of clanging cogs, of screeching wire ropes, the vicious hammering of drills, the impetuous puffing of engines mingled with the more melodious tones of men in command, and with the soft and soothing sound of rivulets springing out of crevices in the rocky walls. There are now between 1,500 and 2,000 men employed directly on the three works, which are being pushed with all the speed possible.

Beginning up stream, in the order in which the power houses are situated, we find that the Ontario Power Co., which has been in construction for about two years, will probably have its generating station finished before next winter sets in. The intake and gate mechanism are situated above Dufferin Island, and the rock excavation for this work, which has an ultimate capacity for 200,000 h.p., is now nearly finished. The retaining walls, which are to bound the forebay, are already nearly completed; and the house screen and gate mechanism will shortly be commenced, and will probably be completed before summer is over. As explained in our previous sketches, the water, after being carried under Dufferin Island Creek, will pass along a steel conduit or feeder pipe eighteen feet in diameter, and laid as near the surface of the ground as possible, till it reaches a point past the crest of the Canadian Falls, at the foot of which, on a floor of rock now being excavated for the purpose, the power house will be built. The position of





Toronto and Niagara Co.'s Power House. Designed by E. J. Lennox, architect, Toronto.

the generating station at the foot of the fall reverses the order of conveying power adopted by the other concerns on either side of the Niagara. The rapid formation of ice from the ceaseless volumes of spray at the foot of the falls renders it necessary that the work should be completed before ice forms; hence operations are being pushed with the utmost despatch. The 18-foot steel pipe referred to is 6,600 feet long, and half of this is now laid in its trench through the park. This pipe has a carrying capacity for

Toronto and Niagara Power Co.—Site of wheel pit in March, 1904.

60,000 h.p., and when this power is taken up and more required, another pipe of larger capacity but different form, the mouth for which is already installed, will be laid. The Messrs. Nunn are the contracting engineers, with Mr. Sohr, of Montana, as hydraulic expert, and J. R. Harsch in charge of the business department. Chas. H. Mitchell, of Niagara Falls, Ont., is resident hydraulic engineer.

The Toronto and Niagara Power Co. (the Electrical Development Co. of Ontario), the next in order, are pushing their works with the energy characteristic of the men at the head of its affairs, of whom Frederic Nicholls, of Toronto, is, perhaps, best known to electrical men. The concession held by this company is being executed by a company composed chiefly of the same shareholders, and known as the Electrical Development Co. of Ontario, which is now excavating the big wheel pit, over which the power house will stand, at a spot known as Tempest Point. The accompanying engravings show the rate at which the wheel pit is being sunk, the first photo, taken in March last, showing only the loose rock cleared away, while the second, taken early in May, shows a depth of nearly 70 feet excavated. The wheel pit is 416 ft. by 22 ft. and will be 144 ft. deep. At present it is sunk 90 feet in one part and 72 feet in the shallowest portion. There are 20 rock drills at work. The coffer dam surrounding the works is now practically complete, and pumping will begin a few days after this sketch is published. About 1,000 feet of the tunnel is finished, through which the water, after expending its power, will be discharged, right under the Horseshoe Falls; and at the lower or discharge end of this tunnel there remained, when the writer visited the works, only a thin shell of rock separating the workmen from the furious backwash of water and spray which drives against the wall. Sixty men are working in the tunnel day and night. The company is empowered to take 125,000 h.p. from the river, and the power house, whose classic outlines are shown in the accompanying engraving, has provision for eleven turbines of somewhat more than 10,000 h.p. each. These are being constructed by the General Electric Co., of Schenectady, and the Canadian General Electric Co., of Peterboro'. The contract calls for the completion of the whole works by June, 1905. The Toronto and Niagara Power Co. under its charter will have the right to expropriate lands, and has already completed surveys for both its transmission line and an electric railway to Toronto. This portion of the work is under the direction of W. T. Jennings, C.E., of Toronto. The right of way will have a minimum width of 80 feet. It is decided that the line will be erected on steel towers of a new type, which will lessen the risks of accident or leakage of current. B. R. Value, C.E., for seven years on the new Croton dam of New York, is resident engineer, and Robt. C. Brown, E.E., is chief electrical engineer of the transmission line.

The works of the Canadian Niagara Power Co. have already been described in the Canadian Engineer, this company having been the pioneer in the development on the

Toronto and Niagara Power Co. From a photo taken May, 1904, showing progress of excavation work in wheel pit.

Canadian as its sister corporation was on the United States side of the river. The power house has a capacity of 110,000 h.p., and the whole of this immense power will be provided for at once, except 10,000 h.p., which will be held as a spare unit. The work progresses smoothly and rapidly under the skillful direction of Cecil B. Smith, C.E., the resident engineer. The wheel pit is now excavated, and a considerable part of it is lined. It is 165 feet deep, 18 feet wide inside of the brick lining, and is 570 feet long. The power house, the steel frame of which is erected by the Hamilton Bridge Works Co., is similar in design to the power house No. 2 of the company on the United States side. It is of Queenston limestone, with colored tile roofing, and will be lined with mottled buff brick, the base being of enamelled brick. Two 50-ton cranes were designed and erected for handling the heavy material for this structure, and these are operated by current taken from a transformer station on the hill above the park. This station is supplied by current taken from the power house on the United States side, from which not only these, but the other works in progress take current to the extent of about 4,000 h.p. The hoists and rock drills are chiefly operated by steam and compressed air. Of the eleven mouths for as many turbines, nine will be placed in position now, and six of these are having wheel pits cut and bricked up ready to attach the machinery, which will be ready for delivering power about December next. The turbines, each of a capacity of 12,500 horse-power, were designed by Escher, Wyss & Company, of Zurich, Switzerland, and are of the twin Francis vertical type, inward discharge, two draft tubes to each unit, discharging into the open tailrace below. Three of these units are being manufactured and installed by this firm, and two units on the same design by I. P. Morris Co., Philadelphia. The generators, each of 10,000 horse-power, are of the internal revolving field type, and will generate alternating 3-phase current, 25-cycles, at 12,000 volts. Five of these are being installed by the General Electric Company. The generator and turbine are direct connected by a vertical shaft, and will revolve at 250 R.P.M. The auxiliary machinery, consisting of exciter turbines, exciters, water pumps, oil pumps and oil tanks, etc., are located in three chambers built into the side of the wheel-pit 100 feet beneath the surface. This machinery will all be operated by an independent water service drawn from the canal above. From the portions of machinery now on the ground and in

Toronto and Niagara Power Co.—View in tunnel.

the power house one can form a fair idea of their immense power. The first dynamo is being put together, after having been erected and tested at the works in Schenectady, and then taken apart for transportation to Canada. There are 50,000 laminations in this machine, the largest in existence at the present day, its actual net capacity being 10,250 h.p., and its diameter 18 feet. The turbine to which it will be connected will exert 12,500 h.p., the weight of all the revolving parts being 187,000 lbs. The shaft on which this immense machine revolves is forty inches in diameter, of steel, and hollow except for the bearing part, which is fourteen inches in diameter, and of solid nickel steel. The steel castings forming the lower elbow of the penstock are in two sections, each half weighing 75 tons. There appears to be only one place in the world—Pilsen, Germany—where steel castings of such a size and shape can be made. The transformer station, equipped with water-cooled transformers, has a present capacity of 25,000 horse-power. It will be supplied with water for cooling purposes from pumps located in the chambers of the wheel-pit. There will also be a standpipe 116 feet high and 30 feet in diameter carrying

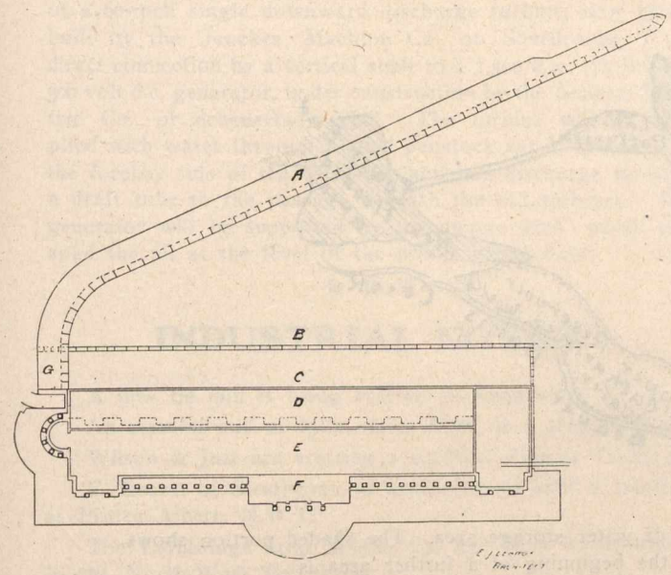
Map of Niagara Peninsula, showing transmission lines of Toronto and Niagara Power Co., and of Hamilton Cataract Power, Light and Traction Co. (the latter starting from De Cew Falls.)

one day's supply of water, to be drawn upon in case of any accident to this pumping system. This would supply 50,000 h.p. for the day. This station is now about completed. The tunnel tailrace, just completed, is 2,200 feet long and of a horseshoe form, 25 feet high and 19 feet wide, lined with 17 ins. of concrete, with vitrified brick facing. The grade of this tunnel is seven feet per thousand, which will give a speed of water when plant is in full operation of about 27 feet per second. The head canal has a clear waterway 15 feet deep and 250 feet wide, and is crossed by a five-span stone arch bridge, now finished, which carries the tracks of the Niagara Falls Park and River Railway, a carriage way and sidewalk. This canal widens into a forebay 600 feet wide, extending the whole length of the power house. The underground conduits are now being laid. The main one runs from the power house down to the Upper Arch Bridge, on which it will be carried across to the United States side for transmitting such current as is required in New York State. This conduit, which is half finished, and is 1½ miles long, will have 32 holes, with a transmission capacity of 75,000 h.p. The other series of conduits is carried to the transformer station on the hill, half a mile distant, and will contain 24 ducts, with a capacity of 50,000 h.p.

The River Ice Problem.

The plan adopted by the Canadian Niagara Power Co. for keeping the power-house clear of ice has already been described in this paper. The retaining wall forming the forebay is two feet lower at its point of junction with the walls than at the upper end. As the heavy floating ice is carried down the forebay, the narrowing of the water area and the

difference in the level of the wall tend to increase the surface current so that the thick ice will be thrown over into the river again. In front of the power-house, and parallel to its face is an outer ice rack formed of steel rods placed 10 inches apart, not standing vertically, but inclined in the direction of the current so that any ice reaching the rack may be lifted and helped down to the outlet. Coarsely screened by these rods the water passes through submerged archways under a portion of the power-house, and any small ice remaining will be caught, before reaching the mouths of the penstocks, by a second rack composed not of rods but of bars placed one inch apart.



Toronto and Niagara Power Co.'s scheme of protection from ice. A, retaining wall; B, outer ice rack; C, inner rack; D, line of penstocks; E, wheel pit; F, offices.

The Ontario Power Co.'s intake has an outer forebay and an inner forebay. A fender for coarse ice with a screen for finer ice are expected to take care of these troubles.

The accompanying diagram shows the scheme which the Electrical Development Co. have adopted for dealing with ice at the Toronto & Niagara Power Co.'s intake. A, shows the wall or dam enclosing the forebay. This is 33 feet 9 inches wide at the base, 24 feet high, and is of concrete with granite coping, and a "bull nose" of granite, to break the ice striking the head. B and C are two rows of arches, the inner one being under the power-house. There is one ice screen over the outer arches, formed of bars placed 2 inches apart, and made in sections of 28 bars 17 feet 9 inches high. These can be lifted for cleaning or other purposes. The velocity of water under the arches is 2 feet 1 inch per second, and as in the case of the Canadian Niagara Power Co.'s works it is thought that frazil ice will not occasion serious trouble in the area covered by the building.

HAMILTON'S ELECTRICAL SUPPLY.

The following is a sketch of the proposed enlargement of the hydraulic power system of the Hamilton Cataract Power, Light and Traction Company, with a short description of the plant as a whole:

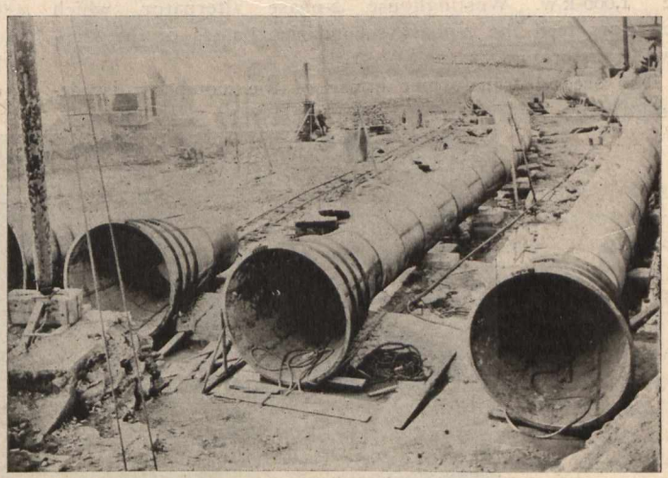
The company's old plant received its water from the feeder of the old Welland Canal into its own canal, being a waterway capable of carrying 250 cubic feet of water per second. This old canal extended from Allanburg to the brow of the Niagara escarpment in the neighborhood of DeCew Falls, well known in history as a military post in the war of 1812. It was from this post that Col. Fitzgibbon, apprized by Laura Secord who walked twenty miles through the woods to warn the British, set out with fifty men and captured 500 Americans who had been sent to seize the post. Immediately back of the forebay at the lower end of the canal, are three storage basins aggregating some thirty acres.

This old hydraulic system having been wholly outgrown, the company is now engaged in altering its conditions as follows: The supply is to be taken from the Lake Erie level of the Welland Canal through a weir constructed in the banks of the canal especially for this purpose. From this weir the water will pass through a new canal capable of handling about 1,000 cubic feet of water per second a distance of three-eighths of a mile. At the lower end of this channel the water is delivered into a natural valley, being the bed of what is known as the Beaver Dams Creek. This stream bed is converted into a lake of about 400 acres in extent by the construction of an earthen dam at its lower end. This newly-formed lake will be connected with the old lake system, and some extensions of it, by means of a short additional canal of about 1,000 ft. in length. The company's waterway will accordingly (all but about a mile for the five miles) consist of a large lake or storage basin, the benefit of which in preventing anchor ice and other winter troubles will be very great. This basin will also have some value as a storage, enabling the company to use its water supply to better advantage and to install a larger plant than would otherwise be possible.

Arriving at the brow of the escarpment, the water is conducted to the power house by seven steel penstocks about 850 feet long each; one of which penstocks is now operating and four under installation. The static head upon the company's turbines is 267 feet. These penstocks are connected up to ten turbines, viz.: two of 1,700 h.p. each of Stilwell-Bierce & Smith-Vaile Company's make, two of 3,300 h.p. each of Italian make by A. Ing. Riva, Monneret & Co., Milan, Italy, and the remaining six of 6,000-h.p. capacity each, manufactured by J. M. Voith, of Heidenheim, Wurtemberg, Germany. Four of these larger turbines are under installation.

The company's generators consist of two Royal Electric 1,000 k.w. three-phase inductor type machines, two General Electric 2,000 k.w. capacity revolving field machines, and six 5,000 k.w. machines, two of which have been purchased from the Westinghouse Electric and Manufacturing Co., the make of the other machines not yet being determined.

The station is arranged to be equipped with automatic electrically operated switches, two in series on each generator. The transforming equipment consists of thirteen 2,900 k.w. oil-insulated water-cooled transformers, wound with 2,400 volt primary to 22,500 or 45,000 volt secondary. The



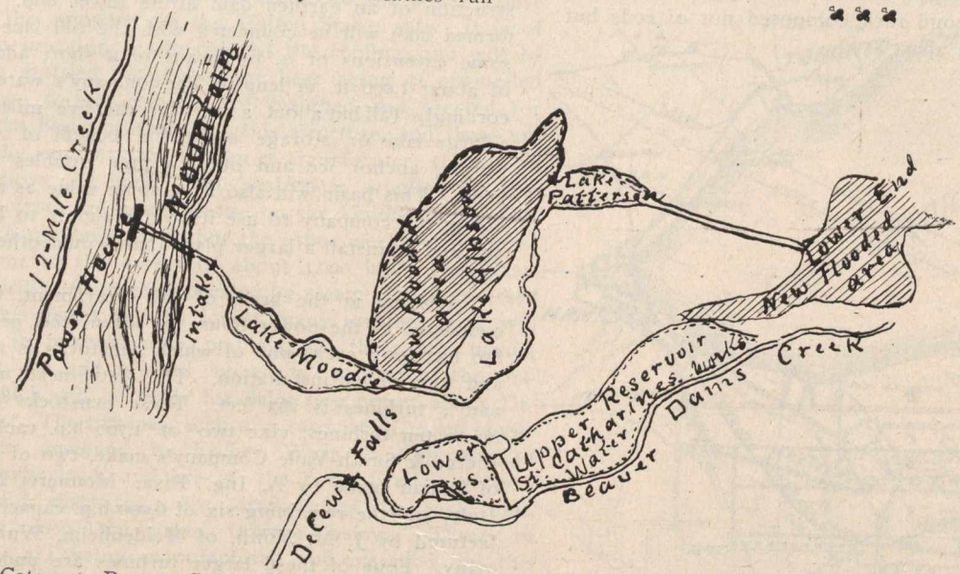
Hamilton Cataract power plant. New penstocks being placed in position on the Mountain.

wiring of the transformers on the transmission lines is arranged for the higher potential.

The transmission lines are two in number, No. 1 line being a 42-inch equilateral triangle composed of three stranded aluminum conductors of 380,000 circular mills area. No. 2 line consists of two triangles of No. 2/0 wire arranged in 56-inch triangles. Both lines are insulated with R. Thomas & Sons' 9-inch "Swamp" type insulator, each one having been subjected to rigid test at the manufacturer's premises before shipment. Barbed wire is used on each of the lines, and their route is shown on the map on page 158.

The receiving stations in Hamilton are three in number,

two of which belong to the company and one to one of its customers. The main sub-station on Victoria Avenue and Shaw Street contains the necessary 500 k.w. step-down transformers, being oil-insulated natural cooled apparatus; all the incandescent lighting distributing circuits; the city arc lighting; rotaries and storage battery for the electric railways; and steam auxiliary plant of 4,000 h.p. capacity. The transforming units are 500 k.w. 20,000, or 40,000 to 2,400 volts, arranged in pairs for transforming three-phase transmission current to two-phase distribution current. The rotaries in this station are 3-300 k.w. Westinghouse 60 cycle machines run



Hamilton Cataract Power Co. Sketch showing extension of water storage area. The shaded portion shows the enlarged area of "Lake Gibson," while the beginning of a further area is indicated by the shaded patch on the right.

upon the railroad circuits in connection with a 400 ampere chloride accumulator. The street lighting equipment consists of five General Electric constant current transformers of 105 lights' capacity each. Tht steam plant consists of four 500-h.p. Stirling boilers equipped with induced draft outfit and steel stack, for 165 lbs. pressure. The engines consist of two 28 and 56 by 42 inch Goldie & McCulloch cross compound non-condensing engines, each directly connected to one 1,000-k.w. Westinghouse 2-phase alternator, which alternators feed the 2-phase secondaries busses of the step-down transformers.

The second transformer house of the company is designed for 12,000-k.w. of capacity in static transformers only. It is at present supplying the International Harvester Works and the Hamilton Steel and Iron Company with current.

The third sub-station belongs to the Imperial Cotton Company, containing their static transformers and switchboard, etc., etc., receiving their current at 20,000 volts and transforming it to 550 for distribution throughout their mill.

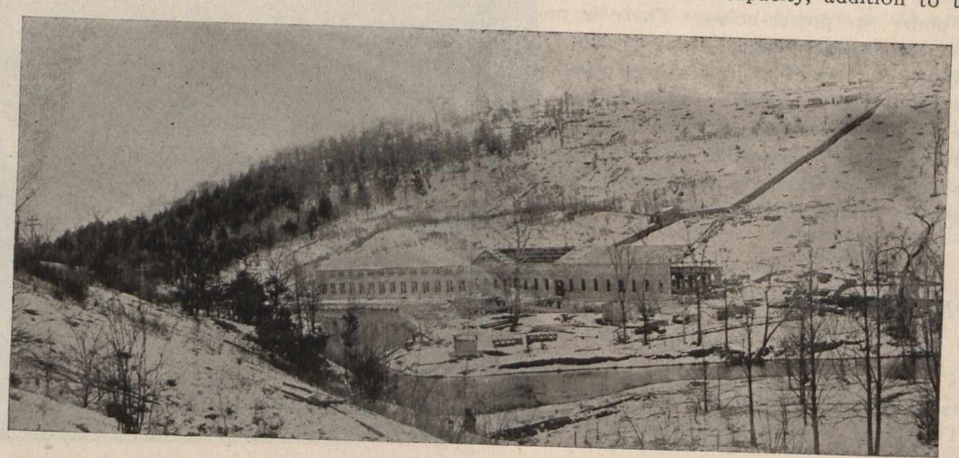
The company has three railways; the Hamilton Street Railway being the city road, and two suburban roads, the Hamilton and Dundas running from Gore St., in Hamilton, to the centre of the town of Dundas, about seven miles; the other, the Hamilton Radial Railway, extending about thirteen miles from Gore and James streets, in Hamilton, to the centre of the village of Burlington on the north shore of Lake Ontario.

In addition to lighting the city streets and furnishing power and lighting in Hamilton, the company also supplies lighting and power to the villages of Beamsville, Grimsby, Burlington, and the town of Dundas.

INTERNATIONAL RAILWAY CO.'S POWER EXTENSIONS.

Although overshadowed by the developments of the three big electrical works now in progress, the new power installations of the International Railway Co., which operates the electric railways on both banks of the Niagara, are of no mean magnitude, and are worth a more detailed notice than is given here.

There are three features of these extensions, which are being carried out by W. G. Chace, the resident engineer: Increase of headrace capacity, addition to the electrical equipment of the power house by the addition of four machines to be driven by the two turbines now in place, and the installation of a complete new hydro-electric unit. Work on the increase of headrace capacity was begun in July last, and, delayed by reason of the severe winter, is now completed. It will provide for 8,000 h.p.; and excavation for the reception of the new turbine is also nearing completion. Additions to the forebay house covering two additional penstock inlets have been made; a new double track through



Hamilton Cataract Power House, showing new additions and penstocks leading from brow of Mountain.

skew-plate girder bridge 100 feet long spans the enlarged intake, and will be supplemented by a new highway bridge, to be placed nearer the river margin. Within the power house the two old turbines, 45-inch New American wheels, installed by Wm. Kennedy & Sons, Limited, of Owen Sound, in 1893, have been overhauled thoroughly. One, being now fitted with balanced cylinder gate, has been placed under control of a Sturgess No. 2 hydraulic governor. The working head on both wheels has been slightly increased by deepening the wheel-pit and lowering its outlet; and, as said above, three 200 k.w., d.c. generators and one bipolar booster are being installed in place of two a.c. generators removed. The new hydro-electric unit referred to consists of a 60-inch single downward discharge turbine, now being built by the Jenckes Machine Co., of Sherbrooke, P.Q., direct connection by a vertical shaft to a 1,500 k.w. 175 R.P.M. 500 volt d.c. generator, under construction by the General Electric Co., of Schenectady, N.Y. The turbine will be supplied with water through a steel penstock set in concrete at the forebay side of the wheel-pit, and will discharge through a draft tube to the passage beneath the old turbines. The generator will be supported by a concrete arch which will span the pit at the level of the power house floor.

INDUSTRIAL NOTES.

A new tie mill is being erected at Keewatin.

An oatmeal mill at Minnedosa, Man., is a probability.

Wilson & Just are erecting a machine shop at Treherne.

F. Beard, of Strathcona, is arranging to build a tannery at Prince Albert, N.W.T.

The Lethbridge Iron Works Co. has been incorporated in the North-West Territories.

I. S. Snider and Peter Rempel have decided upon the erection of a 125-barrel flour mill at Morden.

The Frontenac Cereal Co., of Kingston, is negotiating for a five-story factory at Victoria, B.C.

Baird Bros., furniture manufacturers, recently burned out at Plattsville, Ont., will rebuild there.

Bracebridge will take $15,000 preferred stock in the Hess Furniture Co. to induce them to locate there.

The Dominion Iron and Steel Co.'s rod mill at Sydney, C.B., is now in operation. It has a capacity of 200 tons a day.

The James Robertson Co., of Montreal, is considering establishing a branch of the Dominion Saw Works at Vancouver.

St. Catharines will bonus the J. M. Ross Sons & Co., of Brampton, manufacturers of traction engines, crank separators and harvesting machinery.

Sheldon & Sheldon have bought out the McEachren Heating and Ventilating Co. at Galt, and J. D. McEachren has established similar works.

The J. H. Ashdown Hardware Co., of Winnipeg, has been licensed to carry on business in British Columbia; head office, Nelson; capital, $1,000,000.

C. Kloepfer is building a new factory at Guelph for the manufacture of carriage woodware. It will be 112 x 50 feet, three stories and basement, with boiler-house 30 x 30, pressed brick with stone foundation.

The Percival Plow and Stove Co. have recently installed in their works at Merrickville, Ont., a standard 18-inch and a deep bucket 28-inch "Little Giant" turbine, procured from J. C. Wilson & Co., Glenora, Ont.

The Canadian Bullock Electric Manufacturing Company has changed its name to Allis-Chalmers-Bullock, Limited, increased its capital from $1,000,000 to $1,250,000, and extended its business to include all kinds of machinery.

Some Ontario capitalists, whose names are not announced, have secured a large contract for ties in connection with the Panama Canal, and will build a sawmill at Vancouver to cost about $1,000,000.

The Inglewood Pulp Co. will build several sawmills at Musquash, N.B. They are compelled to do this because bush fires have burnt over a large part of their limits, and the timber must be converted into merchantable timber at once.

The Ottawa Furnace and Foundry Company has increased its capital from $40,000 to $250,000.

The Keller Heater Co. of Canada, incorporated in Ontario, has increased its capital from $100,000 to $250,000.

The mortgage on the Sault Ste. Marie industrial works has been paid and the works turned over to the new company, which will soon have them in operation.

Contracts for the Petrie machine shops at Hamilton have been awarded as follows: Roofing, James Findlay; mason work, George E. Mills; carpenter work, Poag Bros.; painting, Ross Bros.

The Mansfield Glass Works, of New York, with a capital of $200,000, and employing about 150 men, have decided to establish a Canadian branch at Hamilton. They will make lamp chimneys, milk bottles, gem jars and other bottle goods.

The British Columbia Association of Stationary Engineers was recently incorporated under the Benevolent Societies Act of that province. The first board of trustees is composed of William Henry Paddon, William Alexander Robertson, George Henry Fowler, James Johnston Currie, and William Reese, the first four of Vancouver, and the fifth of New Westminster.

The Toronto Type Foundry Co., of Toronto and Montreal, has purchased the plant and business of the Linotype Company, of Montreal. The extent of the business is shown by the fact that last year forty linotype machines, of a value of over $3,000 each, were shipped from Montreal to Belgium, New South Wales, and Queensland, and over fifty machines were sold to Canadian printers.

SCHOOL FOR NATURE STUDY.

The Macdonald Institute at the Ontario Agricultural College, Guelph, will provide a summer school for teachers during the coming vacation. The term will extend from July 5th to July 29th, inclusive, and the work will consist of practical nature study suitable for our public schools. The classes will be under the direction of Dr. W. H. Muldrew of the Macdonald Institute, and Professor William Lochead, of the Biological Department in the Ontario Agricultural College, assisted by teachers in the various special subjects of the course. This course will involve daily excursions, lectures and laboratory work, the preparation of nature study collections and courses of reading in illustration of the subjects discussed.

CATARACT POWER COMPANY'S NEW ENGINES AT HAMILTON.

The Goldie & McCulloch Co., of Galt, recently installed two cross compound non-condensing engines for the Cataract Power, Light and Traction Co., of that city. Some detailed description of these engines will be of interest:. The following are the principal dimensions of the engine: Rated horse power, 1,500 h.p.; maximum horse power, 2,250 h.p.; initial pressure, 150 lbs. per sq. in.; diameter of h.p. cylinder, 28 inches; diameter of L.P. cylinder, 52 inches; stroke, 46 inches; speed, 100 revolutions per minute; piston speed, 768 feet per minute; diameter of piston rods, 5½ inches; size of crosshead pin, 7 inches diameter x 9½ inches long; size of crank pin, 8½ inches x 9½ inches long; size of main bearing, 22 inches x 38 inches long; diameter of fly wheel, 18 feet; weight of fly wheel, 120,000 pounds; total weight of engine, 300,000 pounds.

The engines are each direct connected to Westinghouse engine-type alternate current generators. These generators are of 1,000 kilowatt capacity, and 8,000 alternations at 100 revolutions per minute.

This plant is of special interest from the high frequency of the generators, and the fact that they are run in parallel with each other, and also with water turbine driven alternators at the company's main power station thirty miles distant.

The valve gear of these engines embodies several novel features. The valves are of the flat grid-iron type, and are

seated on removable plugs, which are ground into the cylinder. This allows of the valves and seats being scraped to true surfaces, reducing the friction to a minimum. The removable feature of the valve seats permits of an easy and rapid renewal in case of wear. This is a matter of great importance in large engines, inasmuch as the re-boring of a valve seat by a portable rig can never be as satisfactory a job as the refitting of a flat surface in a shop where the use of all necessary appliances is obtainable. The valves move across the cylinder, and each valve is actuated by a separate eccentric on a lay shaft running parallel to the cylinder. This shaft is driven from the main shaft by steel gearing. The steam valve trip gear is carried on a substantial bracket on the outer end of which is the dash pot. This dash pot is used for a cushioning effect only, the actual closing of the valve being obtained in a very rapid manner by the unbalanced steam pressure on the valve spindle. This rapidity of closing permits the valve gear to be run at rotative speeds up to 150 revolutions per minute. The exhaust valves are worked by a combination of links which gives a very rapid opening and closing of the valve and a dwell during the time they are opened or closed. The arrangement of independent eccentrics permits of a long range of cut off, the maximum being seventy-five per cent. of the stroke. In consequence of the valves being of the multi-ported type, with large surfaces, the wear is extremely small, and the valve faces being horizontal perfect lubrication is assured. By placing the valves at the corners of the cylinders the clearance is reduced to a minimum while getting ample port area for high piston speeds.

The Hamilton Bridge Works Company furnished practically all the steelwork of the power-house and transformer houses, both at Hamilton and DeCew Falls, and built the first line of steel pipe for conveying water from the top of the mountain to the wheel pit.

THE WORLD'S FAIR AT ST. LOUIS.

Through the courtesy of the Grand Trunk Railway and the Illinois Central Railway the Press Association of the Province of Quebec and the Canadian Press Association of Ontario visited the Louisiana Purchase Exposition, May 14th, returning on May 21st. The gentlemen in charge of the transportation of the 200 odd members and their wives who made up the party were Messrs. Charlton, McDonald, Quick and Elliott, of the Grand Trunk Railway. Mr. Louis Larivé, the official Canadian Government's correspondent, with headquarters at St. Louis, also accompanied the party. The arrangements made could not have been excelled, the special Pullmans being new from the shops.

The Louisiana Purchase Exposition, in the opinion of the party, had not been overestimated. St. Louis, with its 1,600 acres of Fair site, has larger buildings, more complete arrangements, and in handling the proposition it has profited by the object lessons furnished by Chicago, Buffalo, Glasgow, and Paris; it has also had more liberal support from the various nations abroad, whose buildings and exhibits are far in advance, both in quantity and quality, of those of any previous American World's Fair.

It is said the total cost of the Exhibition will exceed $50,000,000. When one stops to think that in 1803 the United States Government bought this wedge of land, which had New Orleans for its apex and North-western Canada for its base, for $15,000,000, and that the cost of the Exposition will thus exceed by $35,000,000 the price of the territory the purchase of which is marked by this anniversary, one has a slight idea of the progress made by our friends over the border in the last 100 years.

To the readers of the Canadian Engineer there are four buildings which will be of particular interest, and in which our representative spent most of his time, namely, the Transportation, Machinery, Electricity, and Mines and Metallurgy. These buildings are within easy reach of one another; and the Intramural Railway, with its fourteen miles of tracks and quick service, and which has seventeen stations on the grounds, is certainly the easiest means of reaching any given point, for there are no less than thirty-five miles of roadway, and every style of conveyance that can be imagined plying on the same. The Transportation Palace contains four miles of standard gauge railroad tracks, with exhibits from all over the world of land, water and air methods of transportation all represented. Locomotive tests, automobile speed contests, etc., are features of interest. In the Palace of Machinery, the boilers and engines are all exhibits, and 50,000 h.p. supplies the motive power for the exhibitors' machines located in the building. The Palace of Electricity and Machinery contains modern types of machines for the generation and utilization of electrical energy, and Germany, Great Britain, France and the United States vie with each other in representing the latest types. The Mines and Metallurgy Palace, with its outdoor exhibit, covers twenty-one acres; and particular attention is attracted to the model coal mines in operation, as well as the methods used for extracting metal from ore, and the process of manufacturing these metals into the finished product. Pages could be covered with details regarding the foregoing, but space does not permit. The amusement end of the Exposition is called The Pike, and these attractions are located on both sides of a wide vitrified brick boulevard, a mile long; and through the courtesy of the Press and Publicity Bureau the visitors were supplied with passes which were honored at each and every one of the different attractions, which are greater and of a more varied character than one would imagine. On the return trip presentations of valuable plate and jewellery were made by the Ontario contingent to Messrs. Charlton and McDonald, and each association presented its secretary with a handsome souvenir as a recognition of their splendid work, both prior to and during the trip. On the way back ten hours were spent in Chicago, and a banquet was tendered the Associations at the Victoria Hotel, by the Miehle Printing Press Mfg. Co., and at the King Edward in Toronto Mr. James Harper presented Mr. Charlton with a handsome diamond ring from the Press Association of the Province of Quebec. Mr. Harper, secretary of the Press Association of the Province of Quebec, was in addition congratulated on the beautiful badge worn by the members of his association. This was easily the most handsome worn by any of the numerous associations from all over the world who attended the Parliament of the National Editorial Association during the Press Week. With the largest hotel in the world situated within the grounds, the Inside Inn, and the other accommodations provided by St. Louis, visitors to that city should not experience any inconvenience in securing accommodation within reach of their means; and, while June and July may not be ideal months in which to visit the Fair, no doubt many readers of the Canadian Engineer will find it profitable to visit it during the coming five months. This paper has received invitations from many exhibitors who will extend a courteous reception to those of our readers who will mention the name of the paper. No Canadian paper has as many advertisers represented at the Exposition as the Canadian Engineer.

MINING MATTERS.

The Salernos sailed from Sydney last month with a cargo of 5,000 tons of steel from the D. I. & S. Co., for Glasgow.

J. M. Bell is to be sent by the Ontario Government to make further examination of the iron deposits in Michipicoten district.

Power states that an alloy of iron with 36 per cent. nickel is so slightly susceptible to expansion from heat that the expansion can scarcely be measured by the most delicate instruments.

The McGill College mining class, on their annual tour, first visited Copper Cliff, where they spent three days studying geology under Prof. Adams, and two days on metallurgy under Dr. Stansfield. They visited the various mines and smelters. They then went on to Lethbridge, where Dr. Porter took charge of them for the rest of the trip.

It is expected that Prof. Coleman, of Toronto, will complete his examination of the Sudbury nickel area this season. A report and map will then be published of the entire region.

An extensive deposit of coal has been found in Alaska convenient to the Pacific Ocean, and near the Controller oil fields. The coal and oil are found in two distinctly separate formations that lie in roughly parallel belts. The coal area includes about 85 square miles. The coal resembles the harder bituminous coals of the East more than it does anthracite.

The new steel dredge built at Lilloet will soon begin operating on the Fraser River bars. This dredge is the largest of the kind in Canada, and was constructed at a cost of $87,000. It has five powerful engines, and is most completely equipped in every particular to meet the special requirements of gold dredging on a river where the current is very strong.

The Mic-Mac Gold Mining Company at Millipsigate, N.S., has been putting in new machinery, and a new boiler and air compressor. It has bought a water power at Port Medway River, and it is the intention to run the plant and light the mine by electricity. The shaft is four hundred feet deep, a 10-stamp mill on the ground is used for crushing the ore, and it is the intention to add five more stamps.

A company is stated to have been formed by H. M. Whitney, of Boston, and B. F. Pearson, of Halifax, both of whom were promoters of the Dominion Coal and Dominion Iron and Steel Companies at Sydney, whereby they have secured control of coal properties at Inverness Mines, Port Hood and Chimney Corner, in the County of Inverness, together with the railroads now being operated there in connection with these mines. Very extensive developments are expected.

Canada's exhibit of minerals at St. Louis is said to be very fine. The display is the largest ever made by this country at any exhibition. It occupies a space of 9,000 square feet. As Canada supplies more than one-half the world's production of nickel and 95 per cent. of the asbestos, these two ores are given a prominent place. They are displayed in the form of large pyramids. The pyramid of nickel weighs 17 tons, and that of asbestos weighs 14 tons. Two other pyramids are shown, one of corundum, weighing 15 tons, and another of mica. These pyramids illustrate the processes the ores undergo in the transition from the crude state to the finished product. Coal holds a prominent place in the display. Specimens are shown from all fields, from Nova Scotia on the Atlantic to Vancouver Island on the Pacific. Most of the coal used by the Pacific squadron of the United States navy comes from the Vancouver mines. Gold copper ores and silver lead ores are shown in large quantities, as are also chrome iron and manganese iron ore. Seventy-five table cases contain minerals arranged according to their geographical location.

Hydraulic mining is very active this season in the Cariboo country, B.C. In one case a shaft has been sunk through rock a distance of over 300 feet, and from thence a drift was run several hundred feet in bedrock. The real work began, however, where the gravel was tapped, and the problem presented itself of dealing with an enormous pressure of water then encountered. For several months powerful pumps, throwing a thousand gallons per minute, have been at work in the mine, and, although the pressure has been considerably reduced, some time must elapse before it will be possible to attempt to mine the gravel. That is really the problem, how long will it take to get rid of the water, and will the funds last out until this is accomplished. As a Cariboo mine manager remarked: "Either we have one of the biggest things in British Columbia, or we lose all, our work, our time, our money." To him loss would be a serious blow, for he has spent thirteen years of the best years of his life in the undertaking. There is no question that the values are in the gravel, for the best possible prospects have been obtained, some gravel taken out last fall yielding half an ounce to the cubic yard.

Gold dredging is proving very profitable on the Fraser river, B.C.

A concentrator plant is to be installed at the Alice Mine, Creston, B.C.

The Joggins coal mines, Cumberland County, N.S., will go into liquidation.

The Burley Gold Mining Company, of Ottawa, has surrendered its charter.

The Pilot Gold Mining Co. are putting in a stamp mill at their property at Ymir.

The Jumbo mine, at Rossland, has purchased eight drill compressors from the Mascot mine.

A milling plant is to be installed by the Gold Creek Mining Co. in the Bull river district, B.C.

In the Lake of the Woods district the National Gold Mining and Milling Company will resume operations.

Coal has been found in Siberia, so that on part of the Trans-Siberian Railway the locomotives burn coal instead of wood.

Coal and iron deposits in proximity have been found in the Nicola Valley, B.C., a country not yet reached by a railway.

Work has been resumed at the Poorman-Tiger group of mines, on Wild Horse Creek divide, B.C., the property of John P. Larson.

The Detroit and Parry Sound Mining Co., incorporated under the laws of South Dakota, has been licensed to do business in Ontario.

The Reliance Gold Mining and Milling Co. is installing a Hendryx process mill, of 50 tons capacity, on their property, near Nelson.

A landslide destroyed plant and machinery at the Silver Cup mine in the Lardeau, valued at $250,000. Slides also damaged a number of buildings at the Slocan Star.

A few days will probably see machinery started at Rossland Power Company's two hundred ton concentrator, and the works will be soon crushing to their full capacity.

The American Cement Company has purchased the property of the International Asbestos Co., and intend pushing with vigor the manufacture of their product at Actinolite, Ont.

In the marble quarries, of Carrara, the greatest single blasting operation ever undertaken there has been successfully accomplished, resulting in the loosening of a huge block of marble valued at £12,000.

The output of the Dominion Coal Co. is now 13,000 tons a day, reaching some days 14,500. A large proportion, at least 7,000 to 8,000 tons a day, is shipped to the St. Lawrence. More than 3,000,000 tons have been sold in advance.

Advices from Keewatin state that there are gratifying indications of a revival in gold mining operations in that district. The investments of United States capitalists have been so satisfactory that others are preparing to follow.

Extensive improvements have been made at Port Morien in the Newcastle Collieries Co.'s mine, with a view of increasing the coal output. A Rand air compressor and two 500-h.p. Babcock & Wilcox boilers are among the improvements.

The Canadian Pacific has closed a contract to carry 15,000 tons of lead ore from the Kootenay district of British Columbia to England. They have also made contracts for the shipment of large quantities of copper ore from the Sudbury district.

A movement is on foot looking to the reopening and development of the copper-bearing properties in the Eastern Townships. Under present conditions, the ores have to be shipped for treatment to Staten Island, N.Y., but a smelter and chemical works at Sherbrooke is contemplated.

A ten stamp mill has been put in operation at the Cameron Island mine, four miles west of the Mikado; the owners of the Indian Joe mine, three miles north of the Mikado, are ordering a mill, and development work on the Olympia mine, a mile south of the Mikado, has shown good ore.

MUNICIPAL WORKS, ETC.

Carroll, Man., is to have a new $6,000 bridge.

Almonte will spend $7,000 on granolithic sidewalks this year.

Kingston has eight miles of granolithic walks and Brockville thirteen.

Listowel has authorized the borrowing of $10,000 to complete the waterworks, $21,000 raised by last year's by-law being insufficient.

Peter Lyall & Son, of Montreal, have been awarded the contract for the new Ottawa University buildings, the steel wharf sheds at Montreal, and the C.P.R. station and hotel at Winnipeg.

Barrie will issue debentures for the following improvements: Extending cement pavements, $10,000; extending water works system, $3,000; enlarging fire hall, $3,500; purchase of hose, $1,500.

An official report of the Department of Bridges and Roads in France shows the continuance of good results in rendering roads free from dust by coating the surface with tar. This was tried after the unsuccessful use of a mixture of oil and petroleum. The engineer says: In La Cher two lengths of the Chausée Nationale were coated with tar in June and August of 1902. Both these experiments have been entirely successful, the road now being covered with an elastic skin, while the sound of foot-passengers' tread is muffled and horses and draught oxen require only one-half the effort they put forth before. The noise and vibration caused by vehicular traffic is much reduced, and neither dust nor mud is formed on the tarred surface.

Montreal is having considerable difficulty in connection with the drainage of St. Denis ward, and the northern portions of the city. When the city established a sewage farm and a drainage system leading from it to the Back river, two or three years ago, it was supposed a work had been done which would last for years, but the original plans were altered, so that the surface water, as well as sewage, should pass through the farm. The city surveyor pointed out at the time that this was a mistake, as the farm would be unable to filter such a quantity of water, and it would become flooded and choked. So it has turned out, and the courts have forbidden the use of the farm and drains, as they were creating a nuisance. A report on the means to be employed to overcome the difficulty has been prepared by the city surveyor's department, several alterations being suggested, but before deciding on any one, the municipalities of St. Louis and Outremont, which are specially affected, are to be consulted.

C. H. Rust, Toronto city engineer, recently explained to the Provincial Board of Health the three systems of sewage disposal which he suggests as feasible, with the object of eliciting an authoritative expression of opinion as to the most suitable. Scheme 1 is the carrying of the crude sewage to an outlet in the lake, nine miles east of the waterworks intake pipe. This would cost $1,750,000, with an annual cost, without interest, of $17,000. Scheme 2 is to convey the sewage of Woodbine Ave., treat it by septic tanks and pump the effluent to a sandy farm of 700 acres, north of Danforth Ave. This would cost $2,400,000, and its maintenance would be $76,000. Scheme 3 is to supply septic tanks and bacteria beds on Ashbridge's Marsh, and turn the effluent into the lake. This would cost $2,500,000, and the maintenance would be $37,000. Personally, the Engineer favors scheme No. 1, but it is opposed by Dr. Sheard, Medical Health Officer. Mr. Rust's next choice would be scheme No. 2, the sewage farm plan, although it would be a most expensive one. The other scheme, the placing of septic tanks on Ashbridge's Marsh, would cause a great deal of objection by people residing in the vicinity. Dr. Sheard said he could not approve of turning the crude sewage into the lake. The prevailing winds would be easterly, and would drive the sewage towards the waterworks intake, besides polluting the shore near the sewage outlet. In his opinion the sewage should be treated by septic tanks. He insisted on a pure effluent, no matter what the cost of the system adopted. The matter was referred to the Sewage Disposal Committee of the Board.

A by-law to raise $10,000 to extend the waterworks and electric light plants has been defeated in Strathroy.

A party has left Vancouver to commence the Alaska boundary survey. The work is expected to extend over three years.

Winnipeg will purchase a water tower and an aerial ladder, increase the apparatus at the halls, and build a new fire hall at a cost of $17,000.

The Maritime Contracting and Mining Co. has the contract for the Springhill, N.S., waterworks. The reservoir will be built on the summit of Cobequid Mountain, about seven miles from Springhill. The system will cost in the vicinity of $100,000.

The Canada Foundry Company was awarded the contract for the new steel conduit across the bay at Toronto. Its tender was $14.96 per lineal foot, or 48 cents in advance of the offer made by the Pittsburg firm of James McNeil & Co. The distance is nearly 6,000 feet.

Motor water carts, each carrying 1,100 gallons, have proved successful in Paris. The sprinkling apparatus is connected with the wheels so that water is delivered at a rate corresponding to the speed of the cart, and stops when the cart comes to a standstill.

The Dominion Government will erect such fortifications in the harbor of St. John, N.B., as will enable the port to defend itself against attack from the sea. The chief battery will be built this season upon the highest ground of Partridge Island, which may necessitate changing the site of the present lighthouse. Lord Dundonald is anxious also to have batteries erected to protect the harbor of Vancouver, B.C.

The Canadian Fire Underwriters' Association declare that extensive improvements are required in the Montreal waterworks. The pumping capacity is ten millions of gallons short per day. A fifteen million gallon steam plant for low level is urged; new boilers to take the place of three which have been condemned; two six million gallon pumps at high level, one for service and one in reserve; six more steam fire engines, one of 1,300 and five of 1,000 gallons; additional hose, extension ladders, trucks, chemical engines, hydrants, signal boxes and extended water mains.

The Ontario Public Works Department has purchased from a Hamilton firm five road-grading machines. Two will be placed in the Parry Sound district, one in Algoma, one in Thunder Bay, and one in the Rainy River district. In the past all the colonization roads have been made with pick and shovel, and it is expected that with the graders not only will the work be more cheaply done, but also more satisfactorily. During the past winter about 60 miles of road were cleared in the Temiskaming district, the work of stumping with dynamite has commenced, and this will be immediately followed by the graders.

TORONTO ENGINEERS' CLUB.

Two meetings of the Toronto Engineers' Club were held in May. On the 12th, Henry Wiederhold, of Philadelphia, read a paper on "Rock and Mastic Asphalts," and on the 26th, A. G. Christie read one on "Steam Turbine Testing at the Westinghouse Works, Pittsburg, Penn." Both were illustrated by lantern slides, and were of a technical character, but full of interest to engineers.

—The Egyptian Government has given the firm of Sir William Arrol & Co., the builders of the Forth and Tay bridges, the contract for the construction of three bridges across the Nile, near Cairo, at a cost of about £200,000. Thirty-four tenders in all were sent in from Great Britain, France, Germany, Italy, America, Switzerland and Belgium. Hitherto, owing to the high tenders made by British firms, the chief contracts in Egypt have gone to French firms. Two of the new bridges will be comparatively small, being be 600 yards long and 65 feet broad. The French firm of MM. Dayde & Pillet, which closely competed, has been awarded the work of constructing two railway bridges in the Delta.

PERSONAL.

C. B. Brown, resident engineer of the C.P.R. at London, with his staff of four men, has been transferred to Toronto.

John Croft, who was terribly injured while dynamiting among the fire ruins at Toronto, died at the Emergency Hospital a few hours after being admitted.

T. H. Wiggins, C.E., has been appointed by the North-West Government to take charge of drainage and irrigation work in the Territories, in succession to B. J. Saunders, who resigned. Both are Brockville men.

The sudden death is announced of T. S. Ingraham, first assistant grand chief engineer of the International Brotherhood of Railway Engineers, who dropped dead at his desk at the convention at Los Angeles, May 27th, from apoplexy.

Josiah Dawson, of St. Catharines, one of the best-known marine engineers on the Great Lakes, is dead. He was engineer of the Lakeside, running between Toronto and St. Catharines. A son was lost when the Bannockburn went down.

W. N. Dietrich, an electrical engineer with the C.P.R., jumped off a train near Rat Portage, which was running at a good rate of speed, to rescue a baby which had fallen off the train. Finding it comparatively unhurt, he followed to Winnipeg on the second section of the train and restored it to its frantic mother.

Frank G. Stevens, of Halifax, N.S., who has been superintendent of Le Roi No. 2 mine at Rossland, B.C., has resigned to take the superintendency of large gold and silver mines at Guanajuato, Mexico. He is succeeded by D. R. Thomas. Mr. Stevens is a graduate of Kingston School of Mines.

J. A. McGregor has been appointed assistant superintendent of the C.P.R. car service, with headquarters in Winnipeg. His division extends from Fort William to the Pacific coast. J. Edickson, superintendent at White River, has been promoted to superintendent of the second section of the western division with headquarters at Cranbrook. W. K. Thompson, of Toronto, has been appointed superintendent at White River.

E. H. Henry, recently chief engineer of the Canadian Pacific Railway, and formerly of the Northern Pacific, has been appointed fourth vice-president of the New York, New Haven, and Hartford Railway Company, a new position, the duties of which are to cover the construction, maintenance, and operation of the company's lines operated by electricity. Mr. McHenry will assume the duties July 1st, with headquarters at New Haven, reporting to President Mellen.

Antoine Gobeil, Deputy Minister of Public Works at Ottawa, contemplates, rumor says, retiring from that position and taking up the practice of his profession, that of law. He was born at St. Jean, on the Isle of Orleans, in 1853, and has been in the Public Works Department for thirty-two years, for the last thirteen of which he has been Deputy Minister, holding that position under Sir Hector Langevin, Hon. J. A. Ouimet, Hon. Alphonse Desjardins, Hon. J. I. Tarte and Hon. James Sutherland.

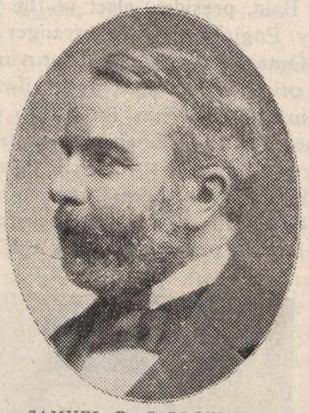
H. W. Breckenridge, secretary-treasurer of the Colburn Machine Tool Co., Franklin, Pa., had an unpleasant experience with a burglar on the night of May 10th, being shot twice in the left side after a heroic struggle with the intruder. The burglar escaped and has not yet been captured. Mr. Breckenridge, who is possessed of a good constitution, has almost recovered. Meantime a big reward has been offered for the capture of the offender, both by the city and private parties, and Mr. Breckenridge's many friends in Canada congratulate him on his plucky defence of his home.

Last month we stated that W. F. Tye would probably succeed E. H. McHenry as chief engineer of the Canadian Pacific Railway. Since then the appointment has been made. Mr. Tye is about 43 years of age, He was educated at the Ottawa University and the School of Practical Science, Toronto, and entered railway service in 1882, acting as rodman, leveller and transitman successively on location, and afterwards as assistant engineer on construction on the C.P.R. In 1886 and 1887, he was transitman and assistant engineer on the St. Paul, Minneapolis and Manitoba. The next year he served as engineer of track and bridges on the Tampico branch of the Mexican Central. In 1890 he was locating engineer of the Great Falls and Canada Railway in Montana, and in 1891 and 1892 engineer in charge of location and division engineer of the Pacific extension of the Great Northern. For about two years he was in charge of the change of gage of the Alberta Railway and Coal Company's road. In 1895 he was chief engineer of the Kaslo and Slocan Railway, and for four years he held a similar position on the Columbia and Western. In 1900 he became chief engineer of construction of the Canadian Pacific, and in June, 1902, was appointed assistant chief engineer of the system, which position he held till his recent promotion.

John G. Bain, president-elect of the Ontario Association of Stationary Engineers, is no stranger to steam engineers throughout Ontario and adjacent provinces. He has held positions in private, municipal, and railway, steam and water plants, and in one case was for fifteen years in the employ of a prominent printing establishment in Toronto. He was also in charge of the first electric light plant installed in Toronto, and while about 6 years ago, on account of his health, he entered the employ of one of the prominent oil companies, as traveller, and was retained on the staff of the new amalgamated independent oil companies, known as the Canadian Oil Co., Limited, he has always been closely in touch with engineering interests. He was secretary for a time of the Canadian Association of Stationary Engineers. He is now recovering from an accident, which happened three months ago, when he was struck by a trolley car and had his skull badly fractured. For many days he was unconscious, and his friends feared the worst from the series of surgical operations he underwent.

The Niles-Bement-Pond Company, Liberty street, New York, have issued a monumental work in the shape of a cloth bound machine tool catalogue of 750 quarto pages. It is said to be the most complete machine tool catalogue published. It opens with six full page illustrations of the various works of the Niles-Bement-Pond Company, and following these are thirteen pages of medals and diplomas awarded the various constituent companies of this concern. The first machines described are those for railroad shop use, including a complete line of driving wheel lathes, car-wheel lathes, a large variety of axle lathes, cutting-off and centering machines, quartering machines, car-wheel borers and hydrostatic wheel presses. The next division of the catalogue is devoted to lathes, including all sizes from the Pratt & Whitney bench lathe to the massive Bement 125-inch crank shaft lathe. Fifty pages are devoted to planing machines, and a specially large variety of heavy planers are shown. A large number of heavy drills are shown, including vertical drills, radial drills and multiple drills. Among the most interesting pages are those devoted to boring machines. First are the horizontal boring machines, which include all varieties of boring machines in which the work remains stationary, the cutting being done

by revolving cutters. A particularly complete line of floor boring machines or horizontal boring, drilling and milling machines are shown, including every conceivable variety of these machines. Fifty pages are devoted to boring and turning mills. Following the section on boring and turning mills are a few pages devoted to miscellaneous machine tools, and then comes a very complete line of boiler shop machinery, including plate planers, bending rolls, punching and shearing machines, hydraulic presses, steam and hydraulic riveters. In the latter part of the catalogue the full line of Bement steam hammers is illustrated, together with a number of installations of Niles' electric travelling cranes. The last pages are devoted to the small tools made by Pratt & Whitney Company. Some idea of the size of the book can be obtained from the fact that it weighs about ten pounds, the entire edition amounting to 75 tons of catalogues. Its circulation is limited to users of heavy machine tools.



SAMUEL R. CALLOWAY.

Samuel R. Calloway, president of the American Locomotive Co., and president of the recently formed Locomotive and Machine Co., of Montreal, died last month in New York, aged 54. Mr. Calloway, who was born in Toronto, had a remarkable career of success as a railway man. Beginning life as an apprenticed clerk in the Grand Trunk, he was transferred to the office of Sir Joseph Hickson, then secretary of the company, from which position his rise was rapid. In 1874 he became superintendent of the Detroit and Milwaukee, and ended his railway life as president of the New York Central. This high position he resigned to take the presidency of the two locomotive manufacturing companies, which do business for both halves of the continent. His abilities were said to have been recognized by the highest salary ever paid to a railway official. He was a man of great force of character, and simple in his tastes.

The Canada Smelting Co., Montreal, to take over the business of the Canada Smelting Co., and to carry on business as smelters of all kinds of metals; James Lipsky, and others.

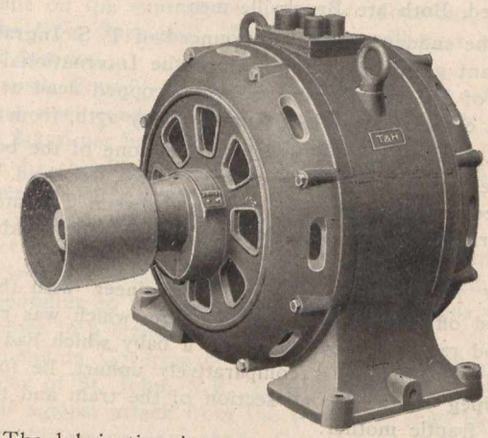
Edward S. Hopkins, manager of the D'Olier Engineering Co., New York, sales agents of the DeLaval Steam Turbine, visited Canada during the past month, and was impressed with the possibilities afforded for trade in his line in the Dominion. It is possible that his firm will shortly open up offices in Canada.

Sadler & Haworth, manufacturers of leather belting, Montreal and Toronto, were the successful tenderers for the order for leather belting for the International Portland Cement Co., of Ottawa and Toronto, to be used in their new plant at Hull, Que. The order amounted to about 7,000 feet of both single and double belting. The company's Durham plant had previously been supplied with Sadler & Haworth belting.

Peterboro town council has passed a by-law granting a ten-year franchise to the Canadian Machine Telephone Co. In the business streets the wires are to be placed underground and the system is to be in working order within twelve months. The rate is not to exceed $15 for private houses, $20 a year for places of business, or for house and place of business, $30 per year. Ottawa is in favor of giving a franchise to the same company.

T. AND H. SEVEN-KILOWATT DYNAMO.

The accompanying cut illustrates a dynamo of seven kilowatt capacity, built by the Toronto and Hamilton Electric Co., direct connected to a 5¾ x 6 Racine engine. The machine is especially designed for steamboat lighting and other places where small floor space is used, and the absence of belts is an important consideration. The engine is of the centre crank type, and is entirely enclosed, to prevent splashing of oil or water on the windings. Regulation is guaranteed within 1½ per cent. from no load to full



load. The lubrication is very perfect owing to the system of sight feed lubricators and oil tubes. The dynamo is the standard multipolar generator, compound wound, using the usual form of wound coils. Ventilation in this machine is excellent, and in operation it is sparkless and cool, even under a heavy overload. The outfit is noted for symmetry, simplicity and efficiency. The same firm have a line of alternate current machinery, which they advertise on another page.

The following are additional to the list of steamboat engineers given in the May issue: Corona, Wm. Walsh; Garden City, John Cunningham; Samuel Marshall, R. H. Lawson; Arabian, Jas. H. Brown; Neepawah, Robt. Duguid; Wahcondah, R. W. Ross; Lake Michigan, J. Hamlin.

The Canadian Westinghouse Company, Limited, of Hamilton, have sold to the Northern Electric and Manufacturing Co., Limited, of Montreal, Que., manufacturers of telephone apparatus, a 300 kw. steam turbine unit, consisting of a Westinghouse-Parsons turbine and a Westinghouse turbo-alternator.

—There will be an international electrical congress in the World's Fair grounds at St. Louis, from the 12th to 17th September. The last world's congress of electricians was held at the Paris Exposition in 1900. The coming congress will be in the week just preceding the proposed Scientific congress at St. Louis. It has been arranged so that visiting electricians may attend the ceremony of dedicating the Bureau of Electrical Standards at Washington, at which President Roosevelt will officiate. The electrical congress will be divided into sections, comprising the following subjects on which papers will be read by prominent men. In general theory: Mathematical, Experimental. Applications: General Applications, Electrochemistry, Electric Power Transmission, Electric Light and Distribution, Electric Transportation, Electric Communication, Electrotherapeutics. Among the associations that are expected to take part are: The American Institute of Electrical Engineers, the American Electrochemical Society, the National Electric Light Association, the Association of Edison Illuminating Companies, the Pacific Coast Transmission Association, the American Electrotherapeutic Association. It is also hoped to secure the participation of scientific sosieties. Prof. A. E. Kennelly, of Harvard University, Cambridge, Mass., is organizing secretary, from whom terms of the membership fee for this convention may be obtained. Prof. H. T. Barnes, of McGill University, Montreal, is on the committee of organization.

MECHANICAL WOOD PULP.*

By Stanislas Gagne, B.A., Sc.

(Continued from last issue.)

Grinding.—What constitutes the mechanical process of "pulping" wood is the grinding operation instead of a "cooking" with chemicals; hence if mechanical wood pulp is badly ground it will be inferior in quality no matter how well other operations have been performed. We have seen before that wood is an agglomeration of fibres, and the object of grinding is to derive from that agglomeration a pulp or a soft mass of particles that will have the proper qualities for paper making, namely, that it will be long, thin, flexible and felt well. To attain this end we have several kinds of grinders which differ but little in principle. Fig. 12 illustrates the principle of an ordinary grinder. We have first a stone A, against which the sticks or bolts of wood, with their longitudinal axes parallel to the shaft turning the stone, are pressed in pockets B. by hydraulic pressure on pistons C. in cylinders D. These stones, which must be composed of very small and sharp grains and have a certain strength to resist the centrifugal force caused by revolving at a high speed, are quarried out of sand stone and turned to required diameters. Some good stones are quarried in Nova Scotia, but the best ones are said to be those derived from certain districts in England.

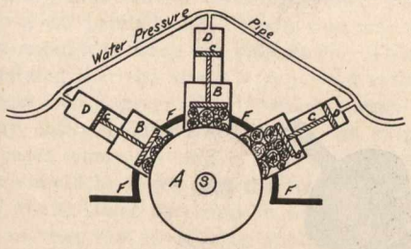


Fig. 12

Sectional Elevation of Grinder

A, stone; B, pocket; C, piston; D, cylinder; F, frame; S, shaft.

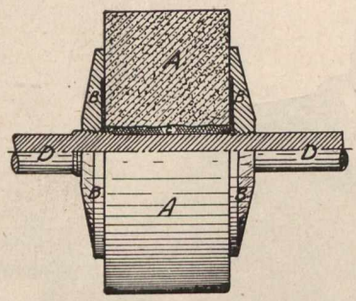


Fig. 13 Stone & Flanges

A, stone; B, flanges; C, Cement; D, shaft.

Grinders.—Taking the Port Henry Grinder, built by the Jenckes Machine Co., of Sherbrooke, Que., as a typical example of the kind which is used in Canada, the following is a general description of the machine: Fig. 18 shows a cut of it, and the name of the chief parts may be obtained by referring to Fig. 12. The shaft, which is very large, is made of hammered soft steel, and on both sides of the stone are threads on which the flanges are screwed. These flanges, which are about 38 inches in diameter, are faced where they come into contact with the stone (see Fig. 13); threads are cut right and left, and they weigh about 800 lbs. each. This grinder, which is so made as to take stones from 50 to 54 inches in diameter, and 18 to 26 inches wide, can grind until the stone is reduced to about 40 inches in diameter. The main shaft boxes or bearings are self-adjustable and quickly conform themselves to any variation in the shaft. The length of the box is about 18 inches, wood lined for bearings in water, or babbitted boxes are sometimes used with them. The pockets are made in oen piece, 2 inches in thickness and can be closely adjusted to the stone so that very few splinters can pass through underground. The middle pocket will take wood 16 inches in diameter, and the two side ones, 14 inches in diameter, hence the use of a splitter is largely dispensed with. The pockets are raised or lowered in the sides, on planed surfaces, by two 2-inch soft steel screws (S.). The doors for the pockets are of soft steel plate, and slide up and down in a groove in the pocket. The pocket followers are provided with strips cast on the lower side to prevent the wood from rolling in the pockets. The cylinders are made of iron, lined with brass, and have heads accurately fitted to them. The lower heads connect direct to the top of the pockets, and are provided with doors on the back and front, which are easily removed when lower packing glands of piston rods require adjusting or re-packing.

Operation of new piping system (patented).—Referring to Fig. 18, suppose the two side pockets are grinding under high pressure, and that one of the side pockets needs refilling; the centre pocket is then idle; but by changing the three-way valve A. the high pressure is thrown on to the centre pocket and causes it to grind under high pressure. The empty side pocket being now relieved, the low pressure of water, automatically opens the check valve and acts upon the piston lifting the pocket follower from the stone. The pocket is then refilled. The valve B. is shifted, allowing the low pressure to bring the piston down until the wood is pressed firmly against the stone. At this point the three-way valve is turned so that the high pressure water is diverted from the

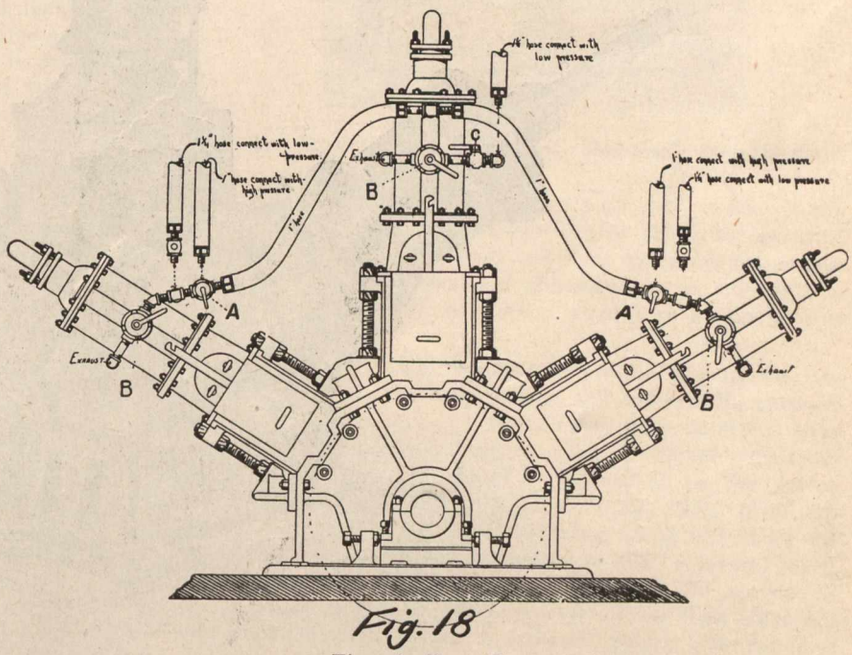


Fig. 18

Fig. 18—Port Henry Pulp Grinder.

centre pocket and enters on the top of the piston, at the same time automatically closing the low pressure check valve. The centre pocket is now idle, and if the other side pocket requires refilling, it is done in a manner similar to the above. If not, and if the centre pocket should require refilling, the follower of the centre pocket is lifted from the stone by means of valve B., which is always connected with the lower pressure, the pocket is refilled with the low pressure again introduced into the cylinder above the piston. In this manner, as above stated, the cylinders are always filled with water at a high or low pressure, consequently, when the three-way valves are shifted there is no loss of time before the pockets begin to grind, and the grinder is thus always in action. Fig. 19 is a view of the grinder built by the Waterous Engine Works Co., Limited, of Brantford, Ont. As will be noticed, the general outline is the same as the Port Henry, and differs only from it in details. The grinder built by Carrier, Laine & Co., of Levis, Que., differs from these above mentioned, as seen by Fig. 20. Its construction allows the pulp to remain longer around the stone, which is run with part of the lower side in pulp and water, while those others are usually intended to run clear of the water underneath. The directions of the pressure of the stone of the latter is not the same as

*The above paper won the first prize given by the publishers of the Canadian Engineer for the best student's paper presented to the Canadian Society of Civil Engineers for 1903, the judges being members of the Society.

on those others, more distance being allowed between the pocket. Some objections are made to this method of distributing the pockets, because the horizontal thrust on the bearings from one of the side pockets, when the other is not grinding, is so great that it quickly wears out the bearing; and they say that the more vertical the resultant pressure is the better for the bearing.

OPERATION OF GRINDERS.

STONE SETTING.—Stones usually run direct on the turbine shaft, so as to eliminate the loss of power caused by belting or gearing and are coupled to it by means of two flanges, which screw in opposite directions on the shaft, as described before, and so arranged that the pressure on the revolving stone will tend to tighten the flanges and not loosen them. Care is taken to centre the stone properly, and when the flanges are screwed up tight, cement is poured in around the shaft and between the stone and the flanges, by grooves and holes in the flanges for that purpose, to fill all the space that may be left, so that the stone may be set tightly everywhere.

Some claim that it is an improvement to bolt the stone and flanges by one-inch bolts running through the stone from side to side, their reason being that this adds to the strength and solidity of the stone and prevents it from bursting. Others who have tried them, discarded them because they claim that they cause the stone to break; one reason for this is that the stone is bound to slip sometime when heavy pressure is suddenly applied; this it cannot do if it is bolted tight and the flanges cannot screw any more, and the only alternative left to the stone is to break.

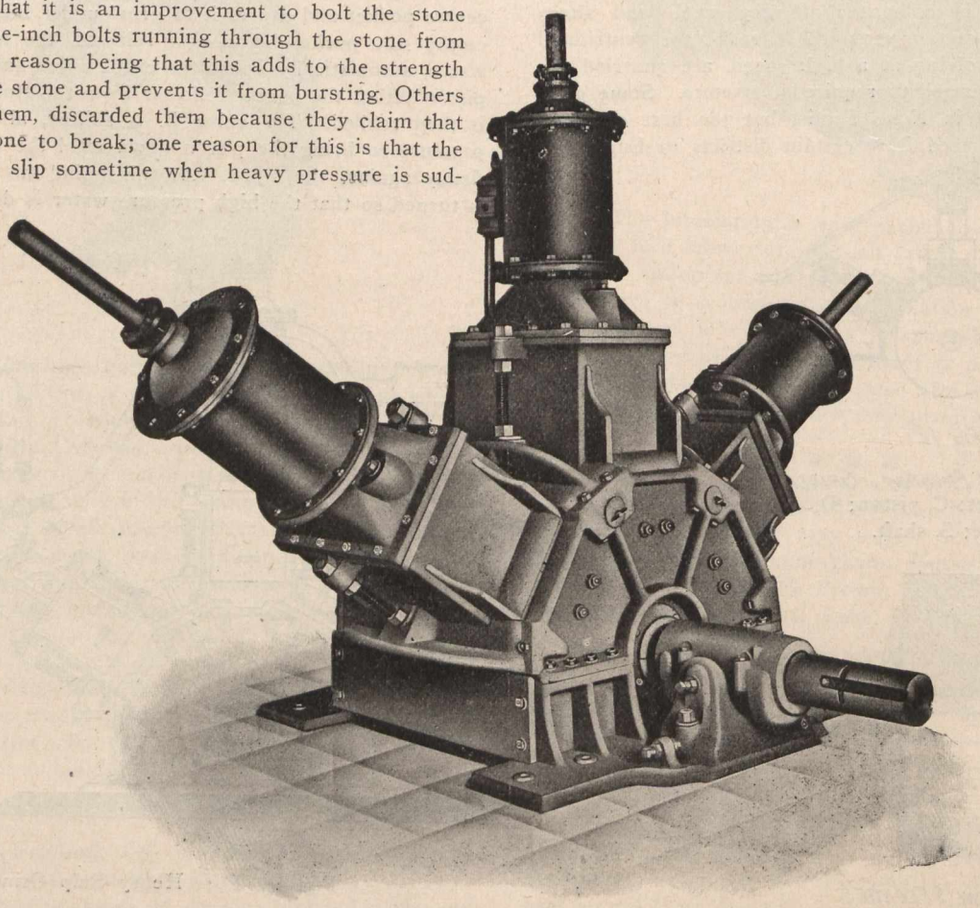


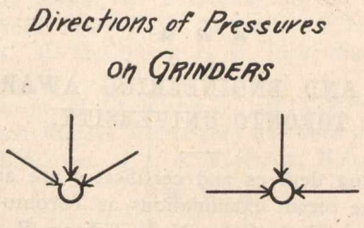
Fig. 19.—New Success Pulp Grinder.

TURNING.—This is done by means of an arrangement represented in Fig. 21. The Fig. B. is pressed against the revolving stone, where it requires turning and is actuated by a screw and hand wheel. The stones are usually thus dressed with a slight crown at the centre, or with the edges slightly rounded off to prevent sprawling of the stone. Great care is taken that no cracks are made in the stone which would cause it to fly when revolving under pressure.

SHARPENING.—This is the next operation and a very delicate one it is. In most cases the value of the pulp depends on the skill with which it is performed, as may readily be seen. A perfect sharpening would be one that the surface of the stone would be composed of a large number of very small sharp points or projections which would detach the fibres one by one. In actual practice opinions vary greatly as to how to produce a good sharpening. In nearly every case a steel jig or burr, about 3-in. wide and 3-in. in diameter, with pyramidal projections numbering 16 to 100 per sq. inch, is used, but it is in the use of that jig that opinions vary so much. Some manufacturers employ two jigs, a close pointed one, so as to make even cuts, being passed over the surface, which is afterwards somewhat smoothened down with a coarser jig. Others make use of but one jig, usually a close, pointed one, which is passed several times over the surface, until the latter is judged in proper shape. What seems to be a reasonable method is to pass a sharp and rather close-pointed jig (with say 100 projections per square inch), quickly across the surface of the revolving stone, so that it will not pass over the same surface twice, thereby causing an even surface of about 100 projections to the square inch on the stone. Dull jigs should not be used as they make pits instead of sharp projections. If the stone has been sharpened too much, a brick or a plane surface stone is used to smoothen it. Some stones will sharpen by use instead of dulling, in which case they must be smoothed instead of sharpened. The frequency of sharpening depends mainly on the quality of the stone and on the speed and pressure used; for an ordinary English stone with a 50 to 75 lbs.' pressure per square inch in the cylinders, and a speed of 225 R.P.M. twice a week in summer and once a day in winter is a fair average. After sharpening, the stone is washed to remove all the loose grains of sand and then is ready for operation. The pockets are filled with wood and turbines started.

SPEED.—Some maintain that the maximum production of a grinder occurs when the stone revolves at a speed of 175 to 200 R.P.M. while others claim that a speed between 225 and 250 R.P.M. with an ordinary 44 to 50-inch stone produces the best results. Which is right? The result only tells. Assuming the same sharpness of the stone and the same pressure on the wood, the production increases with the speed up to a certain point and then decreases, and the quality of the pulp also increases up to a certain point and then decreases, but the quality is decreasing when the production still continues increasing. If the speed is too low, the pulp will be coarse, and if too high, it will be mealy and short. To find the correct point, both in speed and pressure, a careful examination must be made and several tests of the products must be applied. An ordinary grinder, with a 50-inch stone, using 24-inch bolts and turning at a speed of 200 to 225

R.P.M. with a pressure of 60 to 75 lbs. per square inch in the cylinder, corresponding to a pressure of 15 to 18 lbs. per square inch on the grinding surface, will require 300 to 350-h.p. to produce five tons of air dry pulp per 24 hours. With 500-h.p., a pressure of 100 to 125 lbs. per square inch and 200 R.P.M., it will produce 7 to 8 tons in the same period. The side plates of the pockets should be set down as close to the stone as possible to prevent chips and splinters from passing through unground. The supply of water required to keep the



Approximate direction of pressure in the Port Henry type. Same in the Carrier, Laine & Co., type.

stone at the proper temperature and to wash down the pulp is usually introduced from a spray at the top and must be carefully attended to. When the lower part of the stone runs into a vat partially full of pulp and water, the spray must be just enough to wash the pulp down. This water should be so regulated that the stone is kept at a rather high temperature (about 100 degrees Fah.), which causes the grinding to be more easily accomplished, hence the output to be increased. In cases where the mill is stopped for repairs or for Sunday, care should be taken that the stone is allowed to cool slowly, and, if the lower part runs in water that the water is drained off so that the stone may cool evenly. The reason why stones crack and fly off when running, is resumed and may sometimes be looked for in the neglect of such details. Sometimes the wood jams in the pockets, thus relieving the pressure on the stone which then ceases grinding the wood in that pocket; in that case it is only necessary to remove the pressure and loosen the wood by means of a short bar. The undersides of the followers should have strips cast on them so as to prevent wood from rolling in the pockets, as seen in the case of the Port Henry grinder. An ordinary good English stone properly handled and operated lasts about a year and wears down in ordinary grinders from 54 to 40 inches. If several stones are coupled directly on the turbine shaft, as in case of Fig. 10, each one has its shaft length, which shafts are all equal and held together by ordinary couplings. All mills should be provided with extra shaft lengths and at least one ready mounted stone; thus, when a stone anywhere on the shaft has to be changed or replaced, the turbines are stopped only the time necessary to uncouple the old stone and replace it with the ready mounted one, which requires but a short time. All grinders used in Canada are of the horizontal running type, as described. In some other countries, however, vertical types are used and the grinding is done cold. Other types have also been invented but so far as the writer knows none has yet proved to be more economical and practical than the present one.

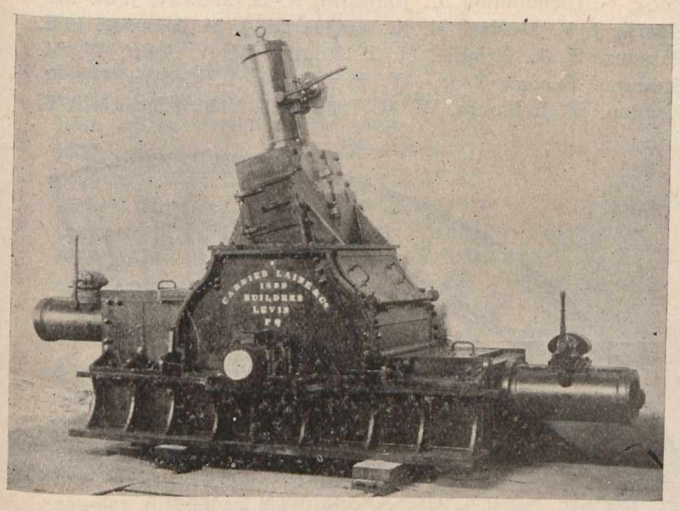


Fig. 20—Pulp grinder, manufactured by Carrier, Laine & Co.

PUMPS.—At least four sets of pumps are necessary for an ordinary exporting pulp mill: 1st. High pressure pumps for the cylinders of the grinders. 2nd. Low pressure pumps for backing cylinder pistons for sprays on the stones and in screens and wet machines and various other uses. 3rd. Stuff pumps to convey the ground pulp from the tanks under the grinders to the screens, and 4th. High pressure pumps for the presses. In case of a mill deriving its power from a high head, the number of pumps may be reduced to the last two, pressure direct from the flume or water pipe being used instead of the first two.

1st. Pump for Cylinders of Grinders.—Ordinary triplex power pumps are used, the sizes varying with the work to be done. At least two are employed and are so arranged that

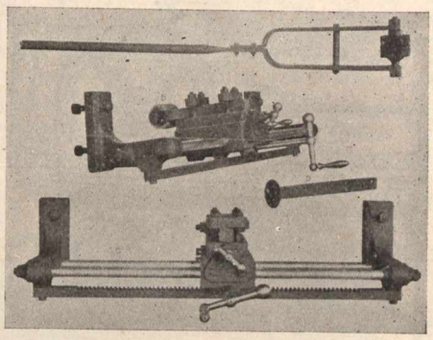


Fig. 21—Stone-turning device for "Success" Pulp Grinder.

if one fails, the other will do the work without any of the grinders being stopped. They are usually driven by means of a belt from the turbine shaft, and thus, the pressure varying with the speed, they will act somewhat as a governor if desired. If a constant pressure is wanted an accumulator is used to regulate it.

2nd. Low Pressure Pumps.—The same type as the one above mentioned, but built lighter will answer the purpose.

3rd. Stuff Pumps.—As the turbines must be set as near the tail race as possible (in most cases not higher than about 15 ft.), the ground pulp must be pumped up to the screen above the wet machines. This wet pulp falls from the grinders into tanks or troughs running along and under the grinders, and is conveyed by gravity to one or several reservoirs from which the stuff pumps take it. On account of the usually low head to be overcome and of their simplicity and freedom from valves, centrifugal pumps are the best adapted for this purpose. Ordinary stuff pumps are sometimes used.

4th. High Pressure Pumps for Presses.—These will be considered later.

(To be continued.)

SMOKE HOOD AND EXHAUST SYSTEM FOR LOCOMOTIVE HOUSES.

Alfred J. Stevens, C.E., and M.E., Toronto, has invented a new method of removing smoke from locomotive houses, which will appeal both to railway managers and municipalities.

This system is designed to replace the Wigwam Jack, now in common use, and to fulfil other ends. It consists essentially of a horizontal main smoke pipe, suspended to the roof and reaching over all the stalls in the house to be served, and provided with swinging, adjustable hoods which fit closely to the stacks of the locomotives. The main pipe is connected to an exhaust fan or chimney, and the smoke is delivered through a single stack at any desired elevation above the engine house or surrounding property.

The application to an engine house of eighteen stalls is shown by Fig. 3. The house is divided into three sections, and the main pipe is reduced in size in each section. The

draft of 1-in. water gauge is usually sufficient, but can readily be reduced on any engine, or increased on the whole system. The pipe (Fig. 3), is connected to an exhaust fan operating the power plant boilers, and is dampered so that the draft on the boilers or in the main pipe can be regulated at will. Another fan may be installed with that of the power boilers, or it may be an independent installation located where desired. The main pipe may be connected to a suitable chimney or stack, and the fan omitted or used as an auxiliary.

The temperature inside the main pipe always being equal to or above that in the house, there will not be any condensation and deposit of dirt over the locomotives. The draft keeps the pipes clean. There always being an inward draft at all openings no fire or smoke can escape. Further, as concrete and other fireproof roofs are now being constructed, or insulation if required could be provided, these questions can be dismissed.

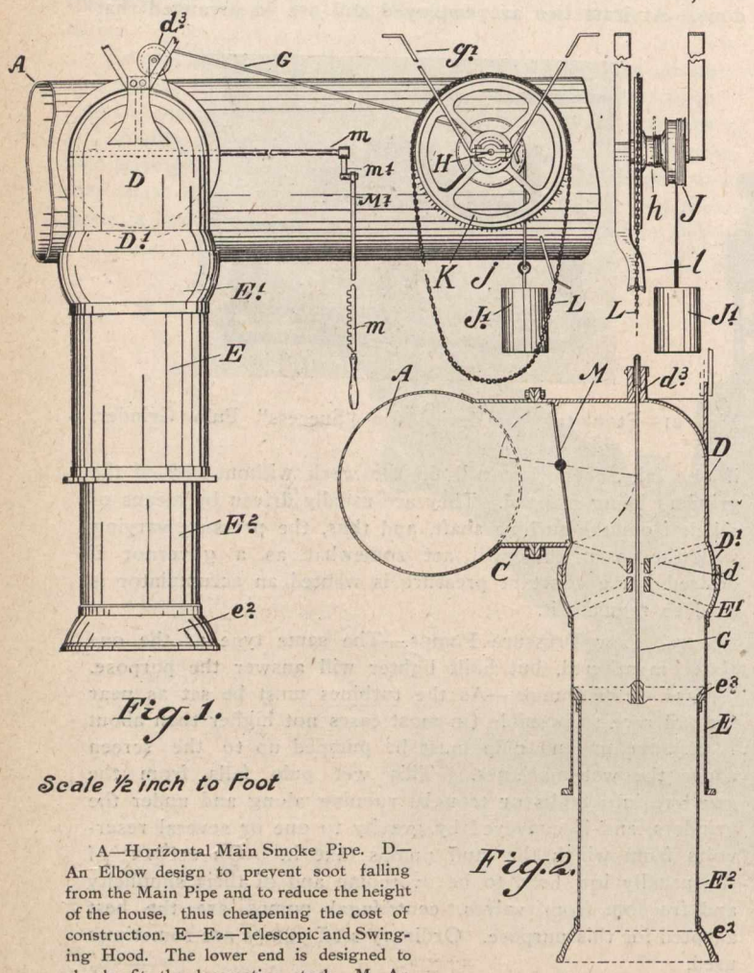


Fig. 1.

Scale ½ inch to Foot

A—Horizontal Main Smoke Pipe. D—An Elbow design to prevent soot falling from the Main Pipe and to reduce the height of the house, thus cheapening the cost of construction. E—E2—Telescopic and Swinging Hood. The lower end is designed to closely fit the locomotive stack. M—An adjustable Damper, designed so its weight and draft will assist in closing it. The damper when closed effectively prevents unnecessary drafts through the Engine, and saves heat and money which escape through the Wigwam Jack. G—A Cord or Chain adjusting the telescopic E2. If found necessary, an auxiliary check chain or stop may be provided. K.H—A Differential Hoisting Wench for adjusting the telescopic part of the Hood. The counter balance weight J1, is designed so as to nearly overcome the weight of the telescopic part E2. Other suitable counterbalance weights or lifting mechanisms can be provided.

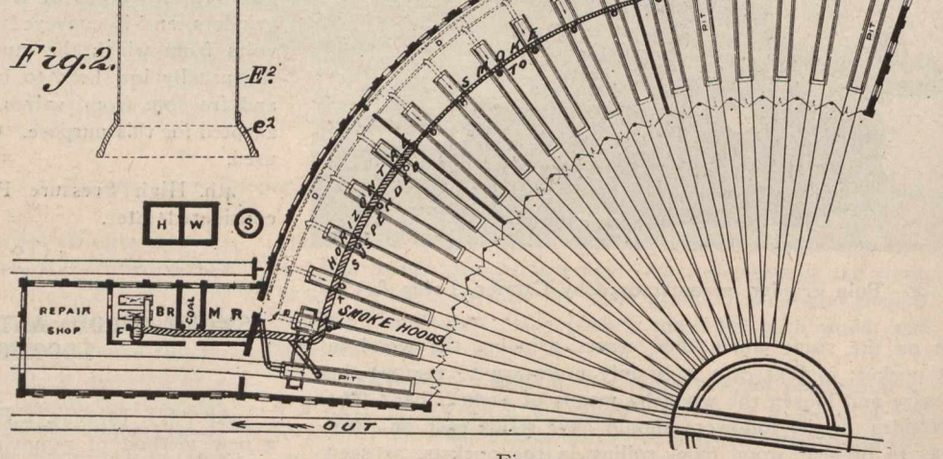


Figure 3.

B.R.—Boiler Room. F.—Induced Draft Fan for Boilers and Horizontal Main Smoke Pipe M.R—Machinery Room, Fan Heater, Dynamos, Pumps, etc. D.D.—Hot Air Duct, Lorry Track above. H.W.—Hot Well. S.—Slushing Tank.

The main pipe somewhat resembles the breeching over a battery of boilers, but as the conditions are not so severe, the pipes may be of lighter material.

Railway corporations and municipalities will find this system removes all objections to the location of engine houses near residential property, where a factory chimney is permissible. The better draft in the fire-box of the locomotive will cause less smoke, and what is made can be delivered at a high elevation. There are many advantages to railway companies, cities, towns and employees in keeping the work of the employer and the homes of the employed near each other.

The advantages of this system are summed up as follows: It is independent of wind, weather, high buildings or hills; quick steaming and despatch of locomotives; no air or steam blowers required; freedom from storm water, condensation or back smoke; there being no pipes through roofs, no flashings are required; clean machinery, pure air, and improved conditions for employees, as well as for residents in the neighborhood.

* * *

SCIENCE AND ENGINEERING AWARDS AT TORONTO UNIVERSITY.

The following degrees and certificates are announced as the result of the recent examinations at Toronto University:

H. H. Angus, F. A. Gaby, N. R. Gibson, P. Gillespie, N. D. Wilson are eligible for admission to the degree of Bachelor of Applied Science, with honors.

E. W. M. Edward, C. J. Fensom, J. C. Gardiner, J. F. Hamilton, D. Mackintosh, A. H. McBride, J. A. McFarlane, I. H. Nevitt, E. W. Oliver, J. D. Pace, B. B. Patten, T. H. Plunkett, H. G. Smith, S. L. Trees are eligible for admission to the degree of Bachelor of Applied Science.

Prize in Civil Engineering for general proficiency in the third year, W. N. Moorhouse. The prize is a gift of Mr. T. Kennard Thomson, C.E., of New York, a graduate of '85.

S.P.S. Certificates.—Honors—H. H. Angus, F. A. Gaby, N. R. Gibson, P. Gillespie, A. H. McBride, H. G. Smith, N. D. Wilson.

Pass.—C. L. Coulson, W. M. Edwards, C. J. Fensom, J. C. Gardner, J. F. Hamilton, J. A. McFarlane, I. H. Nevitt, E. W. Oliver, J. D. Pace, B. B. Patton, T. H. Plunkett, S. L. Trees.

Department of Civil Engineering.—Honors—First Year—O. B. Bourne, A. L. Carruthers, M. J. Carroll, W. A. M. Cook, G. Clendinning, C. Johnston, A. G. Mackay, J. A. McKenzie, J. V. McNab, M. K. McQuarrie, J. M. Menzies, J. E. Parsons, H. L. Pringle, H. T. Routly, W. A. Scott, W. M. Stewart. Second Year.—W. Barber, N. L. Crosby, T. R. Loudon, W. J. Moore, W. M. Treadgold. Third Year.—T. F. Code, W. A. Cowan, S. R. Crerar, A. L. Ford, W. C. McFarlane, W. N. Moorhouse, J. D. Sheply, E. W. Walker, A. F. Wolls.

Department of Mining Engineering.—Honors—First Year—W. Huber, R. C. Purser, O. Rolfson. Second Year—W. A. Begg, C. S. Scott. Third Year—E. Wade.

Pass.—First Year—C. S. Acton, E. W. Banting, M. Bates, C. W. Bissett, E. J. Hassard, K. A. Mackenzie, C. J. Murphy, J. H. Ryckman, G. P. Stirrett. Second Year—W. C. Campbell, C. S. L. Hertzberg, D. W. McKenzie, W. N. Mc-

Lean, E. F. Pullen, C. L. Ramsey. Third Year—C. A. Chilver, C. J. Ingles, J. Parke, F. N. Rutherford.

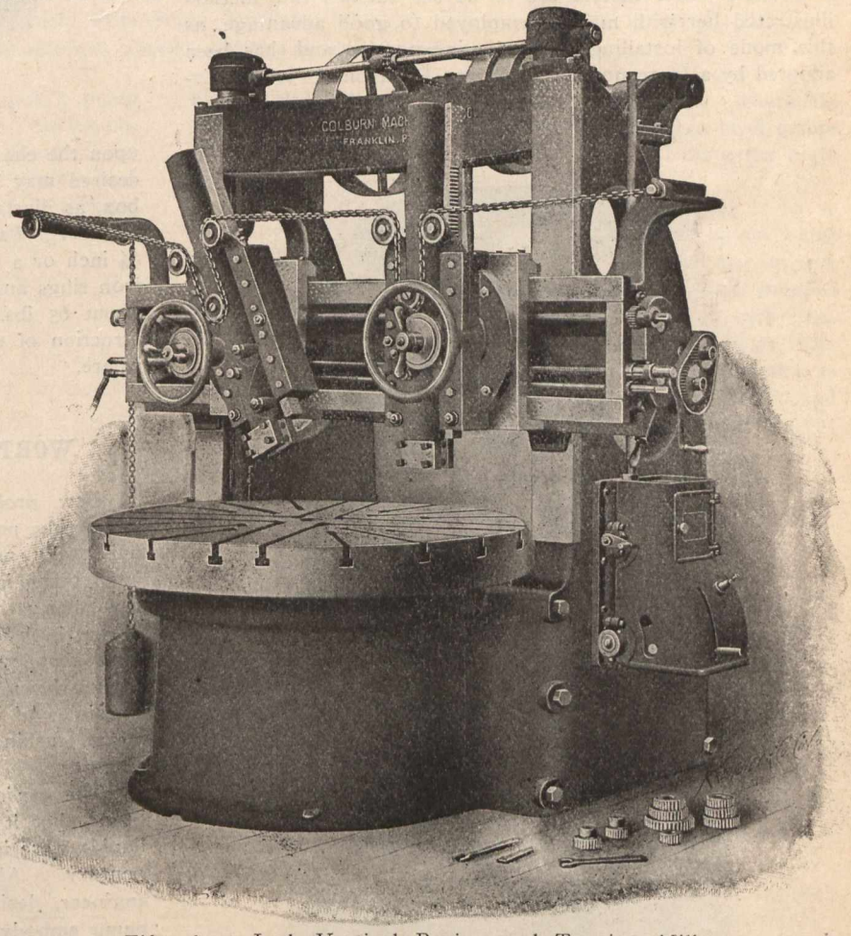
Mechanical, Electrical Engineering.—Honors.—First Year—W. L. Amos, J. C. Armer, F. Barber, W. C. Blackwood, C. A. Colhoun, R. S. Davis, C. B. Hamilton, A. L. Harkness, C N. Hookway, A. H. Hull, W. Maclachlan, D. G. McIlwraith, B. W. Marrs, W. K. Sanders. R. L. Sewell, C. L. Vickery, J. N. Wilson, E. M. Wood. Second Year—G. B. Aylesworth, G. G. Bell, W. R. Carson, F. W. Harrison, C. Kribs, C. E. Sisson, W. F. Stubbs, E. D. Tillson, W. E. Turner. Third Year—J. H. Alexander, J. H. Barrett, A. M. Campbell, C. P. McGibbon, A. E. Pickering, M. R. Riddell, R. S. Smart.

Department of Chemistry.—First Year—C. C. Forward.

The Cecil Rhodes scholarship has been awarded to E. R. Paterson, B.A., son of J. A. Paterson, K.C., Toronto.

FIFTY-THREE INCH VERTICAL BORING AND TURNING MILL.

The following is a description of a 53-in. vertical boring and turning mill placed on the market by the Colburn Machine Tool Co., of Franklin, Pa.: The capacity is full 53 inches in diameter, and will take 46 inches in height under the cross rail. The table is 50 inches in diameter, geared 21 to 1, and 105 to 1 with back gears in, and has 20 changes of speed. It is of massive construction and ample provision is made for securing any description of work, is driven by steel pinion on to cast iron spur gear with 105 teeth 2½ diametral pitch, and powerfully geared from high-speed drive. The table speeds are correctly graded in geometrical progression. The spindle is of cast iron with large angular babbitted bearing at the top and straight vertical bearing in the centre. Bearings running at high speed, or subjected to heavy wear, are bushed with bronze. The heads are entirely independent in their movements, both as to direction and amount of feed, can be set to any angle and carry tool bars that have a movement of 25 inches. Either head can be brought to the centre for boring, and centre stop determines its correct position. The cross rail is 7 feet long, extra heavy, and is raised and lowered by power. The feeds, both vertical and horizontal, are duplicated on the right and left hand side of machine, are positive, have 10 changes ranging from 1-32 to ¾ of an inch horizontally, and from 1-64 to ⅜ of an inch in vertical and angular directions, and are in correct geometrical progression. The screw cutting attachment, when ordered, is furnished for right hand side unless otherwise specified; but can be fitted to either side as required. It is arranged to cut from 4 to 13 threads per inch, including 11½ for pipe thread. All feed and change gears are clearly indicated on an index plate in plain view, and are readily adjusted for the required changes. The lubrication of machine has received careful attention, and proper provision for convenient and ample oiling of all sliding surfaces and running bearings has been provided. Belt drive: When machine is supplied as regularly equipped with belt drive, it has five step cone for 3-inch belt. The full range of speeds are obtained by shipping countershaft speed between each successive step of cone, giving ten changes, which number is doubled by throwing in back gears, avoiding the confusion and complication embodied in some makes now on the market, and subsequent neglect in taking advantage of the full range in grade of speeds and feeds. The floor space outside of all projections is 9 feet 5 inches by 7 feet 6 inches. The height from floor to centre of cone pulley is 94 inches. Diameter of large step 20 inches. Diameter of plain pulley 24 inches. Extreme height 8 feet 10 inches. The cone pulleys do not overhang but are placed between the housings, and the shafts on which they run are supported on both ends. Two countershafts are regularly furnished, one mounted on the housings of the machine, carrying the upper five-step cone pulley and one 24-inch pulley for 4-inch belt. The other countershaft has double tight and loose pulleys, 20 inches in diameter, for two open 4-inch belts; also one 24-inch driving pulley for 4-inch belt. The speeds of this countershaft should be 425 and 499 revolutions per minute. The net weight of 53-inch mill is about 17,000 pounds.



Fifty-three Inch Vertical Boring and Turning Mill.

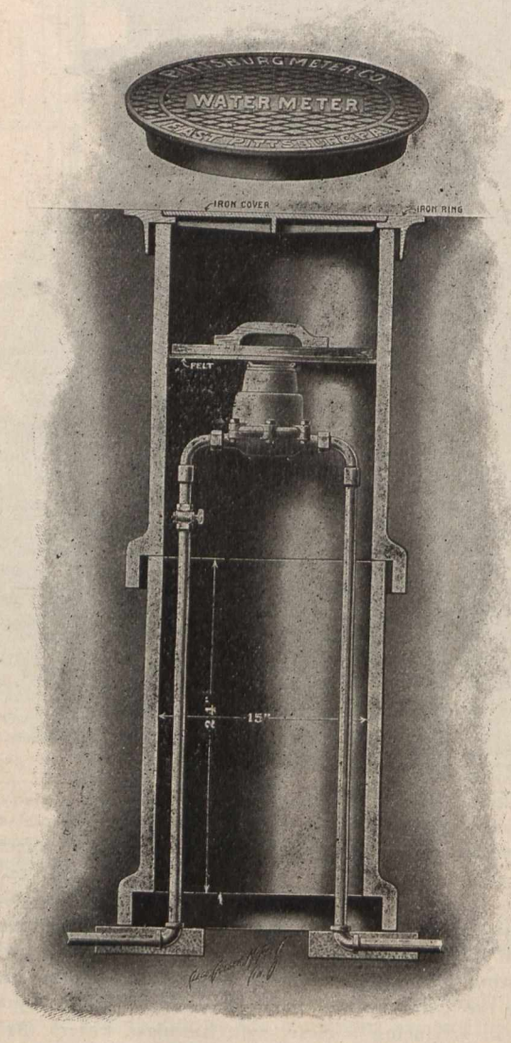
WATER SOFTENING.

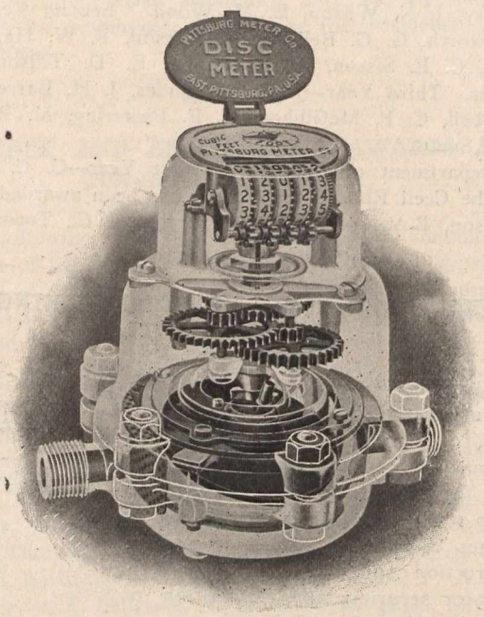
"Worth Knowing" is the title of a book issued by the Keystone Chemical Manufacturing Co., of Camden, N.J., setting forth the claims of Keystone tri-sodium phosphate. This Keystone tri-sodium phosphate (Na_3 Po_4) is a white crystalline substance resembling table salt, is very soluble in water, non-corrosive in action, and, being non-volatile, will not vaporize and pass off with the steam. This makes it particularly valuable in establishments where the goods manufactured are of such a delicate nature as to be affected by coming in contact with the steam, as in lard refineries, breweries, ice manufacturing plants, etc. It is the only commercial chemical that will, with or without heat, immediately change the hardenable carbonates of lime, magnesia and other incrusting minerals into unhardenable phosphates, and neutralize the carbonic and sulphuric acid released by decomposition, producing a clear, soft, harmless water. From the fact that water hardness and boiler incrustation result from the presence of these minerals, the great value of this chemical is seen. The boiler compounds that are composed mainly of tannic acid and caustic soda, mixed in different proportions, are replaced with a scientific chemical containing neither of these ingredients, and one having a positive action that is both chemically and mechanically correct.

Analysis of scale taken from boilers in the affected districts shows that incrustations are chiefly composed of carbonate of lime, carbonate of magnesia and sulphate of lime. The carbonates are insoluble in pure water, and owe their presence in springs and rivers to free carbonic acid, which forms with them soluble bicarbonates. Boiling such water expels carbonic acid, and the carbonates of lime and magnesia separate and deposit in the form of insoluble powders, which, in combination with organic matter, bake into scale. The action of Keystone tri-sodium phosphate upon these insoluble carbonates is to convert them into phosphates of lime and phosphate of magnesia, substances resembling snowflakes in appearance. It also neutralizes the carbonic acid released from the carbonates of lime and magnesia, preventing all corrosive action. The manufacturers have such unbounded faith in the goods they manufacture that they are not only willing to send their book, "Worth Knowing," to anyone having trouble with scale in their boilers, but are willing to make analysis of the feed water and ship a sufficient quantity of the chemical for thorough trial, free of charge, that its value may be demonstrated.

SETTING WATER METERS.

Where water meters are to be set outside, the method illustrated herewith may be employed to good advantage, as this mode of installing meters is inexpensive and has been adopted by a large number of Water Departments with satisfactory results. The meter box, as shown, cohsists of two sections of 15 inch vitrified sewer pipe, resting on a brick foundation, and covered with a strong, corrugated cast-iron ring and cover. In localities subject to hard frost the wooden lid shown may also be installed. The bottom of this lid is covered with felt, and rests lightly on the top of the meter, thus forming an air space between the meter and the outer cover and retaining the heat which arises from the warm earth below the frost line, thereby preventing the meter from freezing. The depth of this box may be increased by the addition of another length of sewer pipe, or by adding to the height of the foundation underneath; the foundation can be built either of concrete or brick laid dry, depending upon the character of the soil; or, in fact, any other changes desired may be made to meet local conditions. The meter box, as illustrated, is supplied by the Pittsburg Meter Co., of Pittsburg, Pa., and is capable of accommodating either a ⅝ inch or a ¾ inch water meter. The company supplies the iron rings and covers, as illustrated. A ring and cover weigh about 65 lbs. The other materials required for the construction of this type of meter box are easily obtained anywhere.



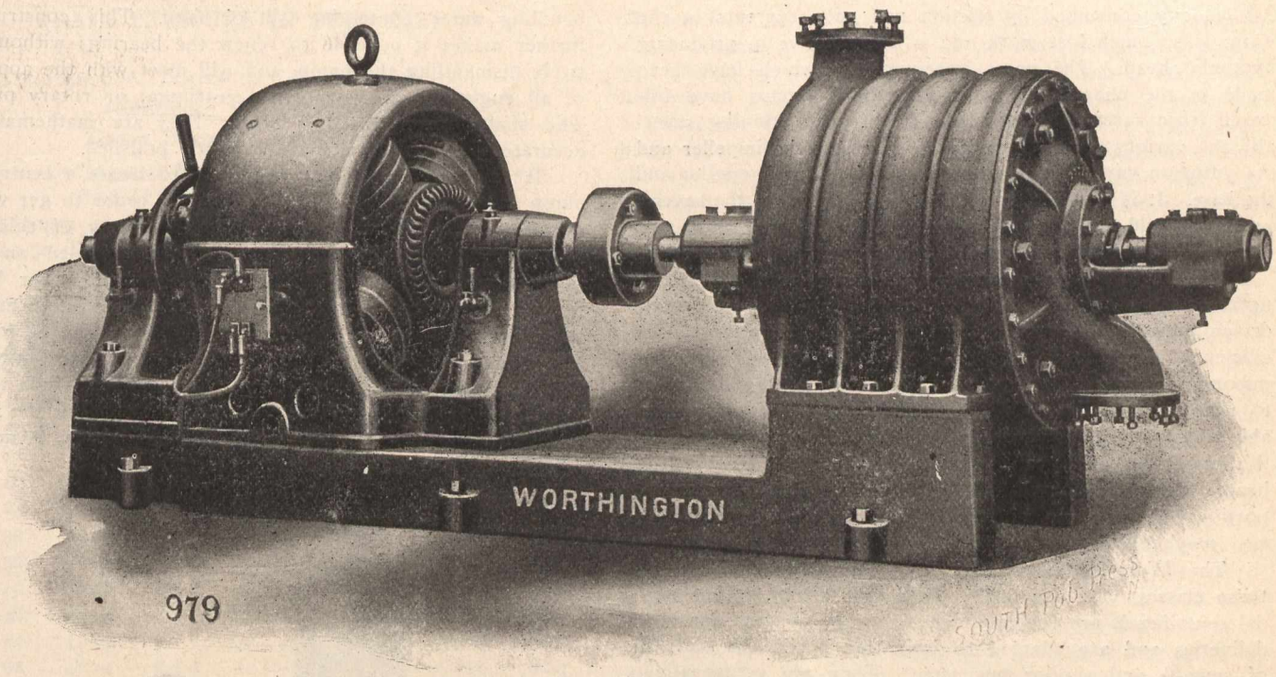


WORTHINGTON CENTRIFUGAL PUMPS.

Few problems in the field of hydraulics present more interesting possibilities and at the same time have been so universally neglected as centrifugal pumping. The centrifugal pump is the converse of the turbine water-wheel. Its development has been analogous to that of the steam turbine in that both were pioneers in their respective fields, and both were abandoned in favor of reciprocating machines before having been thoroughly exploited, the pump because the principles of its action were not clearly understood, and the steam turbine because of mechanical difficulties in construction.

The earliest history of the centrifugal pump cannot be traced, but it is known that centrifugal machines for lifting liquids were in use during the latter part of the seventeenth century. About 1703, Denis Papin, the famous French engineer, designed his Hessian Suck, a form of centrifugal pump embodying nearly all of the essential features of the present day machine. Drawings of this pump are in existence which show that Papin was not only a designer of no mean ability, but that he had a good comprehension of the principles with which he was dealing. After Papin there seems to have been no further development of his ideas until 1818, when the earliest prototype of the present form of centrifugal was brought out in Massachusetts, and has since been known as the Massachusetts pump. This pump was of the type herein designated volute, and was provided with double suction openings and an open impeller. It was reinvented by Andrews and others in 1846, and was shortly afterwards introduced into England by Mr. John Gwynne.

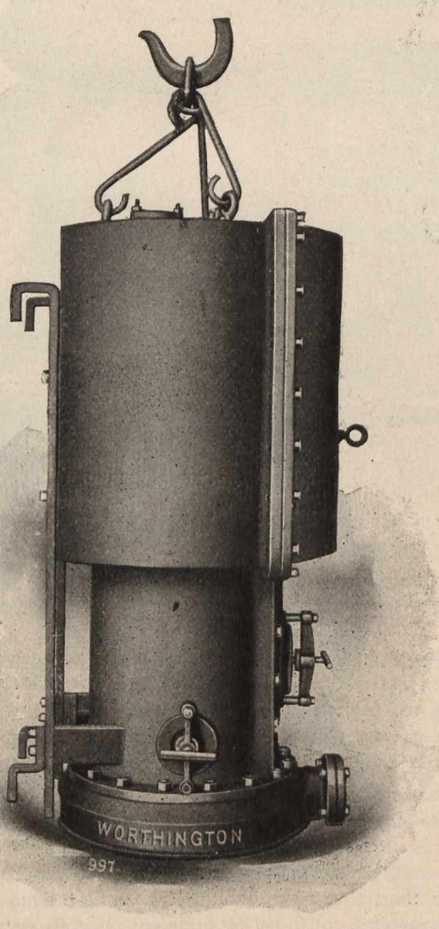
The commercial history of the centrifugal pump dates from the year 1849, when Appold exhibited a model at the meeting of the British Association at Birmingham. During the next two years he so improved on his first model that his pump became one of the chief features at the Exhibition in

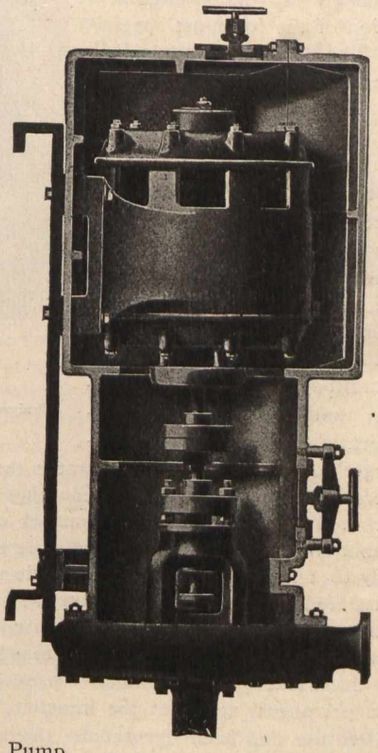


Five-Inch, Four-Stage Turbine.

U ed as a station pump in a gold and silver mine. Capacity, 500 gallons per minute against 520 feet head.

London, in 1851. The interest aroused by Appold's pump was productive of much experimentation and discussion, which resulted in improving the pump until it assumed the form that it has maintained up to the last two or three years. Many attempts were made at high-head work, but without success.





Three-Inch, Turbine Sinking Pump.

The direct-connected motor is enclosed in a cast-iron housing.

From the crude and inefficient low-lift pump this company has developed a scientifically designed, high-lift centrifugal, which has found application within the field hitherto occupied by displacement pumps exclusively. While 50 feet head was formerly considered the maximum for efficient operation, 2,000 feet is now practicable, and the efficiency has been placed on a par with that of displacement pumps. There has also been plenty of room for improvement in low-head pumps and these have not been neglected while perfecting the high-head pump.

The problem of the centrifugal pump designer is to so proportion the parts of his pump that it will pick up the water from rest, or from, perhaps, a velocity of 10 feet per second, bring it to the high velocity required by the head pumped against and then allow it to come to rest again in such manner that during the whole operation there shall be as little internal or other friction or loss by leakage or slippage as possible. Success depends almost wholly upon the form and proportions of the passages through which the water enters the impeller chamber, the shape of the impeller vanes and the design of the chamber into which the water is delivered from the vanes.

The early centrifugal pumps were made with straight, flat vanes, which discharged into a chamber of more or less conventional form. The result was excessive internal friction.

All velocity consumed by friction and eddy currents in the water is so much lost work and is not effective in producing hydraulic head. The great improvements which have been made in the characteristics of centrifugal pumps have followed from careful, scientific design in proportioning severally the various parts of the pump chamber, the impeller and the diffusion vanes between the periphery of the impeller and the case. It is possible by properly proportioning the several parts to build a pump having almost any desired characteristics and fitted for any special requirements of service.

The Worthington centrifugal pumps show efficiencies nearly always in excess of those of other types of power-driven pumps used in the same services. Heretofore, the efficiency curves of centrifugal pumps have always reached maximum values at points which the builders (endeavoring to adapt one design to all services) seem to have been unable to control. However, by intelligent, specialized design, this maximum point can be made to occur at any desired head. This is accomplished by modifying the internal proportions of the pump without in any way changing the general mechanical features.

The Worthington centrifugal pumps are divided into three classes, viz.: Conoidal, volute and turbine. The conoidal centrifugals are designed especially for low lifts and large deliveries and are adapted to irrigation work, the handling of sewage and similar purposes. They are comparatively inexpensive, and operate at high rotative speeds, making possible direct connection to electric motors. For heads up to 30 feet they are unexcelled in the pumping field.

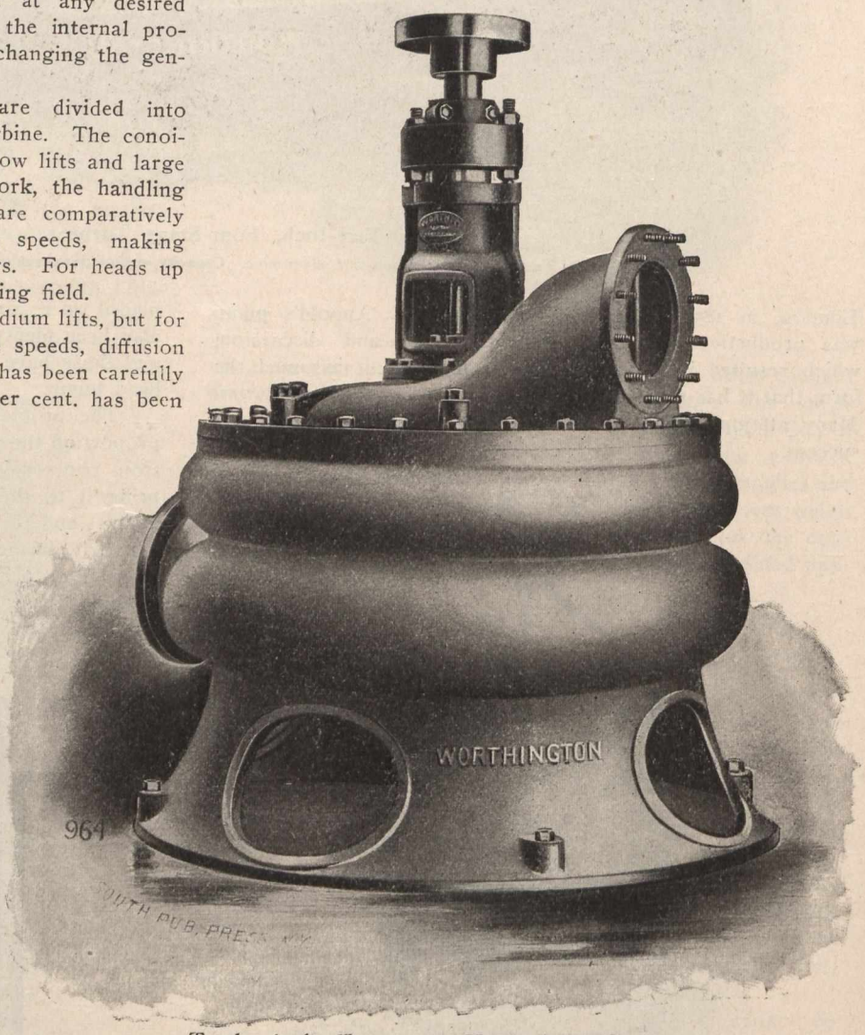
The volute centrifugals are built for medium lifts, but for all capacities. Since they run at moderate speeds, diffusion vanes are not needed, but the volute casing has been carefully designed to obtain high efficiency, and 86 per cent. has been shown under test. These pumps are recommended for heads up to 70 feet, although they will safely withstand 150 feet.

The turbine pump is suited to very high lifts, even exceeding 2,000 feet.

The Worthington turbine pump has been developed by a long series of experiments conducted by able engineers under the direction of the foremost specialist in this field. The diffusion vanes, which form the distinguishng feature, take the place of the usual whirlpool chamber in other forms of centrifugal pumps and assist in bringing the water to rest without internal commotion or shock. They correspond in function to the guide vanes of turbine water-wheels. One of the difficulties presented by high-lift centrifugal pumps has been the great peripheral speed required when only a single impeller is employed. This has been overcome in the Worthington multi-stage turbine pump by mounting a number of discs or impellers, each operating in a separate chamber, upon a single shaft and passing the water through the impeller chambers in succession. The lift can thus be multiplied three, four or five times, while the number of revolutions is kept within such bounds that it is possible to connect the pump directly to a steam engine or an electric motor. It has been demonstrated by experiment that on the same work and within reasonable limits, multi-stage centrifugals are more efficient than single-stage pumps, the increased efficiency being due to a decrease in the frictional losses coincident with the reduced peripheral speed of the impeller.

Particular attention has been devoted to the mechanical details in order to produce a machine that would withstand the most severe service for long periods of time without renewals or repairs. The bearings, of liberal proportions, are supplied with ring oilers, and are lined with the best quality of babbitt, hammered in, reamed true, and scraped to a perfect fit. In all except the very small sizes these bearings have been entirely separated from the pump casing, an improved form of construction effectually eliminating all possibility of foreign matter working into the bearings when the pump is handling water containing silt or sand. This construction further makes it possible to renew the bearings without entirely dismantling the pump, and will meet with the approval of all engineers familiar with centrifugal or rotary pumps. The shafts are of machine steel. They are mathematically accurate and straight and are perfectly polished.

It is frequently found necessary to locate a centrifugal pump in a pitch below the floor level, in order to get within suction distance of the water supply. In cases of this kind the vertical centrifugal has been extensively used and has proved most satisfactory. The pumps can be either belted or connected directly to vertical motors. The latter method makes an ideal pumping plant, as the motor can be located above ground, where it is free from all moisture, and can receive proper care. The design of the pump is such that it requires very little attention, and it is necessary for the attendant to go down into the pit only at long intervals. A number of these pumps are being used at blast furnaces and steel mills for general water service. They are also widely used in irrigation for pumping from wells in which the water level fluctuates greatly, often submerging the pump and rendering the use of horizontal belted or motor-driven pumps inadmissible.



Twelve-inch, Two-stage, Vertical Turbine.
Designed for direct-connection to a vertical-shaft motor. For general water service in a large steel plant. Capacity, 5,000,000 gallons per day against 140 feet head.

In starting centrifugal pumps massive foundations are not necessary, but the pump should be so placed that perfect alignment is assured. The suction line must be free from air leaks, and, if more than twenty feet in length, it should be larger than the pump suction to avoid undue friction. The discharge line must be of sufficient size to remove the water without excessive friction loss. A gate valve should be located in the discharge near the pump. Before starting the pump, it is necessary to fill the casing and suction line with the fluid to be pumped, as machines of this type will not create a vacuum of any moment without first being primed.

The accompanying illustrations show several types of Worthington centrifugal pumps. These pumps are manufactured by the John McDougall Caledonian Iron Works Co., Limited, Montreal.

GRAIN PRESSURE IN DEEP BINS.*

By J. A. Jamieson, C.E., Montreal.

(Continued from May issue.)

Grain Pressure Test, No. 1A.

Wheat.—Corrugated Steel Bin.—Bottom Pressure Test.
Size of Bin 12″ x 12″ x 6′ 6″ high.
Diaphragm on bottom, size 12″ x 12″ = 144 sq. inches.
Wheat 50 lbs. per cu. ft., equal to 62.2 lbs. per bushel.

Grain weighed into bin.	Height of grain column.	Equival'nt fluid Pressure	Pressure grain on diaphr'm	Grain carried on bottom. Weight.	% of total weight of grain.	Grain carried on bin-side. Weight.	% of total weight of grain.
lbs.	in.	in. water	in. water	lbs.		lbs.	
25	6	4.81	3 1-2	18.184	72.7	6.816	27.3
50	12	9.62	5 1-2	28.575	57.1	21.425	42.9
75	18	14.43	6 5-8	34.420	45.9	40.580	54.1
100	24	19.24	7 1-2	38.966	38.9	61.034	61.1
125	30	24.05	7 7-8	40.914	32.7	84.086	67.3
150	36	28.86	8 1-16	41.888	27.8	108.112	72.2
175	42	33.67	8 1-4	42.863	24.5	132.137	75.5
200	48	38.48	8 7-16	43.837	21.9	156.163	78.1
225	54	43.29	8 1-2	44.161	19.6	181.839	80.4
250	60	48.10	8 1-2	44.161	17.6	205.839	82.4
275	66	52.81	8 9-16	44.486	16.1	230.514	83.9
300	72	57.62	8 3-4	45.460	15.1	254.540	84.9
325	78	62.53	8 3-4	45.460	13.9	279.540	86.1
Effect of 50 lbs. of weights placed on top of grain column:—							
682	[1]163,68	131,27	9⅜	48,708	7.1	633,292	92.9

Increase of pressure on bottom by placing weights on top of grain column in bin:—

Weights. lbs.	Increases gauge reading From	To	Increases in Inches.	lbs.
50	8¾	9⅜	⅝	3,247
100	9⅜	10	⅝	3,247
150	10	10⅝	⅝	3,247
Total increase with 30 lbs.			1⅞	9,741

When weights were removed gauge returned to 8¾″.

Note.—By sharply tapping sides of bin, grain settled 2¼″ from top, and gave a maximum gauge of 10½″ of water, equal to a load on bottom of 54,553 lbs., or 16.78 per cent. of total weight of grain in bin.

By raising bin by means of screws at the corners, the gauge receded to 7 inches.

1A grain column weighing 325 lbs. exerts a pressure of 45.46 lbs. on the bottom. 50 lbs. therefore are equal to a grain column weighing $\frac{326 \times 50 \text{ lbs.}}{44.56}$ or 357 lbs. This added to the 325 lbs. already in the bin equals 682 lbs.

The author may state here that while vibration or shock will slightly increase both the vertical and lateral pressure, as the lateral pressure increases the total friction on the wall will correspondingly increase and therefore there cannot be found any good reason for assuming any material increase of pressure due to shocks. Again, by slightly raising the bin with screws inserted between the frame of the diaphragm and the bottom of the bin walls, the pressure on the bottom could be very materially decreased. This decrease allowing the water in the gauge to recede from the maximum of 10½ inches to 7 inches, clearly shows that the greater the pressure on the sides the greater the load carried by the walls. Again, by placing Standard weights of 50 lbs. each on top of the grain, the pressure on the bottom could be only slightly increased by each weight applied, while the pressure on the bottom again decreased as the weights were removed. This experiment was repeated a number of times, in one case 400 lbs. of weights being applied, with practically the same results in every case; indicating clearly that the increased pressure on the bottom by the application of weights on the top of the grain, was due to a slight vertical compression of the bin walls, or the elasticity of the grain. On the bin being again lowered to its original position, while no increase of lateral pressure was shown by the side diaphragm, there was a very large increase of pressure on the bottom diaphragm, or sufficient to cause the water to flow out of the top of the 4 ft. gauge glass tube, which was not therefore long enough to record the pressure; in fact, the total weight of the grain was then resting on the bottom diaphragm, and in addition the grain was acting as a column to support the weight of the bin itself.

Very careful tests were also made to ascertain the pressure due to grain in motion, or when the grain was being drawn out of the bin. To obtain the bottom pressure, the grain was drawn from an opening in the side of the bin close to the bottom. There was found to be a decrease of pressure on the bottom when the gate was opened and this decrease was maintained until the bin was about half emptied, then it became approximately the same as when the bin was being filled. Near the bottom the pressures showed an increase over the curve obtained when filling the bin; this, however, was entirely due to the necessity of drawing the grain from the one side of the bin, as when nearly emptied, the remaining grain was all on one side of the bin, and therefore nearly all resting on the bottom.

When the grain was being drawn from the opening at the side of the bin, it was found that there was considerable difference in lateral pressure on the different sides. On the side directly opposite to the opening there was a large increase of pressure, and on the same side as the opening the pressure decreased to less than half, when the 3″ x 12″ rectangular diaphragm was being used, and when the 2″ square diaphragm was placed directly over and a short distance above the opening, there proved to be practically no lateral pressure at this point.

When the bin is being filled or when the grain is being drawn from the opening of a square or cylindrical bin through an opening exactly in the centre, a line drawn vertically through the centre of the bin is the centre of pressure, and the lateral pressure per square inch is equal on all sides of the bin. If, however, the grain should be drawn from an opening in the side of the bin, or in the bottom close to the side, then, owing to the moving column of grain being over the opening, the centre of pressure is changed, and the lateral pressure is considerably increased on the side opposite to the opening and decreased on the side over the opening, thus throwing very uneven strains into the bin walls. In a square bin, this will simply throw the increased pressure on the far wall, but in a cylindrical bin this must have a very injurious effect, unless the walls should be of very rigid construction. In a steel tank, the walls of which are very thin and have practically no rigidity, this uneven pressure tends to throw the tank considerably out of round, while the decreased pressure on the side over the opening makes this part of the tank shell very unstaple as a column to carry the vertical load, with the result that steel tanks often buckle inward at varying distances above the opening. This conclusively shows that in all bins and especially those of cylindrical shape, to avoid these excessive strains, the grain should always be drawn from an opening in the centre of the bin. This fact has an important bearing on the weaknesses developed by different tank constructions and will be referred to in connection with the "Problem of Grain Bin Design."

To properly ascertain the lateral pressure when the grain was being drawn from an opening in the centre (which is the usual manner in small bins) the bin was provided with a hopper bottom, with the gate opening directly in the centre, the diaphragm being placed on the side as before. The grain was then drawn out and weighed, the gauge carefully observed, readings recorded at the end of each draft, or when the gate was closed, and to ensure getting all fluctuations of pressure, two or three intermediate readings were taken while the grain was in motion. Several similar tests were made with varying sizes of gate openings and grain running out at speeds varying from 50 lbs. to 120 lbs. per minute, and the increase of lateral pressure due to grain in motion over grain at rest, or when the bin was being filled, was found to vary from

*From a paper read before the Canadian Society of Civil Engineers.

5 to 9.3 per cent., the latter being for the highest speed, which is, however, relatively much greater than would be attained in practice in full-sized bins.

Tests were also made by pouring grain in at the top at varying speeds, while it was being drawn out at the bottom, but this was found to have no appreciable effect until the bin was nearly emptied, and the pressure had considerably decreased. By pouring grain in at a higher speed than it was drawn out, we could again raise the pressure, but in no case did this raise the pressure beyond the maximum of 9.3 per cent. over that obtained while filling the bin.

If the grain is drawn from the centre of the bin, it may be safely stated that the increase of pressure due to the grain in motion, over grain at rest, or when the bin is being filled, will not exceed 10 per cent., and the increase will be considerably less than this when the ratio of the area of the gate opening to the area of the bin is 1.150, which is approximately the usual practice in standard sized bins.

That no larger increase of pressure actually takes place due to grain in motion when the grain is being drawn from the centre of the bin bottom is, the author believes, fully shown by his tests in the model and full size bins. With an experience of twenty years in grain elevators, he has never known any weakness develop in any part of a bin or other construction, with one exception, when a bin bottom failed because the operating staff disregarded instructions in filling the bin for the first time, causing the full settlement to take place at once.

After speaking of various tests made in the model bins, details of which he gives in his paper, the author refers to tests made in the bins 6 inches square and 6 inch diameter and 6 feet 6 inches deep, with a view to determining the difference in pressure due to difference in breadth or diameter. It was found that in each case the pressure per square inch was approximately twice as great in the 12 inch bin as in the 6 inch. Thus, if four 6-inch bins were filled with 325 lbs. of grain, the combined load resting on the bottom of the four 6-inch bins would only be one-half as much as in one 12-inch bin. A test was also made by using a stout canvas bag or cylinder 12-inch diameter, 6 feet 6 inches deep, provided with metal rings at both ends, one ring attached to the metal frame of the 12-inch circular diaphragm and a 6-inch gauge glass was used. This formed a cylindrical bin with wall incapable of supporting any vertical load. The bag was extended to full height and the wheat poured in at the top. When the bag was full, it was found that the height of water in the gauge glass multiplied by the area of the diaphragm gave 1½ lbs. more than the total weight of grain, showing that the grain column was supporting a part of the weight of the bag, which weighed 3¼ lbs., and incidentally proving the correctness of the hydraulic diaphragm and water column as an accurate weighing machine. A test was also made in the 12-inch diameter cylindrical bin, using sand instead of grain. The sand was thoroughly dry, clean and of good building quality. Angle of repose 34°, weight 100 lbs. per cu. ft. 537½ lbs. were put into the bin, and it was found that 99.211 lbs. or 19.45 per cent. was resting on the bottom, and 438.289 lbs. or 81.55 per cent. carried by the sides. (It is interesting to note that both sand and wheat gave approximately the same percentage of total weight resting on the bin bottom or diaphragm. The wheat weighed 50 lbs. per cubic foot and gave 18.29 per cent. on the bottom and 81.71 per cent. carried on the sides).

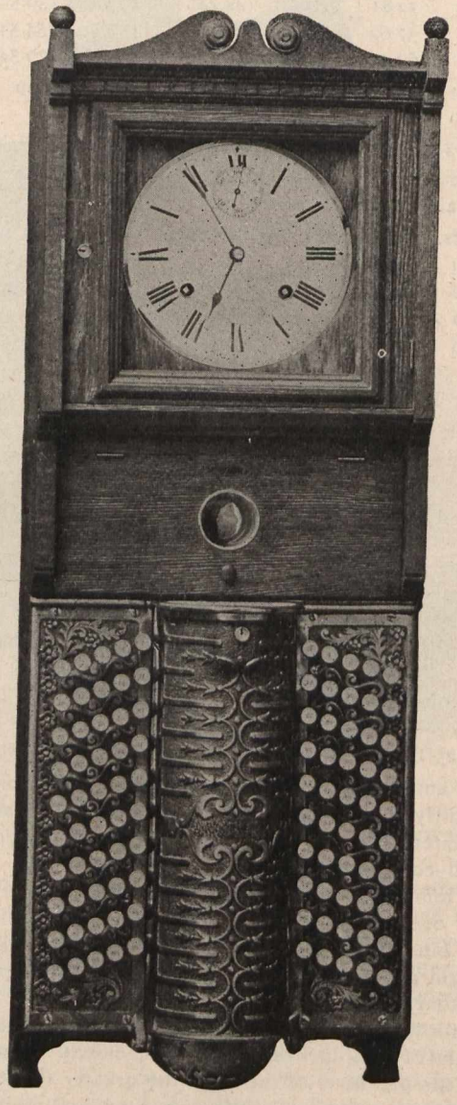
By sharply tapping the cylinder on both sides with the hands, the sand settled 3 inches, increasing the load on the bottom to 120,272 lbs., or 22.37 per cent. of the total weight of sand in the bin.

In conducting the tests, the co-efficient of friction between the grain and the bin walls was readily obtained in the following manner: Having found the total grain weight resting on the bottom of the bin, we deduct this bottom weight from the total weight of the grain in the bin. This gives the weight supported by the walls, and by dividing this weight into the total side pressure, we get the co-efficient of friction. The total side pressure was obtained by multiplying the pressure per square inch for each section of the bin, by the area of the walls, and the sum of the pressures per section give the total pressure on the bin walls.

(To be continued.)

TIME RECORDER FOR FACTORIES.

A new time-recording machine having several points of merit, has been put on the Canadian market by Munderloh & Co., Montreal. In this device the time sheet is fastened to a cylinder, and when an employee presses the button it rings a bell and records the exact time on the sheet by means of a steel pin which makes an indelible perforation in the time sheet within the recorder. The cylinder revolves slowly by power transmitted from, and in exact unison with, the clock. The time sheet is legible and may be rapidly checked. The sheet is ruled horizontally into 30, 50 or 100 spaces, according to the number of employees for which the machine is designed, and it is then ruled perpendicularly into hour, half-hour, quarter, and five-minute spaces, each plainly distinguished by its particular color. A glance at the time sheet



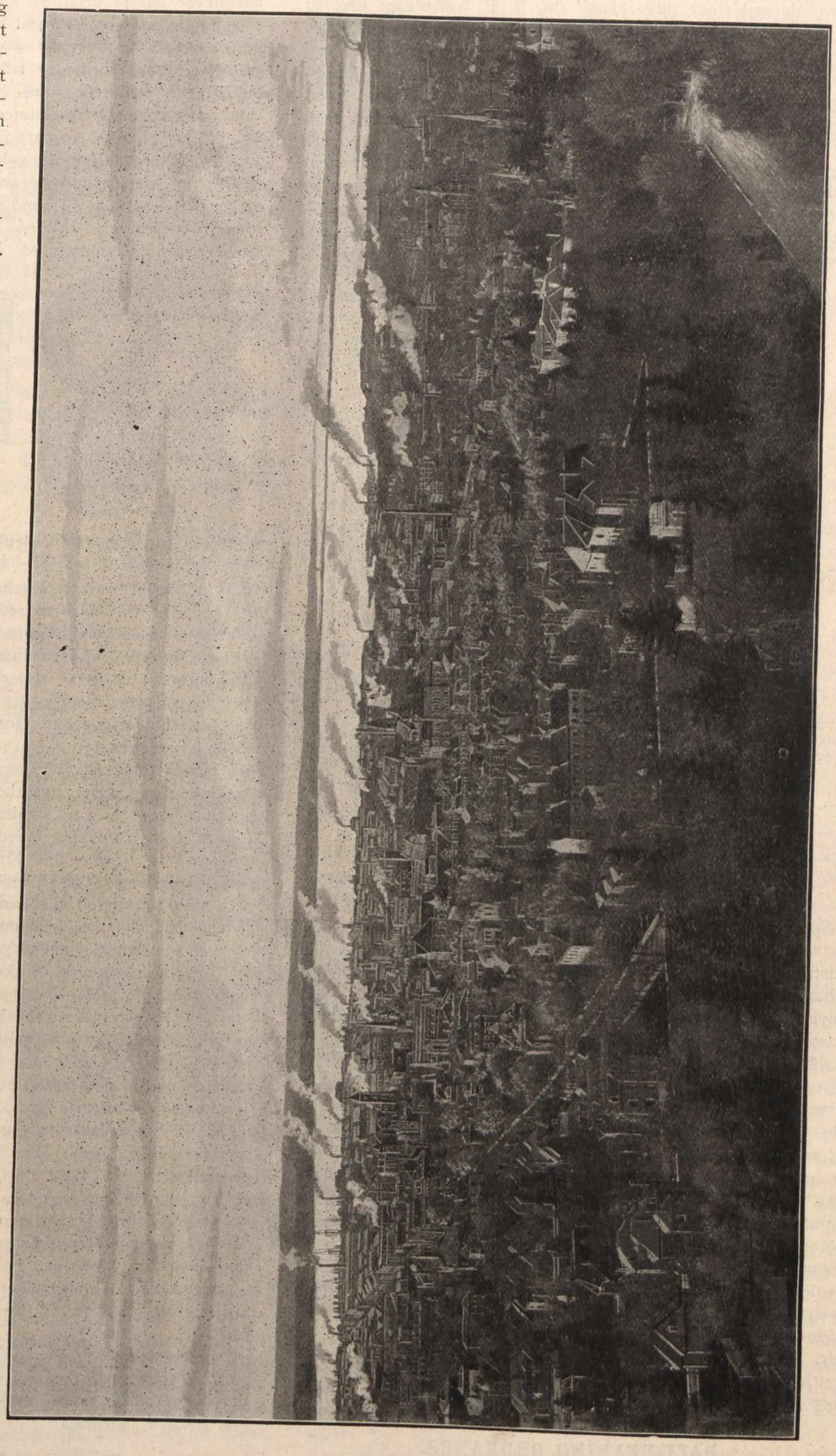
tells the exact time of a man's record, either coming to work or going. The cylinder around which the time sheet is fastened is of hard rubber, with nickel-plated mountings, and is very light. Horizontal grooves are turned in its circumference which allow the pin points to pass through the sheet, making clean, round perforations. The cylinder rests on a pointed steel bearing and is revolved by a worm and gear device at the top connected with the clock movement. The power required to turn it is so slight as not to be perceptible in the action of the clock movement.

HAMILTON AS AN ELECTRICAL POWER CITY.

Hamilton is known as the Birmingham of Canada, but it may well be said to be the Birmingham and Manchester combined, for, not speaking of other branches of textiles, it has more cotton mills than any city in Canada except Montreal, and is one of the chief centres of clothing manufacture. It is the largest centre of stove foundry business in the Dominion, and it has an important and constantly growing aggregation of miscellaneous manufactures in iron, brass and other metal work.

Hamilton has successfully solved several problems of municipal engineering such as sewage disposal and street paving, and it has also taken greater advantage of the development of electrical science than any other city in Canada in proportion to its population. Much of its recent increase in population and industrial progress is due to the early faith of its citizens in electricity; and it should be remembered in this connection that as early as 1881 an exhibition of arc lighting was here given in Dundurn Park on the occasion of the visit of the Marquis of Lorne. This is, perhaps, the first demonstration of arc lighting in Canada, the mechanism being constructed by Thomas L. Willson, the pioneer of acetylene lighting, and the discoverer of the commercial method of producing calcium carbide. The selection of Hamilton, (closely related as it is to the great electrical works at DeCew Falls and Niagara Falls), as the place of meeting for the Canadian Electrical Association this year is very natural, and those interested in the progress of electricity will be much impressed by what they see in that city and the Niagara Peninsula, through which they will make an excursion.

Elsewhere in this issue will be found a programme of the convention, a sketch of the extensions to the Cataract Power, Light and Traction Co.'s works, the Canadian Westinghouse Co.'s new works at Hamilton, and a brief review of the progress of work on the three Niagara Falls.



VIEW OF HAMILTON FROM THE MOUNTAIN.

* * *

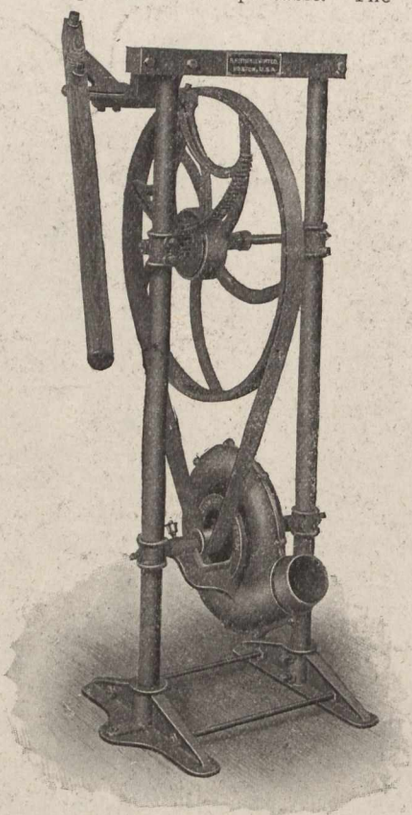
Supplementary letters patent have been issued in New Brunswick, giving directions to the People's Light and Power Co., so as not to interfere with the New Brunswick Telephone Co., in the erection of lines in Fredericton, N.B.

A United States soldier, who is also an electrician, wished to desert from Watertown, N.Y., and before doing so disorganized the telegraph and telephone instruments at the station, so that he was able to get across the border before they could be restored to working order.

Prof. Fessenden, whose wireless telegraph apparatus the London Times is using to obtain its war news in the far East, is a native of Hamilton, Ont., where his mother, Mrs. C. Fessenden, who has been the promoter of Empire Day observances in Canadian schools, lives. He is a nephew of Judge Trenholme, of Montreal.

THE STURTEVANT IMPROVED HAND BLOWER.

In these modern times men are always seeking devices by which they may accomplish the greatest results with the least exertion. To this fact, doubtless more than any other, was due the rapid introduction of the hand blower as a substitute for the old-time bellows. During the years which have elapsed since this change the B. F. Sturtevant Co., of Boston, Mass., pioneers in the manufacture of blowers, have been perfecting their design and construction until their hand blower, known as Style A, has shaped itself into a new design known as Style B, as herewith illustrated. These hand blowers have been extensively introduced in connection with new forges of all kinds, and have likewise been applied to old style brick and iron forges as simple, efficient and economical substitutes for the bellows. Not only are they adapted to forge blowing, but can readily be applied as portable ventilating apparatus. They are simple in design, strong, compact, economical in operation and portable. The lower is ad-

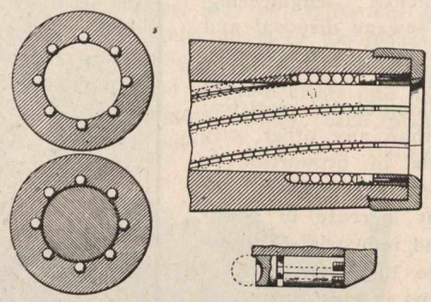


justable on the shaft, and its outlet may thus be set to discharge in any direction, and readily connected to the forge tuyere by means of galvanized iron piping. The blower is of cast-iron, strongly constructed; has a steel shaft running in babbitted boxes, and a fan wheel of galvanized steel solidly riveted to a composition hub with extending arms. The frame is well braced, and is so arranged that the slackness of the belt driving the blower may be taken up by lowering the blower shaft, which is supported by collars sliding on the frame. The blower may be screwed to the floor by holes in the feet. These hand blowers are made in two sizes. The total length on the floor of style B is 18 inches, while the total height of the frame, not including the handle, is 48 inches. The driving wheel is 24 inches in diameter, the blower outlet is 3½ inches in diameter, and the complete outfit weighs but 135 pounds. Style B-2 is of slightly larger dimensions, and has proportionately greater capacity for delivering air. The driving wheel is 24 inches in diameter, the blower outlet is 4¾ in. in diameter, and the complete outfit weighs 155 pounds.

BALL-BEARING ORDNANCE.

A unique application of the ball-bearing principle in the reduction of friction is seen in the rifled gun, invented by Capt. O. C. Cullen, a United States officer, who commanded a battery in the Spanish-American war. The new principle is the inserting of balls in the grooves of the rifle. It is stated that this is the first radical improvement in rifling since 1852, the ingenuity of ordnance makers being devoted towards developing breech mechanisms and other details of ordnance construction to the neglect of the barrel.

The advantages of the weapon may be summed up as follows: The ball-bearing grooves give a rotary motion to a smooth projectile, something that has been long sought for but never before attained. The smooth projectile is much cheaper, as no copper band is required, and the energy that is consumed in forcing a banded projectile through the grooves of an ordinary rifled gun is added to the force behind the projectile, thus increasing its velocity, penetration and range. It is claimed that the strain on the wall of the gun is reduced seventy-five per cent., except over the breech, where the initial explosion occurs, so that the weight of the gun may be considerably reduced, thus cheapening cost and facilitating ease of handling. The life of the gun is prolonged indefinitely. When one set of balls is worn out another can be substituted. The average life of one set of



balls is 3,000 rounds. Calculus shows that it is possible to renew the balls four times before metal fatigue limit of the walls of the grooves is reached. The velocity and penetration of the projectile is increased. In a test with the Driggs, Hotchkiss and Maxim guns, which are said to be the best types of modern rifled ordnance, it is claimed that the Cullen gun showed its great superiority. The average velocity of the latter at the muzzle was 3,200 feet per second, as against 1,800 for the Driggs and Hotchkiss and 2,000 for the Maxim. All four were fired at a plate of nickel steel 20 feet square and 1⅜ inches thick at 3,000 yards range. The projectile from the Cullen gun penetrated the plate, ricochetted and was picked up 1,626 yards beyond, embedded 18 inches in the dirt. The Driggs and Hotchkiss failed to penetrate, and glanced into the earth in front. The Maxim stuck in the plate with the point projecting ⅝ of an inch through it. The test was made with a two-pounder, the conditions being precisely the same, except that the ball-bearing gun used a smooth projectile and all the others banded projectiles.

The initial power of the charge not being required to force the soft metal band of the projectile through friction grooves, the length of the barrel may be shortened from 75 to 85 calibres to 45 to 55 calibres, or even less. Friction being reduced, the gun does not heat up to such an extent. The absence of the ring of soft metal around the projectile will permit the use of nose fuses, which are more reliable than base fuses. The smallness of the recoil will permit of lighter gun carriages being used. The band on the projectile being dispensed with, the flight of the smooth projectile will not be interfered with by jagged excrescences formed on the band in its passage through the grooves, thus promoting accuracy.

The accompanying diagrams will explain the principle of the invention, which can be applied to all classes of firearms —cannon, rifles and revolvers. The smaller of the cuts shows a glycerine cushion at the muzzle, against which the balls rest.

A number of Governments have adopted the ball-bearing gun, and Capt. Cullen is now in Canada bringing it under the notice of the militia authorities. His works are at Waterlick Station, Virginia.

The new bridge over the Zambesi, at Victoria Falls, Africa, will cross the river 420 ft. above the water, being the highest bridge in the world. That distinction now rests with a bridge over Stony Creek, on the C.P.R., in the Rockies.

RAILWAY NOTES.

Mr. Sloan, of Chicago, has been granted a franchise for an electric railway at Stratford.

The Nova Scotia Steel and Coal Company have purchased two new locomotives for work on their road in Cape Breton. They are named John F. Stairs and Senator McGregor.

Two monster freight sheds are to be built by the C.P.R. at Winnipeg, one 1,224 feet, the other 608 feet in length. New roundhouses are being built at Winnipeg, Brandon, Moosejaw, Swift Current and Ignace.

A complaint having been made that alien engineers are being employed on the Grand Trunk Pacific surveys, Judge Winchester, of Toronto, has been commissioned by the Dominion Government to enquire, and has entered on an investigation.

The Tilsonburg, Lake Erie and Pacific Railway has a project on hand for an extension north from Ingersoll. Whether it should go north to Stratford by Embro or through Woodstock to Berlin has not been decided. It is possible the C.P.R. may obtain control.

Building operations in the burnt district in Toronto are being retarded by the application of the Grand Trunk for power to expropriate some of the property south of Front Street for new tracks. It is possible the Union Station may be greatly enlarged, or perhaps an entirely new station built.

The C.P.R. will spend about $30,000,000 this season. Some $10,000,000 will be required for North-West terminals, hotels, stations and the like, and the improvements at Montreal, Winnipeg, and Vancouver, the building of five hundred miles of new road in the North-West, the carrying out of the irrigation scheme, and the addition to equipment will take up the rest.

A bill before Parliament empowers the Guelph Junction Railway, which is owned by the city of Guelph, to extend its line westward to Goderich, with branches to St. Mary's and Clinton, via Stratford. The bill gives the owners authority to enter into an agreement either with the C.P.R. or the Guelph and Goderich Railway for the construction and sale of the proposed Goderich extension.

The first eight of twenty-five of a new type of tourist cars have been placed by the Canadian Pacific Railway Co. between Boston, Montreal, Toronto, and Vancouver. They are the handsomest tourist sleepers ever built, and are highly creditable to the C.P.R. Company's shops, Montreal, at which they were constructed. They are 72 feet long, and contain fourteen compartments, seating fifty-six passengers. They have complete kitchen and toilet arrangements, and spacious smoking-rooms. The seats are so constructed as to leave ample room beneath them for hand baggage. With the exception of being upholstered in leather instead of plush or velvet, and with interior fittings of birch instead of mahogany, they might easily be taken for first-class sleepers.

Alexander McKenzie, professional beggar, who was once an electrical engineer, has invented a successful device for the protection of the third rail on the elevated tracks in New York, and will, it is believed, receive the prize of $100,000 offered by the Interborough Company for that achievement. For several years he has been a conspicuous figure on the platforms of the elevated stations. He has but one leg, and always sat on the floor, with his crutches lying in his lap, and his hat stretched out for coins. At intervals he would be arrested and sent to jail, where he was always a welcome prisoner, for his mechanical genius found great opportunity about the shop and buildings. During his periods of confinement he perfected the models for protecting the third rail, and distrustful of every person who attempted to examine them, finally called upon the Charity Organization for help. The officials at once took charge of the matter, and are pushing his claim.

The first railway in Iceland will probably soon be begun by an English company recently formed for the purpose of working the sulphur mines at Theisstareykir, in the north of Iceland. The mines are about seventeen miles from Husavik, the nearest harbor, to which the proposed railway will run.

The C.P.R. has given orders for five large steam shovels, and fifty ore cars. The former are to be made outside the company's works, the latter will be built at the company's own shops. The consolidated shops, when completed, will be able to build all the company needs in engines, passenger and freight cars.

The Kingston Locomotive Works have sent to the St. Louis Exposition an engine it has built for the Prince Edward Island Railway. Though small, it is said to be the best piece of workmanship ever turned out by the works. Several others like it are to be built. The works are installing a hydraulic riveting and flanging plant. It comprises a riveting machine of 150 tons pressure, a hydraulic frame, accumulator, flanging press and all the necessary pumps, etc. It will be one of the largest plants of its kind in the world. It is furnished by the Chambersburg, Pa., Engineering Co.

City Solicitor Mackelcan, of Hamilton, has a plan to do away with the constant complaints about the noise and dirt created by railway companies in shunting and switching trains. It is to have the railways substitute electric power for steam in moving freight cars within the city limits. The proposal was made some time ago, but was considered impracticable because of the lack of electric power, but the Cataract Company is in a position to furnish all the power required, and the City Council may ask the Railway Commission to pass an order requiring electric power to be used instead of steam.

The Central Trunk Railway Co. is applying for incorporation at Ottawa to build a road from Gaspe to the Georgian Bay. Their proposal is to build from Gaspe Basin to Paspebiac, to buy out the Atlantic and Lake Superior line, thence to Metapedia, to build an airline from Metapedia to Riviere du Loup, saving seventy miles over the Intercolonial route. They would use the I.C.R. from Riviere du Loup to Levis and the Great Eastern and Montreal and Sorel lines thence to Montreal, build a new bridge at Montreal, and either buy or build to the Georgian Bay. Their idea is to open up a large shipping business at Gaspé Basin, which is open to navigation ten months in the year.

The C.P.R. caused a mild surprise within the past month by setting a large number of men at work grading an extension from Sudbury to Toronto. The survey for the extension was made by the C.P.R. seven or eight years ago, and provides for a line running south-easterly from Sudbury through the Nipissing District, touching Byng Inlet, Parry Sound, Bala, and Barrie, and south-westerly to Kleinburg, a station on the Owen Sound branch, twenty-one miles from Toronto. The distance is about 200 miles. It is thought action has been taken at this time to forestall Mackenzie and Mann, who purpose building the James Bay road from Toronto north to connect with the Canadian Northern, but this the C.P.R. authorities deny, and say their purpose to build the Sudbury connection has been announced for a long time. Mackenzie and Mann allege that the C.P.R. people have allowed their charter to lapse, and that they cannot build without securing a special Act of Parliament similar to that held by the James Bay Co. The C.P.R.'s claim is that it can build under that clause in the charter which permits it to build a branch from the main line to any point in Canada. The road will be an expensive one, as it passes through a rough Laurentian country, but there is no thought of asking for any assistance from either the Provincial or Federal Government. There is now imperative reason for the C.P.R. to build this independent connection, owing to the Grand Trunk Pacific being undertaken. Mr. Mackenzie declares emphatically that, whether the C.P.R. goes on or not, the James Bay line will be built, and that it will be begun at once. It will probably pass to the east of Lake Couchiching.

The Canadian Pacific is to build new shops at Iberville, Que.

About 300 men are at work double tracking the G.T.R. between Paris and London.

A compressed air locomotive in Dominion No. 2 colliery, Nova Scotia, hauls 35 loaded cars.

Delorimier, a suburb, proposes to give the Montreal Street Railway a twenty-five year franchise.

It is the intention of the Winnipeg Street Railway Co. to have all their cars built in that city in future.

It is announced that the Ottawa and New York Railway shops will be moved from Santa Clara, N,Y., to Ottawa.

The Hamilton Radial Railway Co. is asking permission from Saltfleet Township to double track its line across the Beach.

The C.P.R. has awarded contracts for their new lines to be built in the west this year to a firm of St. Paul contractors.

A number of Fort William business men propose forming a company to build and operate an electric street railway in that town.

The C.P.R. between Toronto and Smith's Falls is to be relaid this summer with new 80-lb. rails instead of the 72-lb. rail now in use, at a cost of about $50,000.

The Canadian Pacific Railway has added eleven Saxon consolidation engines to its equipment, most of which are in operation between Toronto and London.

The Ottawa, Brockville and St. Lawrence Railway Co. has had the time for the completion of its direct line between Ottawa and Brockville extended to 1908.

The White Horse, Kluane and Northwestern Railway Co. is applying for incorporation to build a line of railway from White Horse to Kluane Lake in the Yukon Territory.

A new railway bridge has been built at the Narrows, near Orillia. It is strong enough to carry the heavy Mogul engines which it is proposed to place on this division of the Grand Trunk.

A train on the Great Western Railway recently eclipsed all records for the conveyance of American mail between Plymouth and London, covering the distance of 247 miles in 237 minutes. The last 118 miles was made in 99 minutes.

Japan has astonished the world's railway experts with the rapidity of her construction work in Corea. The permanent character of the roads shows a confident expectation that they will be made to serve economic uses as well as military necessities.

The Witness says the Grand Trunk has given an order to the Montreal Machinery and Locomotive Company at Longue Pointe for ten enormous locomotives, to be followed by ten more, which are to be finished before the end of the season. Its own shops are not able to supply new engines fast enough.

The Dominion Government has purchased the Canada Eastern Railway, from Fredericton to Newcastle, N.B., 136 miles in length, and made it part of the Intercolonial. It was built by Alex. Gibson and subsidized by the Dominion and Nova Scotia Governments and the municipalities. The price paid is understood to be $800,000.

The Railway Commissions have issued an order with respect to the crossing of the Grand Trunk at Lindsay by the Lindsay, Bobcaygeon and Pontypool Railway. Each railway is to have interlocking semaphores, but the Grand Trunk is also to instal derailing appliances. The Lindsay, Bobcaygeon and Pontypool Railway expects to be ready for operation by August 1st.

There seems a prospect of a new electric road between Montreal and Ottawa being proceeded with at once. Col. E. McMullen, of New York, is the president of the Ottawa River Railway Co., which holds the charter. The motive power is to be both electricty and steam; for the production of the former the Ottawa river will be used. The system will ultimately be extended to the Georgian Bay.

J. D. McArthur, of Winnipeg, has been awarded the contract for five hundred miles of the Canadian Northern to Edmonton. The work includes grading, bridging and track laying.

Contracts for the Trans-Andean Railway have been divided between Clark Co., Spearson & Son, of London, England, and W. R. Grace & Co., of New York, the total amount being $6,750,000.

The Toronto Railway Co. promises to place ninety new cars on their road before autumn. Their shops will be enlarged to build them. They will be of the combination type. The company has been sending cars to Winnipeg contrary to their agreement with Toronto.

Work has been commenced on the Peterboro' street railway. The old road-bed is being torn up, and the new track will be laid as quickly as possible. Mr. Learmouth, of the American Cereal Company, has been appointed manager, and Mr. Edward Burch, of Minneapolis, consulting engineer.

Foley Bros., Larsen & Co., being the lowest, have secured the contract from the C.P.R. for the new lines in the North-West which are to be built this summer. These comprise twenty-five miles east from Wetaskiwin, twenty-five miles of extension east from Lacombe, and forty miles from Pheasant Hill, known as the Lost Mountain section.

The Kingston and Dominion Central Railway is applying for incorporation to build a railway from Kingston through Newboro' and Westport, thence in a westerly direction to some point on the Georgian Bay between Parry Sound and Midland, with power to lease or amalgamate with the Canadian Pacific, the Grand Trunk, or the Brockville, Westport and North Western Railway Company.

Premier McBride, of British Columbia, has promised the British Columbia Northern and Mackenzie Valley Railway a bonus if a guarantee is given that the road will be built within a reasonable time. The proposed railway will traverse the northern parts of the Province, and act as a feeder for the Grand Trunk Pacific. It will enter the gold camps on the Peace, the Liard, the Stickine and the Skeena Rivers, and will give direct railway communication between Dawson and Port Simpson.

Surveys have been commenced on the Stratford-St. Joseph electric railway. The preliminary plans call for a line from St. Joseph, through the village of Zurich to Hensall, ten and a quarter miles; thence to Chiselhurst, four miles; thence to Fullarton, twelve miles; thence through Carlingford to Avonton, and, following the Avon River, to Stratford, a total distance of 38 miles. There may be modifications to avoid heavy grades when the surveys are completed, but this will be substantially the route.

Among the railway charters applied for at Ottawa this session is one for an electric road from Thorold to Port Colborne, thence north-west to Brantford and east to Buffalo. It is promoted by the Wolvin Syndicate, which is running a line of big steamers between Montreal and Duluth, and wish to provide facilities for passengers to visit Niagara Falls, etc., while the boats are passing through the Welland Canal. The Falls will be reached by the Niagara, St. Catharines and Toronto Railway.

MARINE NEWS.

The French steamer Auguste Marie was crushed in the ice and sunk off the coast of Cape Breton.

A new screw steamer, the Sovereign, has been launched at Peterboro' to ply on Rice Lake and the Trent waters.

The Montreal Transportation Co. will rebuild the burned steamer Advance and use her on the lakes as a coal carrier.

The corporate name of The M. Campbell Fanning Mill Co., of Chatham, Ont., has been changed to the Manson Campbell Co.

J. J. Hill is reported to be arranging for a fast steamship line from Vancouver to Skagway.

Steel is slowly but surely displacing hemp as the material of which all hawsers and ropes are made in the ships of the British fleet.

The Quebec Steam Whaling Co., headquarters at Montreal, has been incorporated to carry on operations in the Gulf and River St. Lawrence.

The North American Transportation Company has obtained the contract to maintain the ferry service between Campbelltown and Gaspé, on the Baie des Chaleurs.

There will be four steamers plying between Barry's Bay and Havergal this season, besides a number of barges carrying the output of the Canadian Corundum Co. and Ontario Corundum Co.

A new steamer, the Elgin L. Lewis, is being built at Orillia. The timbers were prepared at Penetanguishene, and taken to Orillia to be put together. She will run on Lakes Simcoe and Couchiching.

A contract has been awarded by the United States for a second canal through the St. Clair flats. The sinking of a vessel in the channel last fall caused much inconvenience, and a second canal will prevent a repetition of such a state of affairs.

A contract has been awarded to Simon McGregor, of Dalhousie, for a wharf at Petit Rocher, in Gloucester, N.B., to cost $60,000. John D. Warwick has been awarded the contract for repairs to the wharf on the Ottawa river at Cumberland, to cost $6,000.

A Kingston dispatch says it is the intention of the Ontario Electric Railway to run its own boats for carrying freight from Kingston to Montreal till such time as the road is extended to that point. Through rates will thus be given at, it is said, about half present rates.

The Star Line Company have purchased a boat for the Gagetown-Fredericton route from the Richelieu and Ontario Company. She is a twelve-mile, single screw boat of oak and hard pine, allowed to carry 250 passengers, and with ample freight accommodation. Her name is not stated.

On the opening of navigation, 1904, the illuminant in the following lighthouses in the river St. Lawrence was changed from petroleum to acetylene, and the lights will henceforth be unwatched, but in other respects unchanged: Lindoe Island, Gananoque Narrows, Jackstraw Shoal, Spectacle Shoal, Red Horse Rock, Burnt Island.

George Yale has been appointed mechanical superintendent of the Montreal Harbor Works, in succession to Mr. Bayfield, who resigned to take up private practice as a civil engineer. Mr. Yale has been for nearly fifteen years mechanical superintendent of the dredging fleet of the Lachine Canal.

While some Collins Bay people were out on the Bay of Quinte in a gasoline launch it exploded and took fire. Those on board had to jump overboard, where they held on to the blazing vessel till rescued by a skiff, their hands being badly burned. A good many accidents from gasoline launches seem to occur, showing the necessity of understanding them and exercising great care.

Glace Bay harbor is to be opened and improved, the Dominion Government having voted $25,000 and the Dominion Coal Company will probably expend $65,000 more in rebuilding shipping piers, dredging, etc. At one time 25,000 tons were shipped from this port in one season, and that was some years before the coal trade had reached anything like its present proportions.

The application has been renewed by the Great Lakes and North-West Transportation Co. for power to construct canals and improve navigation between Lake Superior and Red River at Winnipeg, and thence by Lake Winnipeg or other channel to the Saskatchewan River, to improve the navigation of the Saskatchewan and its branches, providing a transportation route from the head waters of that river to Lake Superior. This is a somewhat ambitious scheme covering a large part of the continent.

The Catherine C., of Sturgeon Falls, is a new addition to the fishing fleet of W. A. and H. N. Cockburn. She was built under the supervision of Capt. Gidley, of Collingwood.

Canadian Lines, Limited, recently incorporated at Ottawa, in which Wm. Mackenzie, of Mackenzie & Mann, is interested, contemplates a line from Quebec to France and other European countries.

A. M. Whitney, of Boston, has offered the Canadian Government, upon a royalty of $100,000, the right to use along the St. Lawrence the submarine alarm service which is controlled by his company in Boston.

Vancouver is to have a floating dry dock to cost over a million dollars. Construction of the steel frame has been commenced in England. E. E. Ling, consulting engineer, representing New York capitalists, has been in Vancouver.

The navigation of the St. Lawrence is to be improved at Cap la Roche. There are two plans, one for dredging and one for a dam which would involve an outlay of about $6,000,000. The former will probably be adopted, on the report of Mr. Wisner, one of the most eminent authorities on the continent.

The Allan steamship Ionian was the first mail boat to arrive at Montreal this season, which she reached May 1st after being detained forty hours by fog and ice. Navigation on the St. Lawrence route has been much impeded by ice this year, and a number of vessels had to go to Halifax to unload.

The Sincennes-McNaughton Co. has added another vessel to its Montreal fleet. It was built at their works at Sorel, and is named the F. Dupre. It is one of the most powerful craft owned by the company, is 80 feet long, 20 feet beam, with 10½ feet draught, entirely of steel, engines with cylinders 18 inches by 36 inches, 24 inch stroke, the total cost amounting to $30,000.

A new boat, the Ottawa, has been built to take the place of the Olive on the Rideau Canal. She is 110 feet long and 24 feet beam, and is a three decker. The hull is of steel and the framework double, so that she is as strong as any of the vessels on the great lakes. She has a fore and aft compound engine of the latest design, and a boiler capacity of 135 pounds. The Olive will be broken up.

The Canadian Shipbuilding Company, promoted by prominent Toronto capitalists, which last year obtained concessions from the commissioners of the Queen Victoria Niagara Falls Park and commenced the construction of an extensive shipbuilding plant on the bank of the Niagara River, just below Bridgeburg, has ceased operations for the present.

The contracts for building the turbine steamers for the Cunard Steamship Company have been placed with Brown, of Clydebank, and Swan & Hunter, of Newcastle. The machinery will be 300 tons lighter than that of reciprocating engines. They will maintain 65,000 indicated horsepower, and the vessels will have a speed of 24½ knots in all weathers. Each will have four shafts. The boilers will be of cylindrical type. The coal consumption will be over 1,000 tons daily. The length of the steamers will be 760 feet.

Steps are being taken in New York to organize a company to build a vessel that will cross the Atlantic in three days. The inventor of the plan is Rich. Benj. Painton, and the means of propulsion is what is termed a multiple electric propeller. The device consists of a series of propellers arranged along the sides of a vessel and driven at great speed by electricity. For a torpedo boat destroyer the size of those at present in use in the United States navy twelve propellors would be necessary, six on each side. In addition, single or twin screws could be provided, to be operated alone, or jointly with the side propellers. The plan is to build a vessel 600 feet in length, at a cost of about $2,000,000. The inventor claims that forty knots an hour can be made. Steamship propulsion now consumes 3,000 tons of coal, at a cost of $18,000 a trip to Southampton. The electrical ship will reduce the coal consumption to 1,500 tons, being a saving of $9,000 on each trip.

The steamer White Star, the upper works of which were destroyed by fire at Toronto last summer, has been purchased by the Montreal and Cornwall Navigation Company. She was towed to Cornwall and will be rebuilt there.

The Dominion Government has decided to place two ice-breaking steamers on the St. Lawrence between Quebec and Montreal. There will be one big steamer to keep the channel at Cap Rouge, the most dangerous spot in the river, clear of ice during the entire winter, and a smaller steamer between Sorel and Montreal. While nothing has been decided upon definitely, it is thought that a vessel measuring 200 feet long, 43 feet beam, and drawing 18 feet of water will about fill the bill. Armstrong, Whitworth & Co., of Newcastle-on-Tyne, will probably be the builders, as they have had more experience than any other company, they being the builders of the Russian ice-breaker Ermak and other large vessels. The Ermak is 305 feet in length, 71 feet beam, and 42 feet 6 inches deep, so that the vessel proposed for the St. Lawrence is considerably smaller. The ice-breaker will be utilized during the summer for light-house and buoy work, and possibly for wrecking. The sum of $300,000 has been placed in the estimates for the vessel. It is expected she will be ready for next fall. The Armstrong & Whitworth Co. state that the experience with these ice-breakers has been very satisfactory.

At the first session of the Merchant Marine Commission, authorized by the United States Congress to consider and recommend legislation for the development of the American merchant marine, C. B. Orcutt, president of the Newport News Shipbuilding Company, told the commission that ships can be built in England at from 50 to 75 per cent. less than they can be built in the United States. A ship costing $400,000 there can be built in England for $100,000, he said. The cause of this great difference was that 75 per cent. more is paid for labor in the yards of the United States than in Great Britain, and at the same time there is 40 per cent. in the cost of material in favor of English builders. He said that the protective tariff was responsible for the difference in cost of material. Lewis Nixon, the shipbuilder, said builders in the United States had been constructing too good ships for American use. "Suppose you should take the duty off all shipbuilding materials, do you think that would be any benefit?" asked Senator Lodge. "You would have to take the tariff off everything, because everything goes into a ship. If we had free material and free ships we should have to have free labor, too, because you recognize that labor is paid as well."

LITERARY NOTES.

The following publications have been received at the office of the Canadian Engineer:

"Modern Air-brake Practice: Its Use and Abuse," with questions and answers for locomotive engineers and electric motormen. By Frank H. Dukesmith, inventor of the Dukesmith air-brake release signal. F. J. Drake & Co., Chicago; $1.50. A useful book for railway men and mechanics.

"Easy Lessons; or the Stepping-stone to Architecture." A series of questions and answers explaining the principles and progress of architecture. By Thos. Mitchell. The Industrial Publication Co., New York; 50 cents. A handy book of reference and information for architects and others.

"Transactions of the Engineering Society of the School of Practical Science, Toronto." This is Vol. XVII. of the issue of these transactions, and contains papers covering a wide field read before the society; 50 cents. P. M. Sauder is corresponding secretary of the society.

"The Currents on the South-eastern Coasts of Newfoundland." Compiled from tidal and current surveys, and published by the Department of Marine and Fisheries, Ottawa.

"The Iron Age Directory, 1904." Classified index of goods manufactured by advertisers in the Iron Age.

"Martin's Up-to-Date Tables, for Use Throughout the Empire: Weights, Measures, Coinage." Compiled by Alfred J. Martin, F.S.I.; published by T. Fisher Unwin, London, E.C. Also, Martin's "Up-to-Date Beginners' Table Book for Schools and Home Teaching" A supplement to above. Price, 1d. Very useful little books.

"The Cement Age: The Many New Uses and Increasing Demand for Plastic Materials." By R. W. Lesley. A paper read before the Engineers' Club of Philadelphia, November, 1903.

"Clarkson Bulletin, April, 1904." Information respecting the Thomas S. Clarkson Memorial School of Technology, Potsdam, N.Y.

CANADIAN ELECTRICAL ASSOCIATION.

Arrangements are well in hand for the annual convention of the Canadian Electrical Association, to be held on the 15th, 16th and 17th inst. at the Royal Hotel, Hamilton. The following are the main items of the programme:

June 15th.—a.m.—Meeting of Executive Committee.
Welcome by Mayor on behalf of citizens of Hamilton.
Opening session.
p.m.—Business, Papers and Question Box.
Evening.—Papers.

June 16th.—a.m.—Visit to sub-stations, Deering Works and Westinghouse Works, Papers.
p.m.—Papers, Question Box, election of officers and unfinished business.
Evening.—Annual banquet.

June 17th.—a.m.—Visit to St. Catharines, DeCew Falls (luncheon) and Niagara Falls by courtesy of Hamilton Cataract Power, Light and Traction Co.

The following papers will be presented:

"Origin and Development of Storage Batteries," E. B. Walker.

"The Curtis Steam Turbine," Frank C. Smallpiece.

"Statistics of Canadian Progress in Electrical Application," George Johnson.

"Heavy Electric Traction by Alternating Currents," P. M. Lincoln.

"The Toronto and Niagara Power Development," with lantern illustration, K. L. Aitken.

A recent accident in Nova Scotia has drawn attention to the danger of the old plan of hoisting men from the pit in tubs or buckets. In many cases there are no indicators in the engine room, and it is understood that the mines department will make the provision of indicators compulsory.

The Industrial Advocate says the old time arrastra is being introduced in the gold mines of Nova Scotia, one being in use at Clam Harbor. It has the very great merit of cheapness, being nothing more than a circular stone of granite revolving in a cast iron pan and its weight is sufficient to break up ordinary ore. Many mining men claim that for free gold milling the arrastra gives results that cannot be approached by modern stamp mills, and refer to the absence of slimes and flouring of the gold. It is much used in the older Spanish mines in Mexico and other places.

R. C. Coutlee, Aylmer, Que., has been appointed good roads instructor by the Nova Scotia Government.

Stollmeyer, the Pitch Lake king, who made a fortune out of asphalt, is dead, at the age of 91. He came to America as a penniless German immigrant.

—The Canadian Association of Stationary Engineers, Toronto, No. 1, will hold their annual meeting in Toronto on June 15th for the election of officers, delegates to the annual convention, to be held in Hamilton, Ont., in August, and other business.