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We judge ourselves by what we feel capable of doing; but the world judges us by what we have already done.

Longfellow.

T. J. DRUMMOND.

Pioneer in the enterprise of Iron Making in Canada.

Lord Bacon in his essay on "Riches," says:—

If a man can play the true logician, to have as well judgment as invention, he may do great matters, especially if the times be fit.

It is not often that we find combined in one man, mechanical instinct, business aptitude, and executive ability. Such personalities are rare, they appear only at intervals like meteors in the sky; but whenever they do appear, the inevitable corollary to their lives is *success.* Especially is this so in the domain of Industry. In the United States the man who was awarded by the American Society of Mechanical Engineers, the John Fritz medal for 1905—George Westinghouse—is a brilliant example.

Among the business men of Canada there is one who possesses in a marked degree the aforesaid three traits; who has justly been described as "the leading pioneer in the enterprise of iron making in the Dominion;" and whose portrait it is a pleasure to incorporate this month in our gallery of men who have "done things."

Thomas J. Drummond was born in Ireland 26th September, 1860, his family removing to Canada in the early sixties, He was educated in Montreal. In 1886 he founded, together with his brother, Mr. Geo. E. Drummond, and Mr. J. T. McCall, the well-known firm of Drummond, McCall & Co., iron and steel merchants. This house early in its career became interested in the industrial life of Canada, and may be ranked as pioneers in the enterprise of iron making in this country. What is known as the "Drummond Group" of iron industries, is perhaps as comprehensive a group of allied enterprises as the Dominion can claim. They embrace the work of;—

The Canada Iron Furnace Co., Ltd., at Midland, Ont., and Radnor Forges, Que.

The Londonderry Iron & Mining Co., Ltd., at Londonderry, N,S.

The Canadian Iron & Foundry Co., Ltd., with plants at Hamilton, Ont., and St. Thomas, Ont.

The Montreal Pipe Foundry Co., Ltd., works at Three Rivers, Que., and Londonderry, N.S.

He is a director in all these companies; president of the Londonderry Iron & Mining Co., Ltd., also of the Montreal Pipe Foundry Co., Ltd., (a fine modern plant, which we purpose describing and illustrating in an early number); and vice-president of the Canadian Iron & Foundry Co. These works combined, employ upwards of 2,600 men. In addition to his active interests in the companies mentioned, Mr. Drummond is vice-president of the Lake Superior Corporation, and was one of the most active spirits in the successful reorganization of that company. Outside of the iron industry he is interested in several corporations, being vice-president of the Montreal Water & Power Co. (of which corporation he was practically the originator), a company which now supplies all the suburbs of Montreal, and several of the wards of the city, with water. He is a leading director in the Drummond Mines, Limited, operating mines near Cobalt, Ont.

Mr. Drummond is also a director of the Imperial Life Assurance Co., of Canada, and is an Associate Member of the American Institute of Civil Engineers, and a member of the American Institute of Mining Engineers, and of the Canadian Mining Institute.

We are on the threshold of great things in iron and steel, and reasoning from the known to the unknown, we fear not to predict that Thomas Joseph Drummond—whose worthy business record we have briefly told, will play an important part in the industrial development of Canada.

Bird's Eye View of Niagara Falls Showing Power Developments on Canadian Side.

HYDRO-ELECTRIC ENTERPRISE IN CANADA

"THE DEVELOPMENT OF THE ONTARIO POWER COMPANY" AT NIAGARA FALLS.

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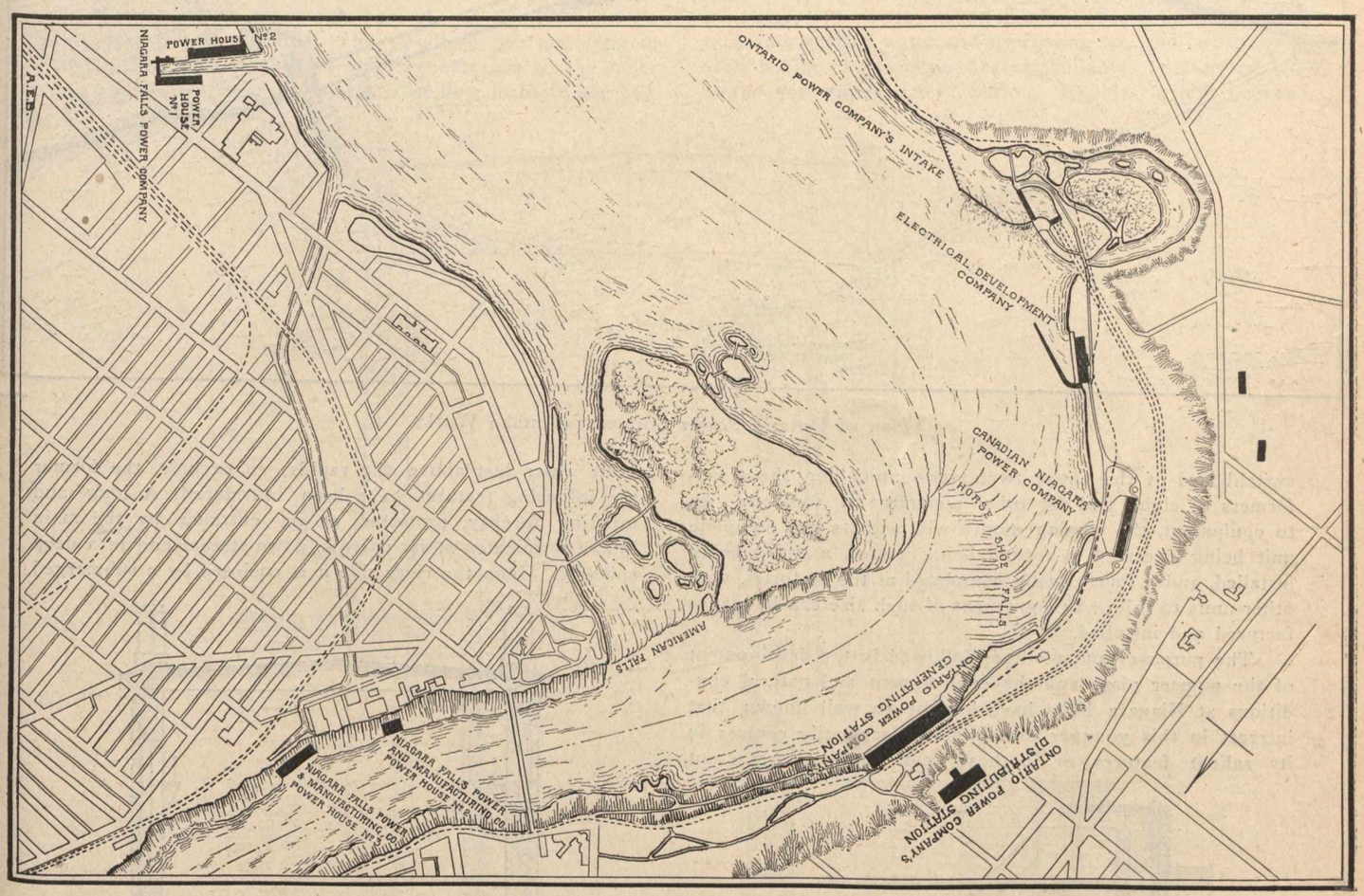
BY PAUL N. NUNN, C.E.

Designer—in conjunction with his brother L. L. Nunn—of the Ontario Power Company's magnificent installation at the "Falls," which was inspected by the Canadian Society of Civil Engineers, Wednesday, January 31, 1906.

The development of electrical power at Niagara Falls has long attracted widespread attention and interest. Since the first installation upon the American side, descriptions and discussions of its works and methods have been granted a conspicuous place in technical records and scientific press. It is not so well known, however, that four other developments, each larger than the pioneer, are now drawing or preparing to draw power from Niagara river. These differ so widely and so apparently as to type and character, and express such differences of conception and method, that it seems fitting at this time, when the largest is about to enter the active field, to present to the technical world, a brief description of a few features peculiar to this plant and a statement of the considerations which have led to so fundamental a departure from the type of construction hitherto characteristic of Niagara Falls.



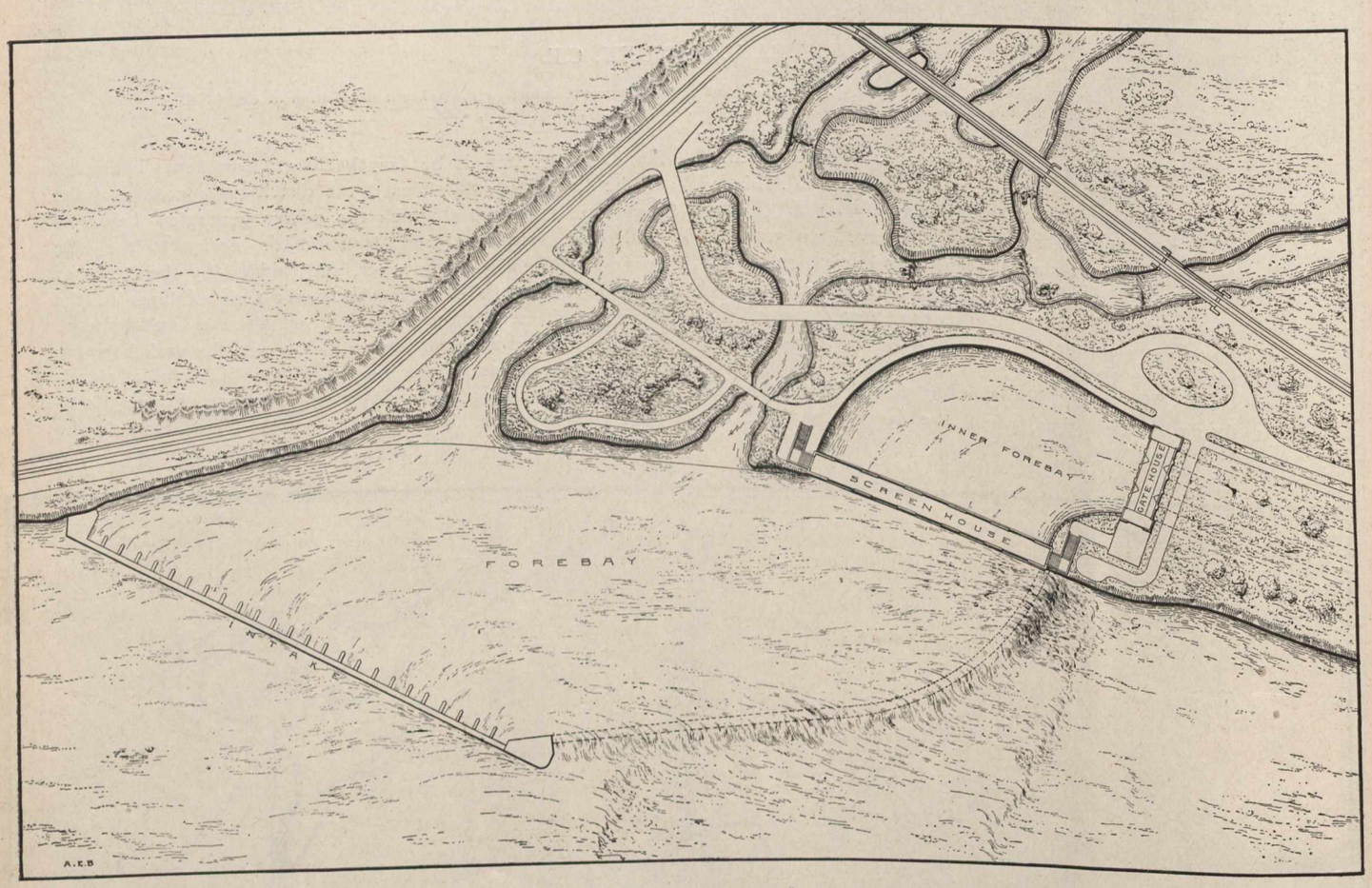
Map of Niagara Falls, showing Location of Power Developments.

Standing upon the upper steel-arch bridge and facing the Canadian falls, one may observe at the foot of the cliff forming the right-hand wall of the gorge a long but unobtrusive building, its farther end obscured by spray from the great cataract. It is of modest though massive design, and its colors almost blend with those of the overhanging cliff. This is the power-house or generating station of the Ontario Power Company. To the right, high above and behind the power-house, upon the bluff overlooking both gorge and cataract, may be seen another great structure, less massive but more ornate, which, on account of its commanding position, is by far the most prominent landmark of the Canadian side. This is the distributing station of the same company, from which the power generated below is controlled, measured and transmitted. Away to the left, around the bend of the river, and hidden by the trees of Goat Island, are the walls, abutments and buildings of the intake and head-gates through which the water from Niagara river is diverted for use below. In the park between these extremes, seen just beyond Horse Shoe Falls, stands the power-house of the Canadian Niagara Power Company, while to the left another power plant, that of the Electrical Development Company, is rapidly building.

From the head-gates of the Ontario company three great steel-and-concrete tunnels or conduits beneath the surface of the park will convey nearly 12,000 cubic feet of water per second to the top of the cliff above the power-house. Thence it will pass through twenty-two steel penstocks in shafts and tunnels down and out through the cliff to an equal number of horizontal turbines in the power-house below. From the generators the electrical cables turn back through tunnels to the twenty-two banks of switches, transformers and instruments of the distributing station above and to the transmission lines beyond, completing an equipment for more than 200,000 h.p.

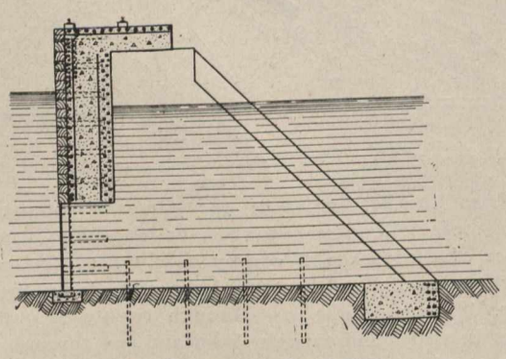
The intake works for the entire 200,000 h.p. are now finished. One of the three main conduits is completed, while for the second and third, portals and head-works have been installed and a portion of the excavation made. Six

of the twenty-two penstocks are already in place within their shafts and tunnels and two others are building, while the power-house is nearly prepared for the concomitant apparatus. The distributing station is completed for the switchboard of the entire twenty-two units, for the transformers of eight, and for other apparatus of fourteen. As to equipment, the coming month will witness one complete unit being operated, a second being tested, a third being installed, and a fourth being completed at the factories, with other units to follow as equipment of such size can be manufactured and installed.



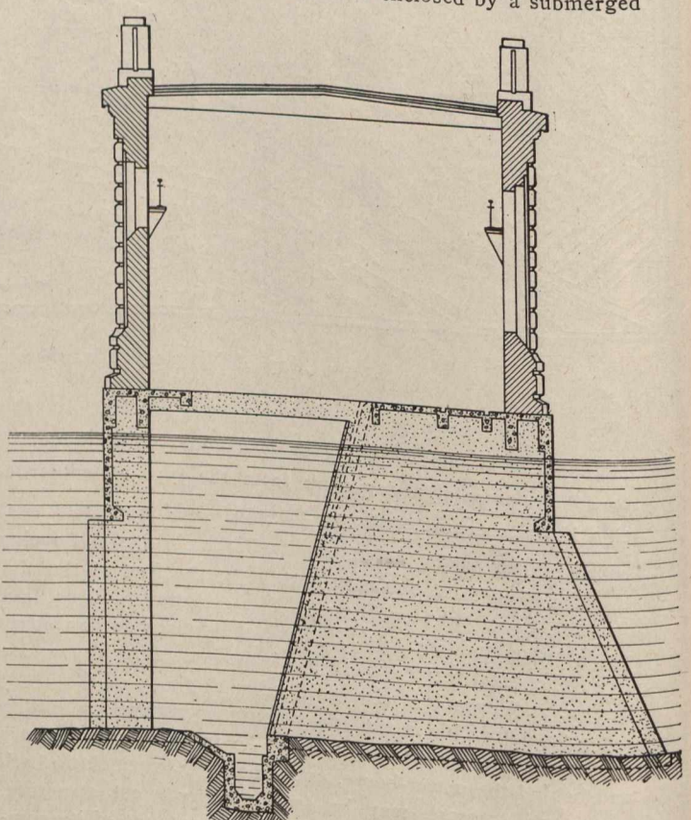
Plan of Ontario Power Company's Intake Works.

The purposes and methods followed in the development of the pioneer plant and the environment and natural conditions at Niagara Falls have become so well known that interest in this younger development necessarily centres in its salient features, or in those most likely to represent advance in engineering. The more important of these are the arrangement of intake works, the design of main conduit and spillway, the horizontal shaft units, the symmetry of arrangement, the centralization of control, and the protective isolation of apparatus.



Section Through Intake.

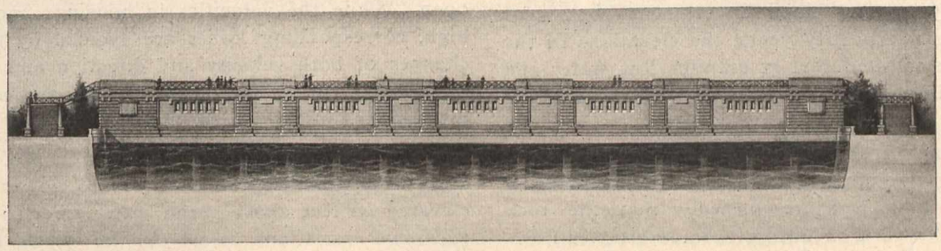
The intake works have been located and designed with especial reference to the ice difficulties, which have been the limiting factor in the success of Niagara power. Cake ice in enormous quantities floats down for weeks at a time from the Great Lakes, and mush ice is formed in the turbulent rapids primarily by the freezing of spray and foam, and secondarily by the disintegration of cake ice. To avoid the latter the intake is located in the smooth but swift water just above the rapids; to exclude the former the following features have been introduced: A long and tapering forebay, protected at its entrance by the main intake terminates at its narrow, down-stream end in a deep spillway. Upon the river side it is enclosed by a submerged



Section through Screen House.

wall, while the other side adjacent to the spillway is occupied by the main screen structure leading to the inner bay and to the portals and head-gates of the three conduits.

The intake, nearly 60 feet long, stretches across the inlet or bay at Dufferin Island almost parallel with the current in the river. Throughout its length a concrete curtain-wall extends down nine feet into the water, here fifteen feet deep, so that the gate openings beneath admit only deep water, and this at right angles to the swift exterior surface flow, which, sweeping the full length of the curtain, carries the floating ice to the rapids beyond. At the main screen this operation is repeated. This structure, 320 feet long in twenty feet of water, lies across the entrance to the inner bay and parallel with the direction of flow in the outer bay.

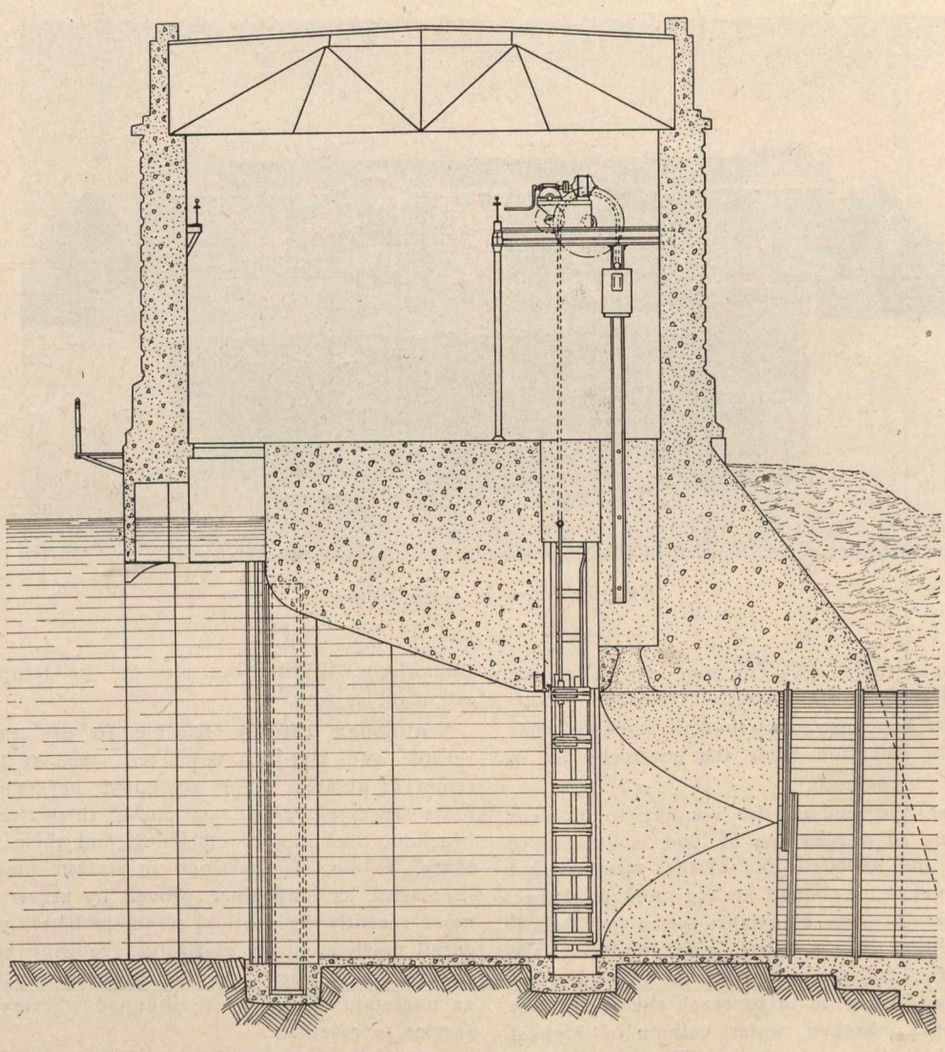


Screen House and Promenade.

Again a curtain, formed by the front wall of the enclosing superstructure, admits to the screens only deep water, here also at right angles, while it excludes ice with the surface currents maintained through the forebay by a voluminous spill of surplus water.

At the gate structure, where the water is thirty feet in depth, the tapering portals leading to the electrically operated Stoney head-gates are protected with wide-mesh screens, which are also enclosed and safeguarded by a curtain carried by the front wall of the gate-house. The bay in front of the curtain communicates with the river by an ample ice-run. Substantial concrete buildings shelter both head-gates and main screens. In each case an open canal between curtain and screen spills into a gravity ice-run emptying into the river. Both buildings are supplied with steam for heating and thawing from an underground boiler-plant situated in the common abutment.

Thus the water before entering the conduits must pass in succession three automatically selective steps, each excluding surface water and its floating ice, and two screens, each behind ice-runs in heated buildings containing live steam for emergencies. Serious trouble is not believed possible while these provisions are maintained with reasonable care.



Section through Gate House.

Screen frames are removable by an electric crane for cleaning and changing. On account of its location in the public park, the top of the long, narrow screen-house, approached at either end by broad steps and landings, is finished as a promenade. From this point of vantage one may have a superb view of the upper rapids. The islands

and channels made in the course of this work give great opportunity to make this portion of the park most picturesque.

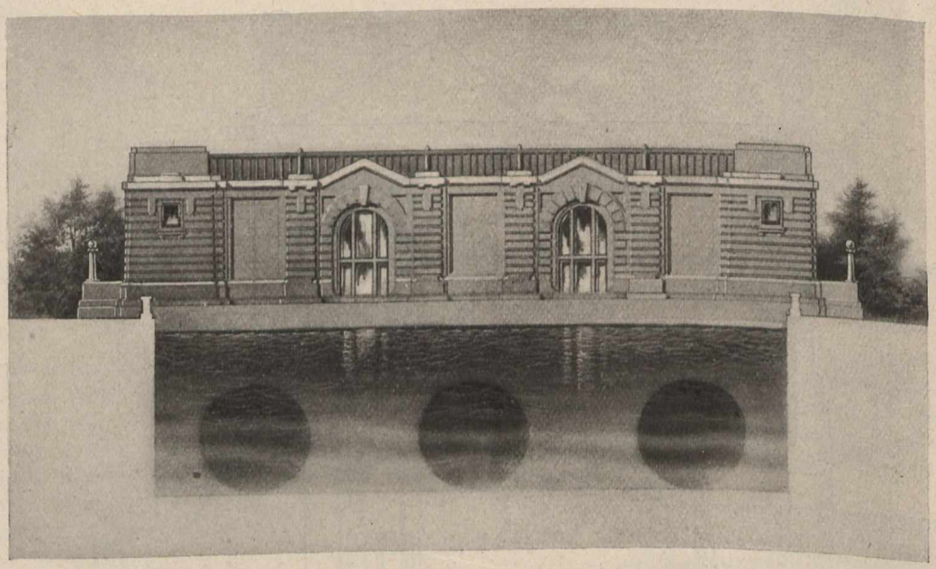
The height of the water in Niagara river, and, therefore, the volume here available, is dependent upon the surface elevation of Lake Erie, the erosion of the river bed, and such temporary causes as ice gorges, storms, etc. From calculations based upon comparative observations extending over a number of years and upon Government reports of Lake Erie levels for nearly fifty years, the elevations of the intake have been so selected that at extreme low water and most adverse conditions a full supply of water should be secured.

The main conduits are of 0.5 in. riveted and reinforced steel embedded in concrete, eighteen and twenty feet in diameter, 6,500 feet long, and are buried within the rock and soil of the public park. Through them the water flows at a velocity of approximately fifteen feet per second. Just beneath the top of the cliff behind the power-house, within a long underground chamber, the arched roof of which supports the conduit above, nine-feet diameter branches pass from the under side of the conduit through gate-valves and become the penstocks, each supplying water at ten feet per second to a single turbine. Each penstock has two expansion joints, a massive thrust anchorage in the power-house foundations, and an automatic relief-valve and a stone-catch discharging into the river. The nine-feet valves are electrically operated under distant control from the power-house below, and are so constructed that all working parts may be removed for attention while the penstocks are in service.

The spillway at the end of the conduit, to prevent water-hammer in case of sudden loss of load, is little more than the enlarged and elevated end of the main conduit equipped with an enclosed weir and underground discharge. Its peculiar features are its adjustable weir and helical discharge-tunnel, which, after a steep initial pitch in the taper from the weir, follows a uniform grade and symmetrical curve while circling about to reach the river, thus preserving a smooth, unbroken water column of highest velocity and least expenditure of energy. The purpose here is to prevent erosion, restricted flow and excessive air-suction, the latter on account of the danger of formation of ice from spray under forced circulation of air.

The generators are of conventional horizontal-shaft type, three-phase, 25-cycle, and deliver 12,000 volts at 187.5 revolutions per minute. The turbines are of Francis or inward-flow type, double, central-discharge or balanced twin turbines, designed to deliver 12,000 h.p. under 175 feet head. Their shafts are 24 in. maximum diameter, and each carries two 78 in. cast-steel runners of "normal" reaction. Housings are of reinforced steel plate, 16 feet in diameter, spiral in elevation and rectangular in plan. Gates are of the wicket or paddle type, and the rotating guides forming them are carried by shafts which project through stuffing boxes to an external controlling mechanism, thus freeing the casings from the objectionable interior gate-rigging and leaving their approaches to the guides symmetrical and open. While the velocities in housings and draft-tubes are high, corresponding losses are avoided by nicely modulated changes of both velocity and direction and by symmetrical and liberal curves free from abrupt angles or obstructing projections.

Of the 175 feet head, 20 feet is in the 10 feet diameter draft-tubes, because the floor of the power-house has been elevated 26 feet above mean water level to provide for the excessive variations to which the water in the gorge is subject. While bearings are self-oiling, all are equipped with water-cooling system, and for still greater insurance a piping system for the changing of oil has been so connected that in emergency it is instantly available for forced lubrication. Believing that disorders of bearings and journals, like those of people, are usually the culmination of gradually increasing ailment, each bearing is supplied with an automatic record-making thermometer, providing the superintendent with a daily record, not only of the temperature of the bearing, but also of the temperament of the attendant as well.



Exterior View of Gate House.

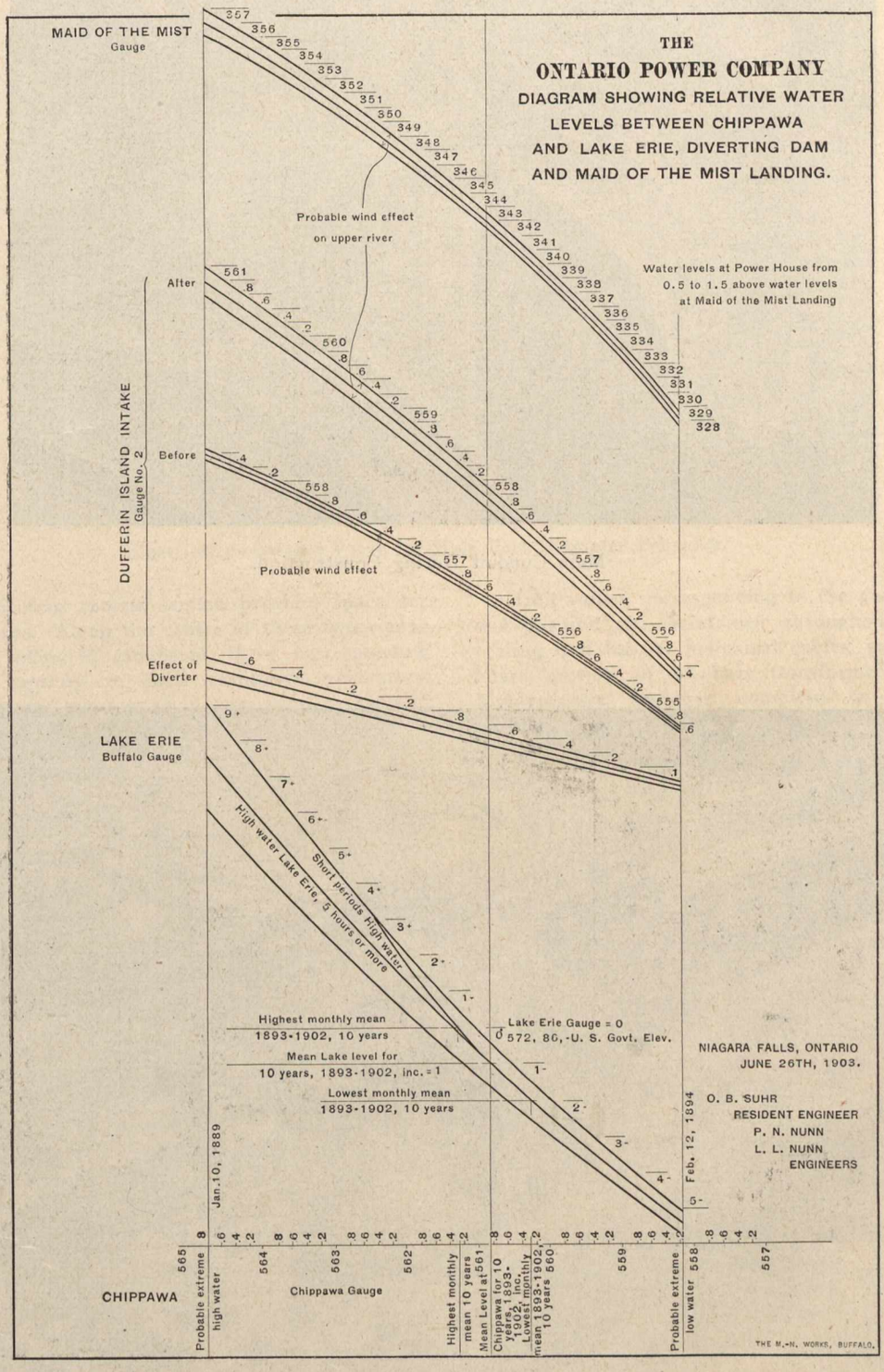
Although entirely feasible to use the vertical-shaft turbine, and, although restricted space at the power-house requires greatest floor economy, nevertheless horizontal units are employed on account of their freedom from step-bearings, their higher efficiency, and their greater accessibility. While step-bearings in certain places are entirely successful, as long since proved by screw propellers, and more recently by vertical steam turbines, yet at best they entail much auxiliary apparatus requiring especial care and frequent adjustment. With high-head turbines they have an uncertain record to be shunned wherever continuity of service is essential.

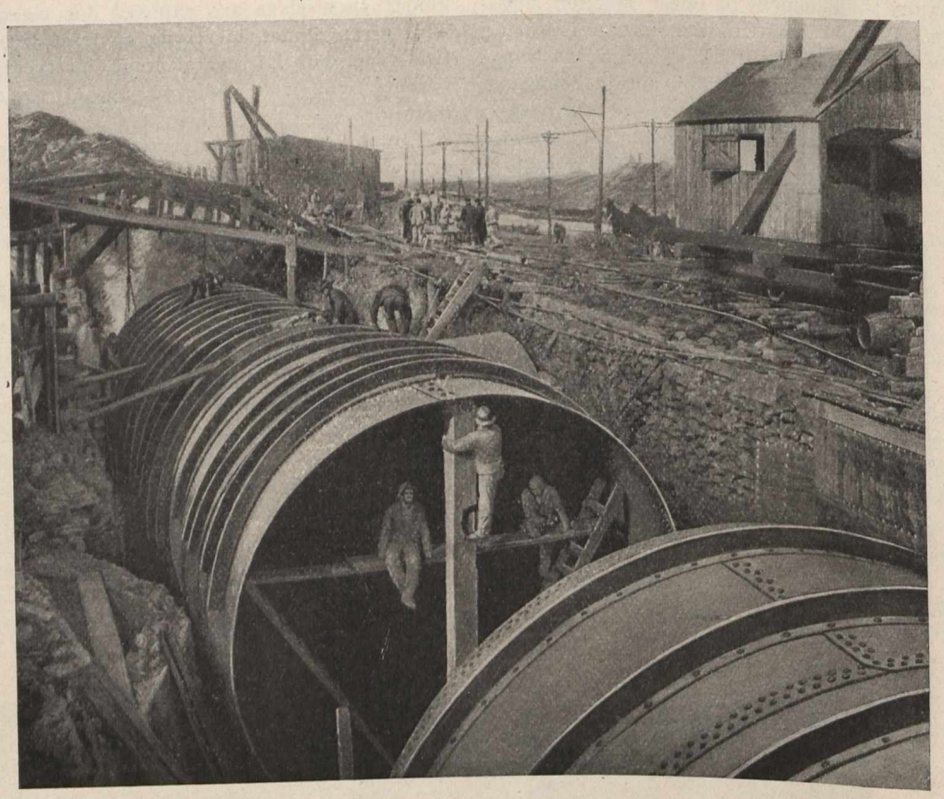
To reduce load upon the step-bearing, the vertical unit is usually of highest permissible speed. While efficiency at the generator is favored by this high speed, the effect upon the turbine is diametrically opposite, and usually many times greater. This is because highest efficiency and durability seem to require "normal" action—a radial relative direction of bucket entry—and narrowly limited relative dimensions of runner. At such reaction peripheral velocity of runner (the components of which—diameter and rotation—are inversely proportional) is fixed by head. At such relative

dimensions power is proportional to square of diameter; hence, inversely proportional to square of rotation. Increase of rotation, therefore, means disproportionately great decrease of power or abandonment of ideal reaction and relative dimensions. When carried to the extremes usual with vertical units, it results in inefficiently high reaction and reduced area of discharge, unfavorably abrupt changes of direction in buckets, and a wastefully distorted and overworked wheel. To such an extent is this distortion carried to meet especial conditions that it is rare to find a high-head turbine possessing nearly the efficiency or durability possible if correctly proportioned. In the present case the speed selected permits almost exact "normal" reaction and ideal proportions without sacrifice at the generator.

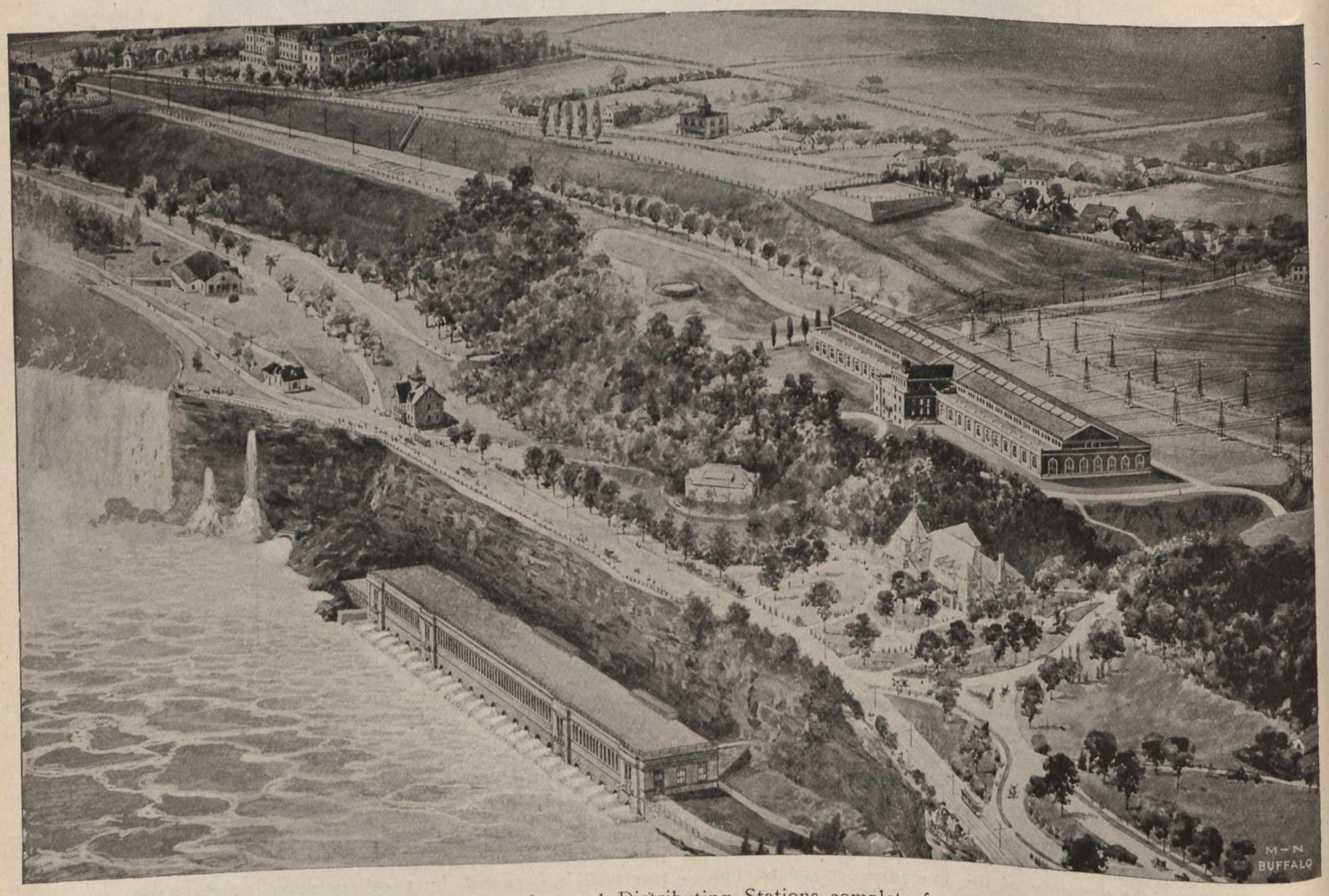
Gratifying accessibility has been obtained by compact arrangement of generators and turbines, with ample clearances and good light, upon the main floor of the station and in full sight not only of the immediate attendant, but also of the chief operator from his post upon the gallery above. As explained, the entire gate-rigging is external; therefore accessible for lubrication, adjustment or repair. Excepting runners and gates, every moving part is in plain sight, and, by the ready removal of a single ring, even the guides themselves are exposed for cleaning or replacing. This arrangement, in strong contrast with that of the vertical type, with its several floors, intervening stairs and dark corners, will, it is believed, appeal to every power-house operator.

In the general arrangement of the works, symmetry and centralization of control are predominant characteristics. The generating and distributing stations are parallel, and nearly 600 feet apart, with 260 feet difference in elevation. On account of limited space the generating station is but 76 feet wide, though when completed it will be nearly 1,000 feet long. Down the centre of this building, side by side in a single row, stand the generating units with turbines next their source of supply. The space between them and the rear wall is occupied by a gallery upon which stands the row of oil-pressure governors, each almost over the end bearing of its turbine.





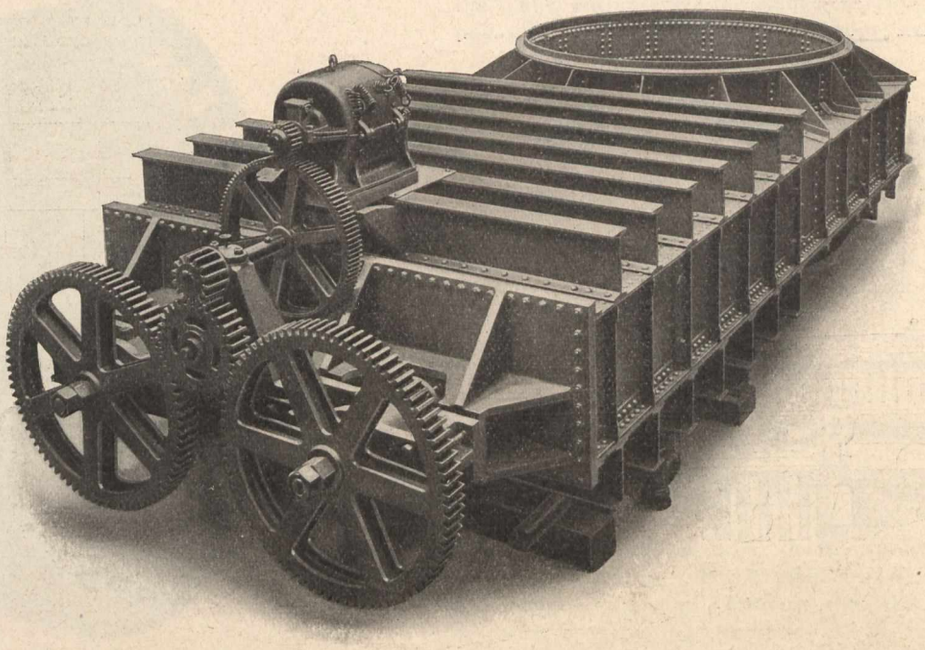
Main Conduit During Construction.



Bird's-eye View, showing Generating and Distributing Stations complete for 200,000 Horse-power.

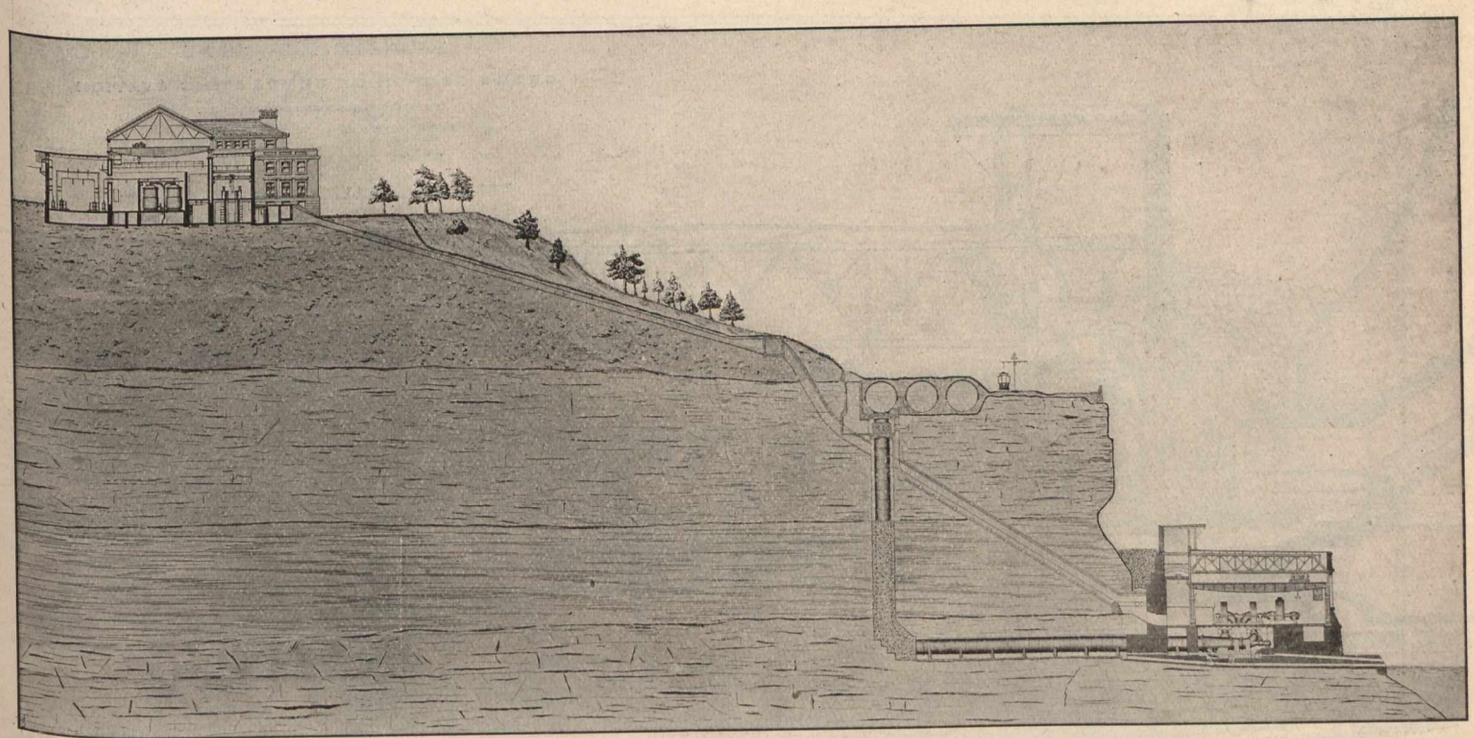
The distributing station, wider and shorter than the power-house, is divided into three longitudinal bays, or five main sections. The narrow front bay contains the switches, bus-bars, etc., at generator pressure; the wider rear bay contains those at transmission pressure. Between these stretches the main middle bay, divided transversely by a three-floor switchboard section into two long transformer-rooms. The projecting central section provides space for the operating offices. Along the centre of these two rooms the transformers stand in groups of three, corresponding in position and capacity to their respective generators. Thus similar apparatus is arranged in rows parallel one with another and with the generating units.

formers. They do not converge for the accommodation of switchboard at one or more centres where congestion prevents separation or adequate insulation, and in many installations causes the most disastrous accidents. On the contrary, they are laid quite regardless of switchboard, the switches and instrument transformers of which are then placed as required by the cables.



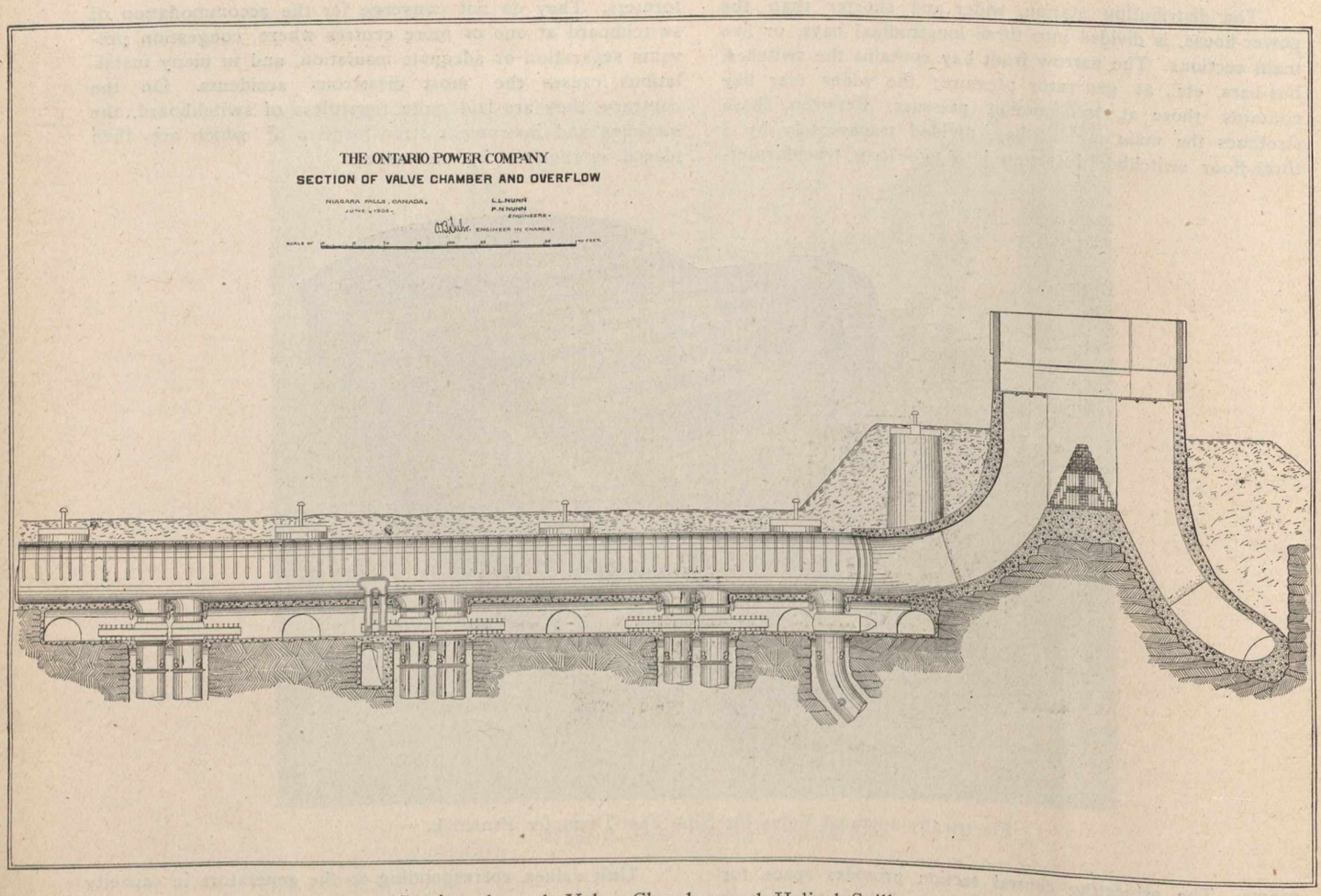
Electrically-operated Valve for Nine Feet Diameter Penstock.

Unit values, corresponding to the generators in capacity and position, are maintained throughout. Thus each generating unit has its individual cables, switches and switchboard, section of bus-bars, transformers, interrupters, and high-pressure switches complete to the transmission, enabling independent operation as an isolated power-plant,

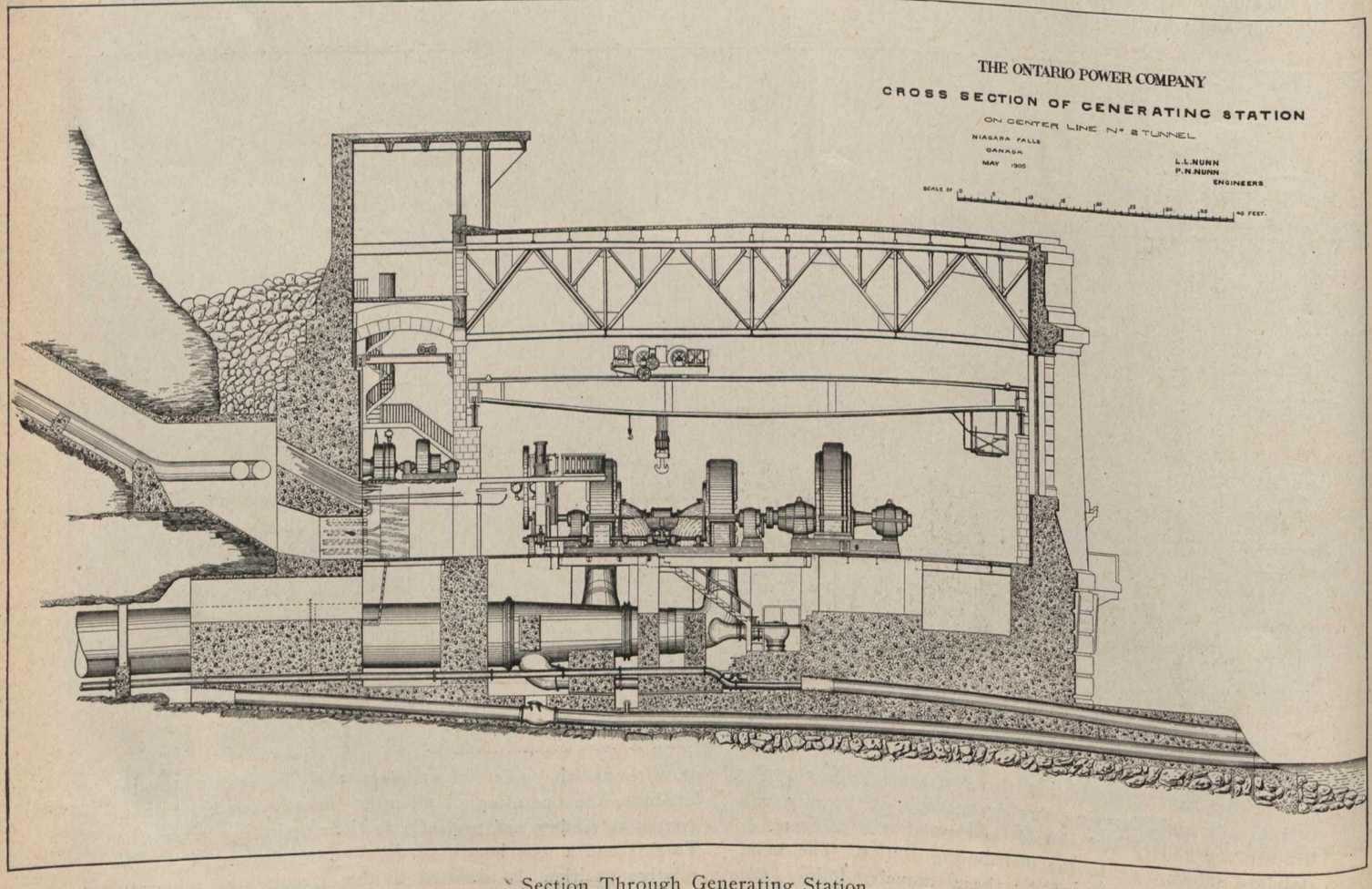


Section through Generating and Distributing Stations.

At the generating station three inclined cable tunnels, one already built, carrying clay ducts, begin at the rear wall beneath the gallery and extend up through the cliff and, as standard subway, on to the distributing station. The main cables, except as diverted by these tunnels, follow the shortest and most direct routes from generators to transformer, through the selector switches and duplicate sectional bus-bars, the operation of all units in any combination of groups as readily and perfectly as their operation in parallel. To this end a unit length of distributing station of similar relative position is devoted to the circuit and apparatus corresponding to each generator.

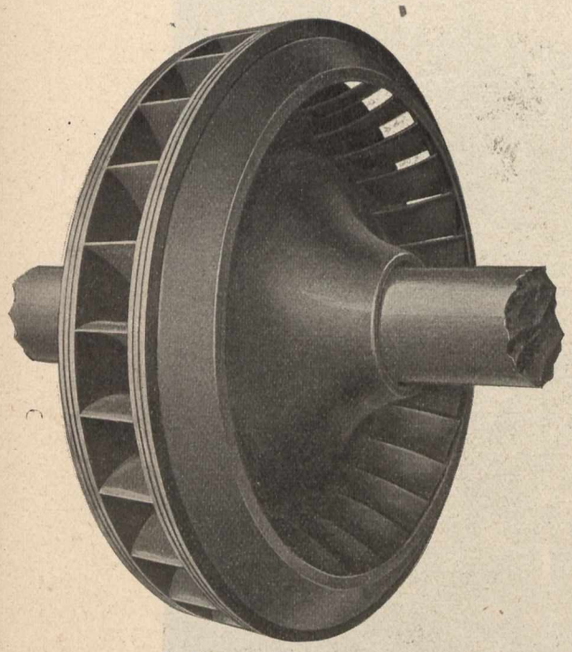


Section through Valve Chamber and Helical Spillway.



Section Through Generating Station.

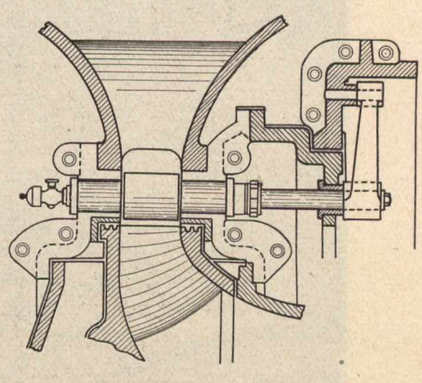
From the above it may be seen that the arrangement is in parallel courses; that like apparatus is arranged in rows or courses parallel with the long axis of the generating and distributing stations; that the main circuits and the unlike apparatus performing the successive functions of these circuits form twenty-two courses transverse to the



A Turbine Runner.

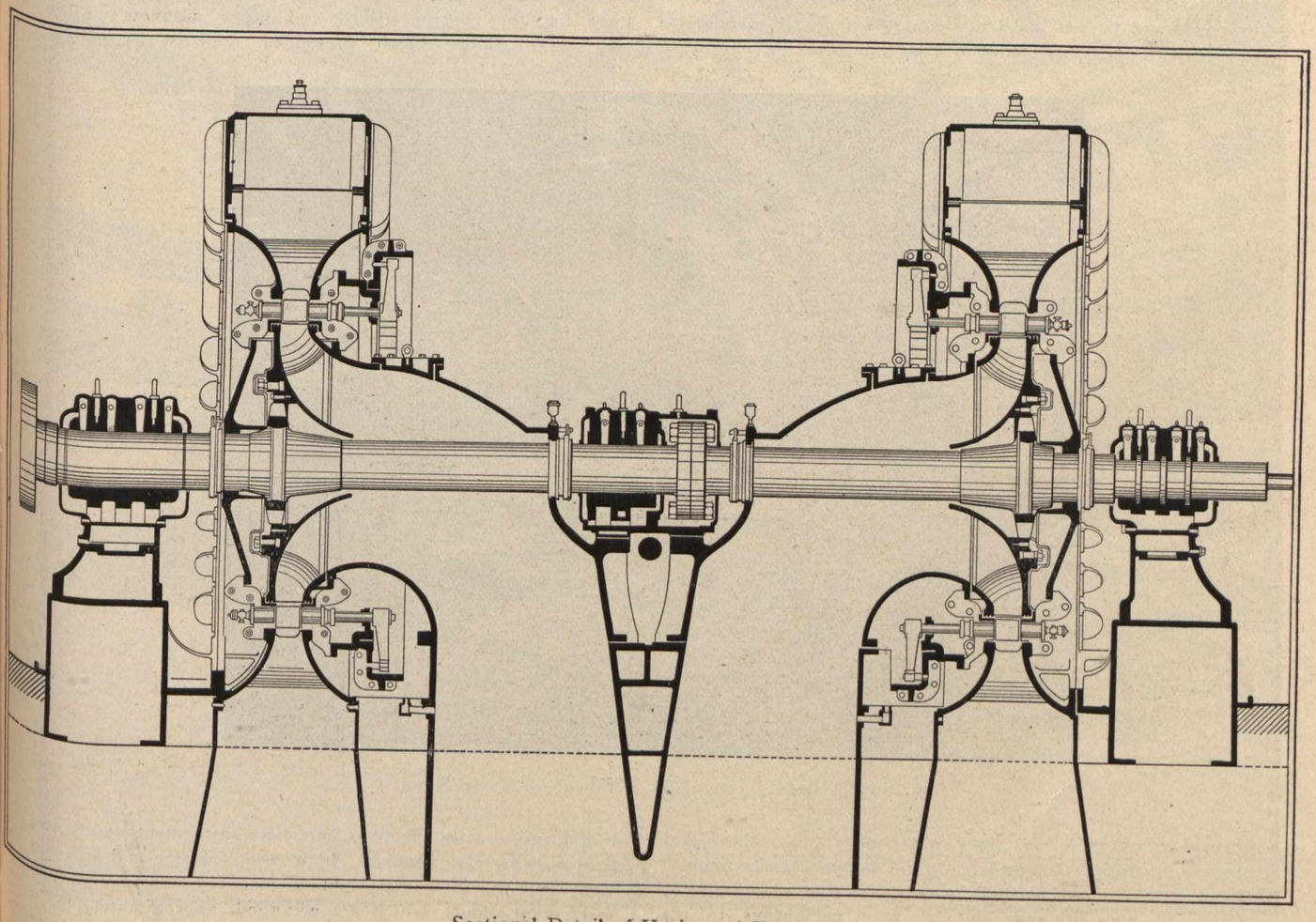
same, and that the courses of the two directions form, as it were, a rectangular or checker-board figure covering an area nearly 1,000 feet square. The arrangement of these courses in logical sequence provides the short and direct route for the main cables previously mentioned. Such symmetry of arrangement, while difficult to attain in a crowded plant or at points of congestion, is of marked value in emergency, especially in a plant of many units, and becomes vital when the units are of such dimensions that the accidental crippling of one costs the output of many smaller plants.

Where the cable tunnels commence, the power-house and gallery are widened toward the cliff. Immediately above the tunnel entrance are the main generator switches, and on one side the duplicate turbine-driven exciters and their



Operating Mechanism of Turbine Gate.

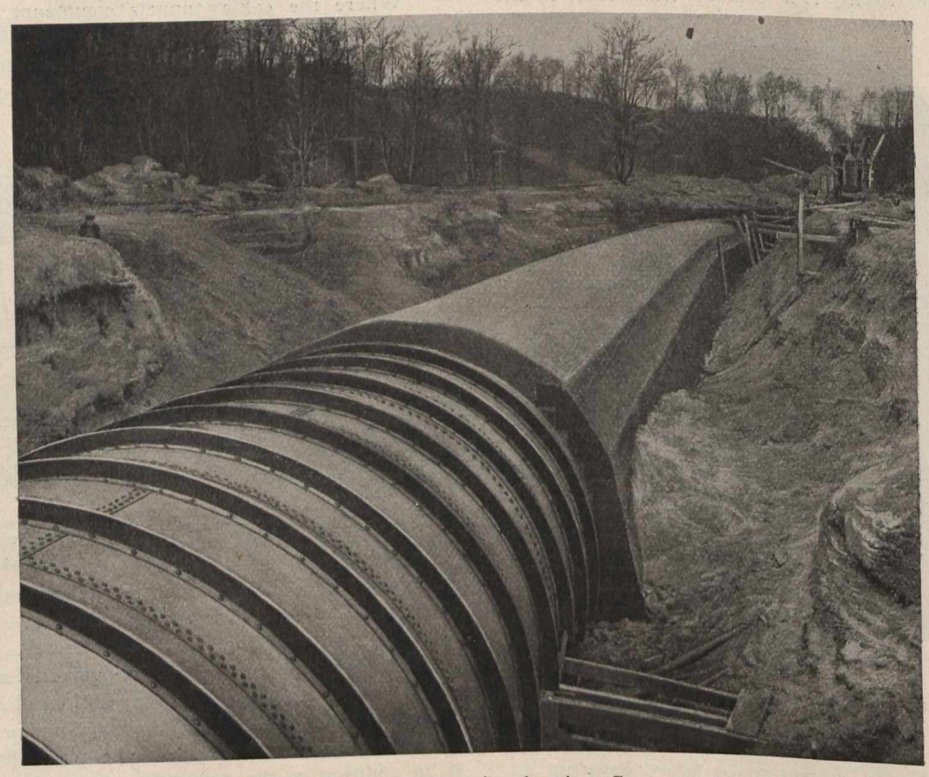
governors, and on the other the motor-actuated main field rheostats. In front of the switches are a few panels of switchboard carrying exciter rheostats and switches, controls for actuating penstock valves, and the necessary circuits and apparatus for a limited local distribution. Relief valves and small drainage-pumps are the only operating machinery beneath the main floor, while upon it, in addition to the generating units, there are only duplicate electrically-driven pumps supplying the storage tank and transformer cooling coils at the distributing station. For air circulation and ventilation and to avoid dampness from spray as well as to ensure cool generators in hot



Sectional Detail of Horizontal Turbine.

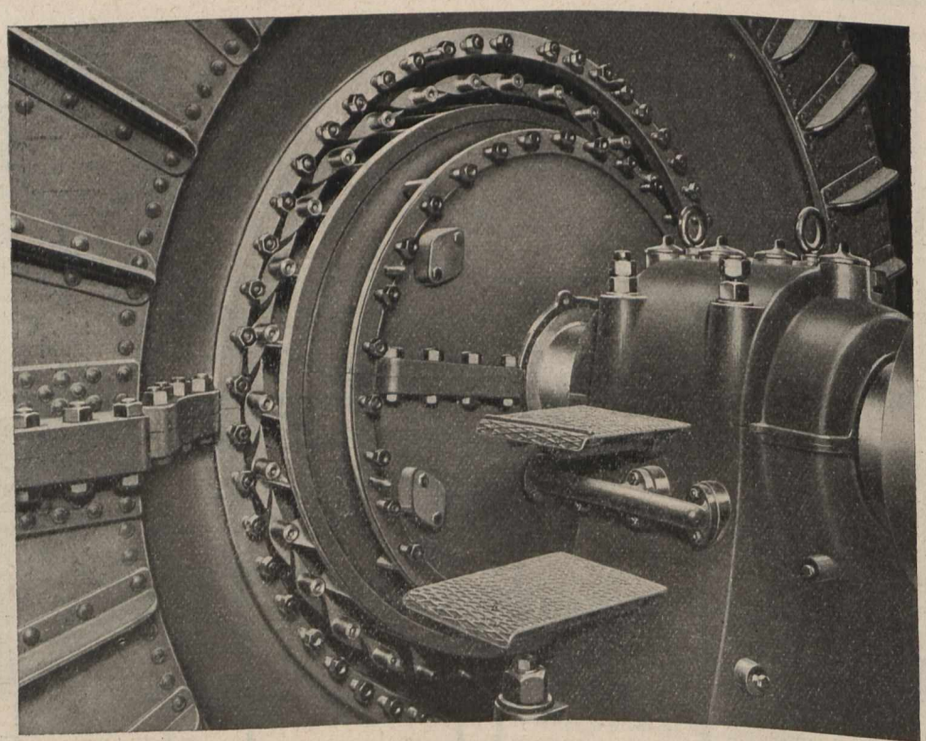
weather, a cold air supply to each generator is provided from a sub-floor chamber communicating with external shafts and heated air escapes through large roof ventilators.

At the distributing station the low-pressure bay contains upon the main floor the 12,000 volt automatic oil



Eighteen-foot Diameter Conduit, showing Concrete Envelope.

circuit-breakers in double column, and in the chamber beneath only the sectional duplicate bus-bars and their immediate connections. In the transformer-rooms the transformers stand in pits six feet below main floor level, and parallel with them adjacent to the high-pressure bay are



Swivel Gate Exposed by Removal of Cover Ring.

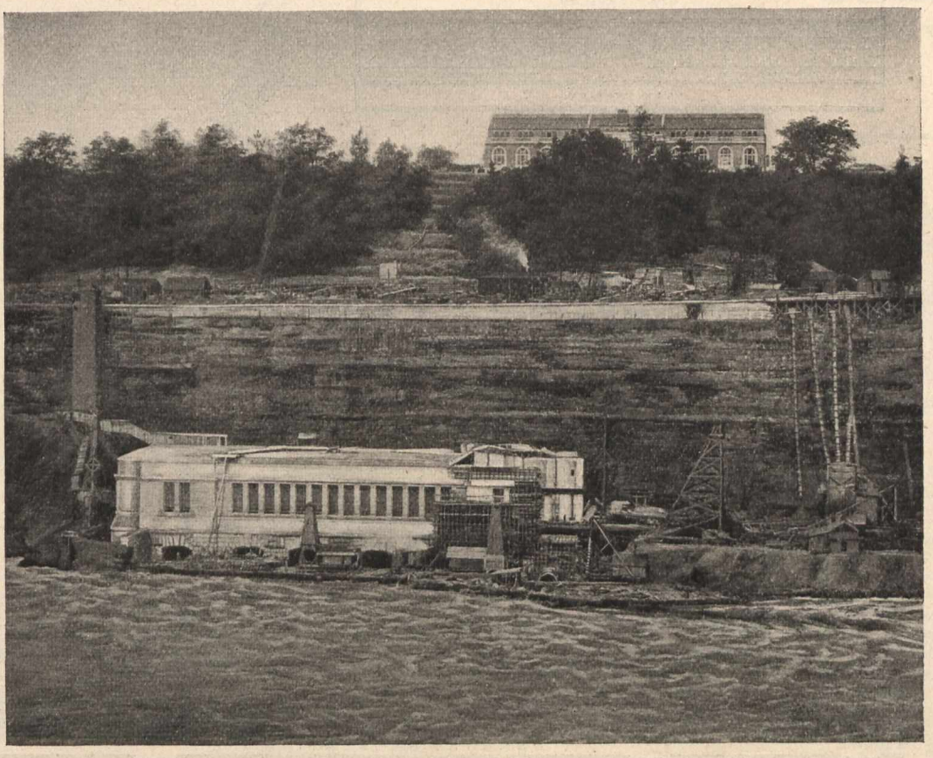
corresponding pits for static interrupters or other protective apparatus. Beneath both and between their foundations are accommodated the several systems of piping for water, oil and drainage and the main cable-ways to the transformers above. Each transformer is fitted with a

record-making thermometer giving the continuous history of internal economy.

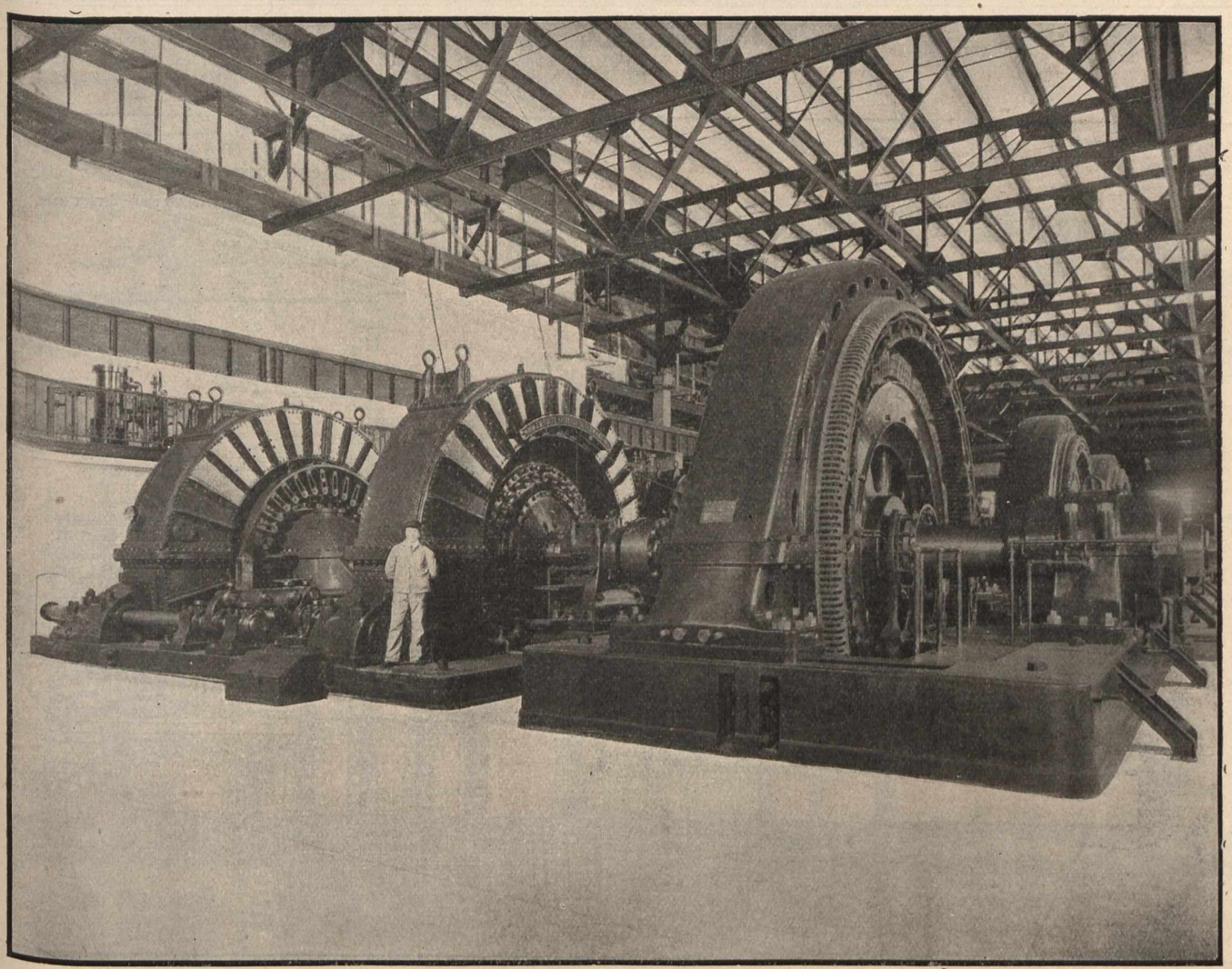
The switchboard section, occupying the centre of the distributing station has four floors, of which the basement serves as a centre for the piping systems, and gives room for conduits and cableways for wiring. On the main and the mezzanine or gallery floors, marble slabs carry record-making and integrating instruments, terminal boards with fuses for the control cables, and other adjuncts of the switchboard above. Upon the upper floor is the switchboard and control chamber, and here instrument-stands and control-pedestals supplant both the conventional marble slabs and the later bench-board. Each of the twenty-two instrument-stands, which are arranged approximately in a semicircle about a central point, corresponds to a definite

unit, carries nine indicating instruments, and faces its twelve-point control pedestal. Doors upon the four sides lead to balconies in the four other divisions of the building of which this room is the centre; those at the sides to balconies extending the full length of the transformer-rooms.

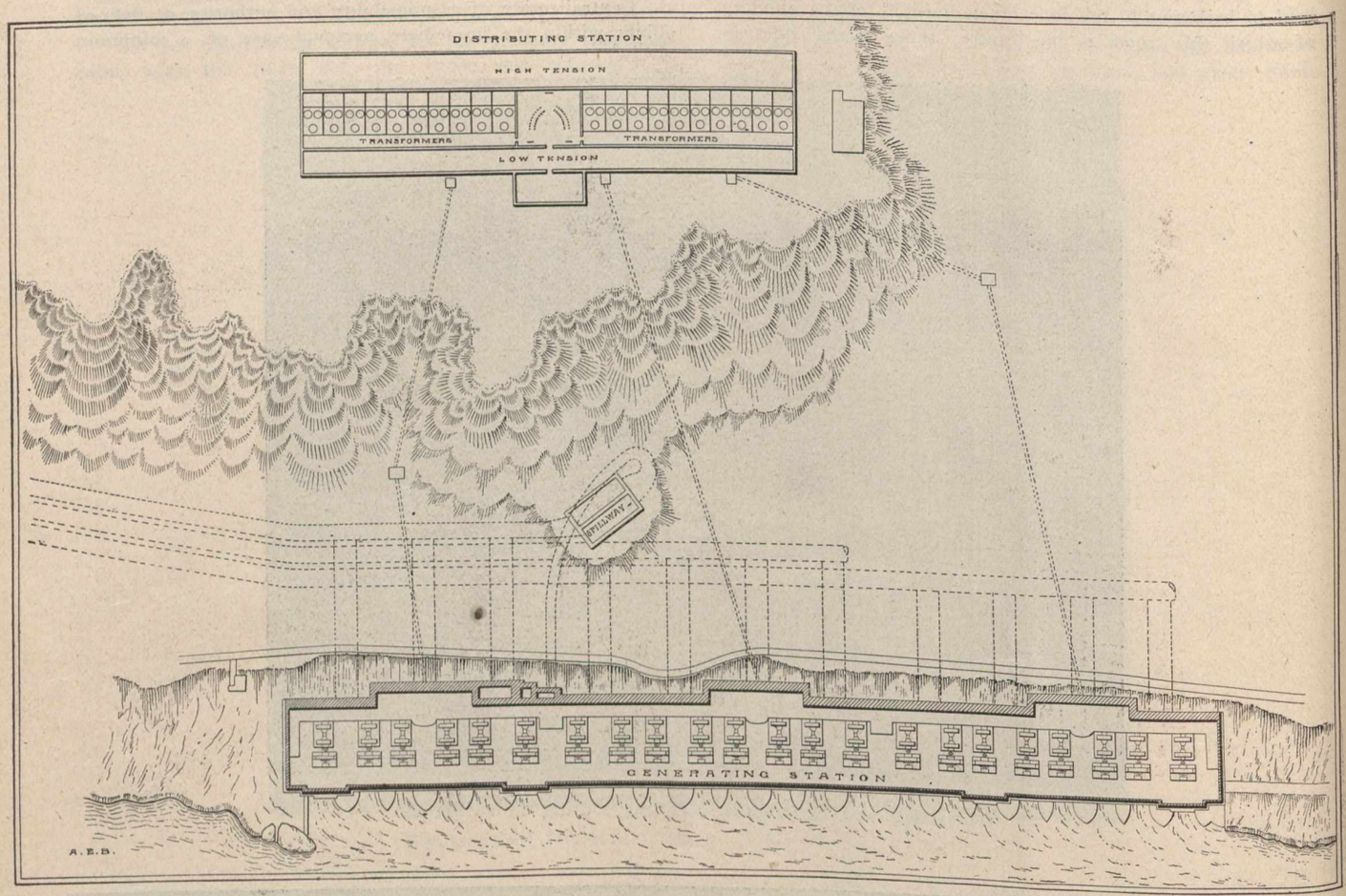
Centralization of responsibility and authority, at defined points within the immediate personal care of a minimum



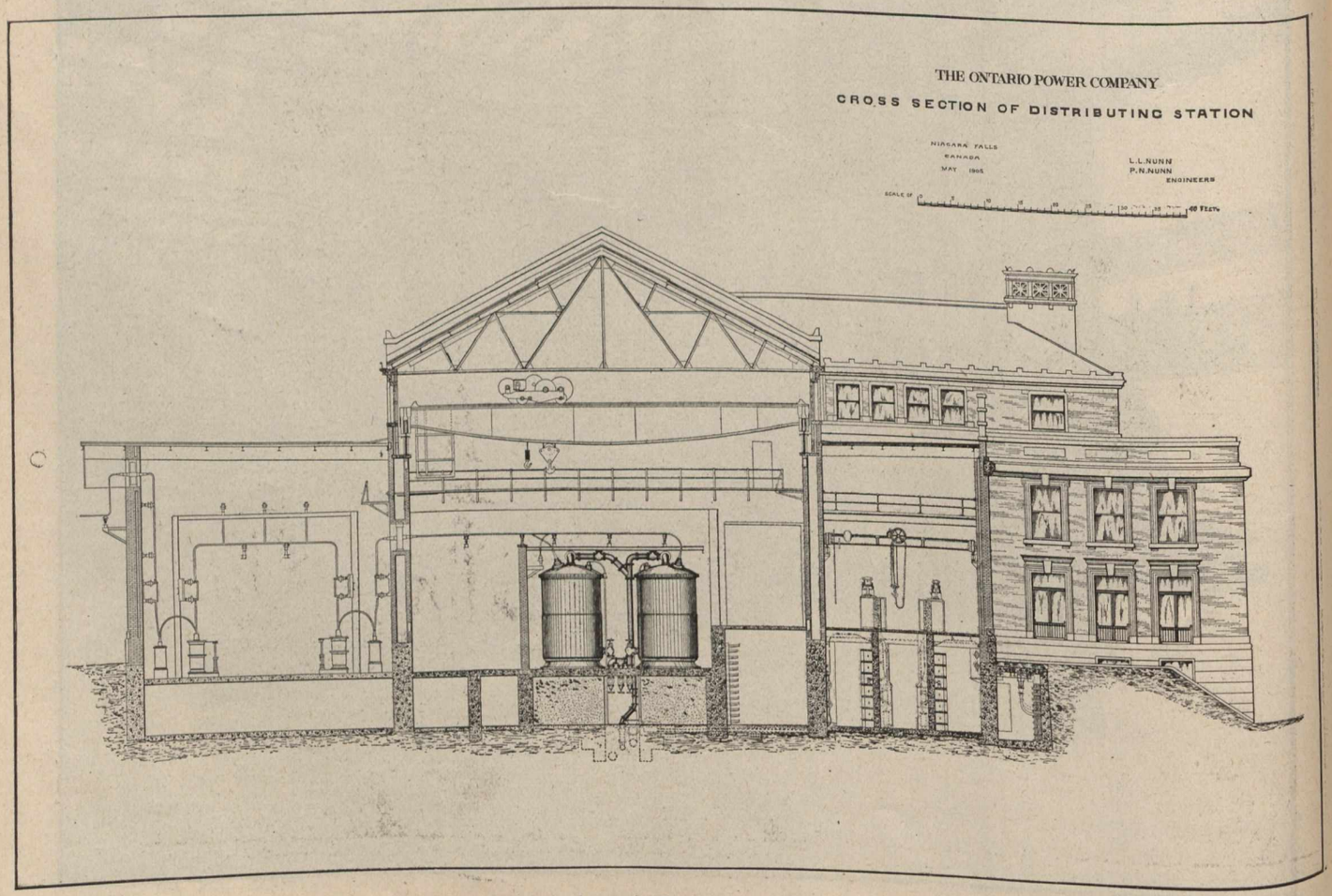
Generating and Distributing Stations During Construction.



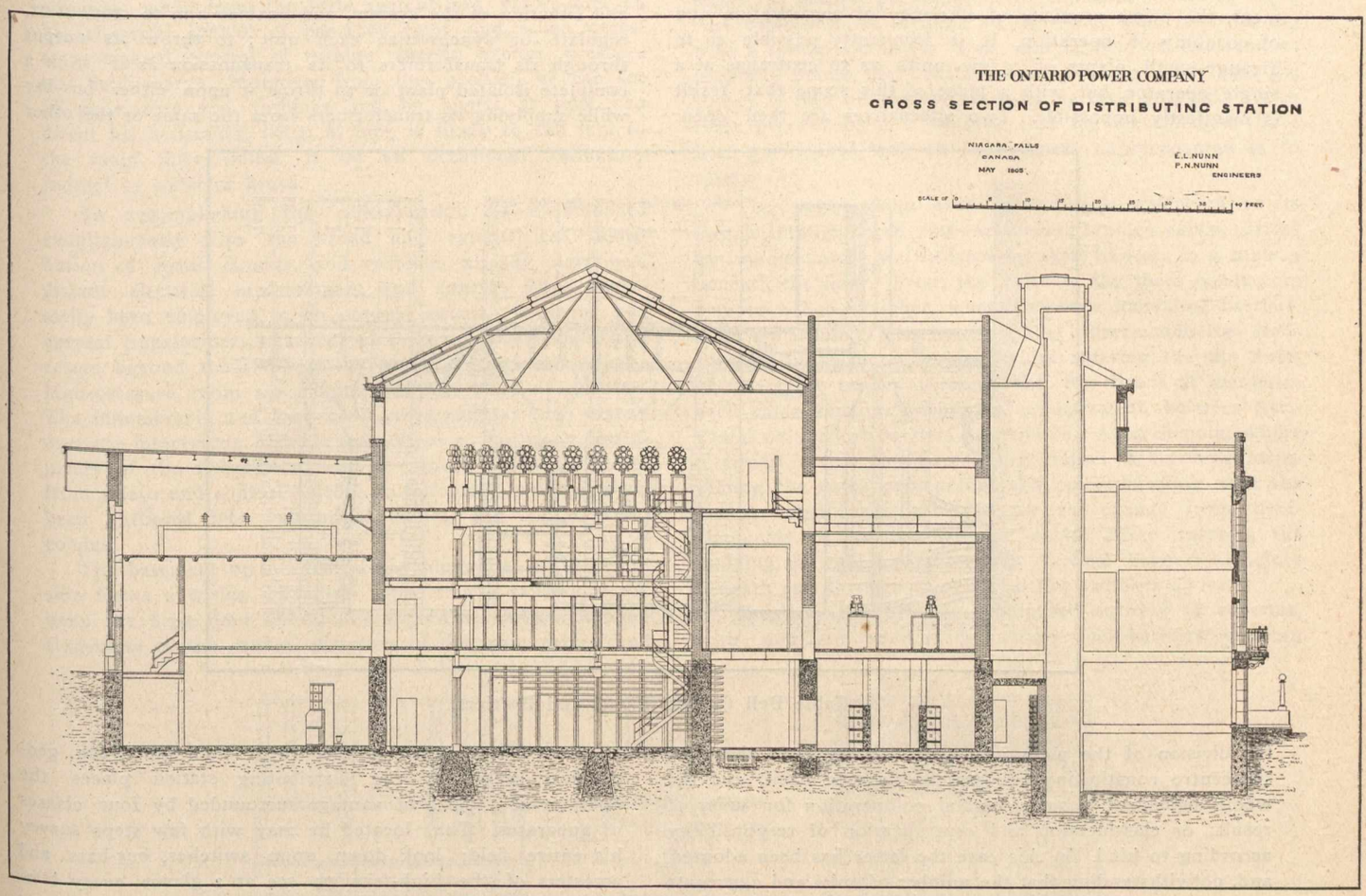
Interior of Generating Station.



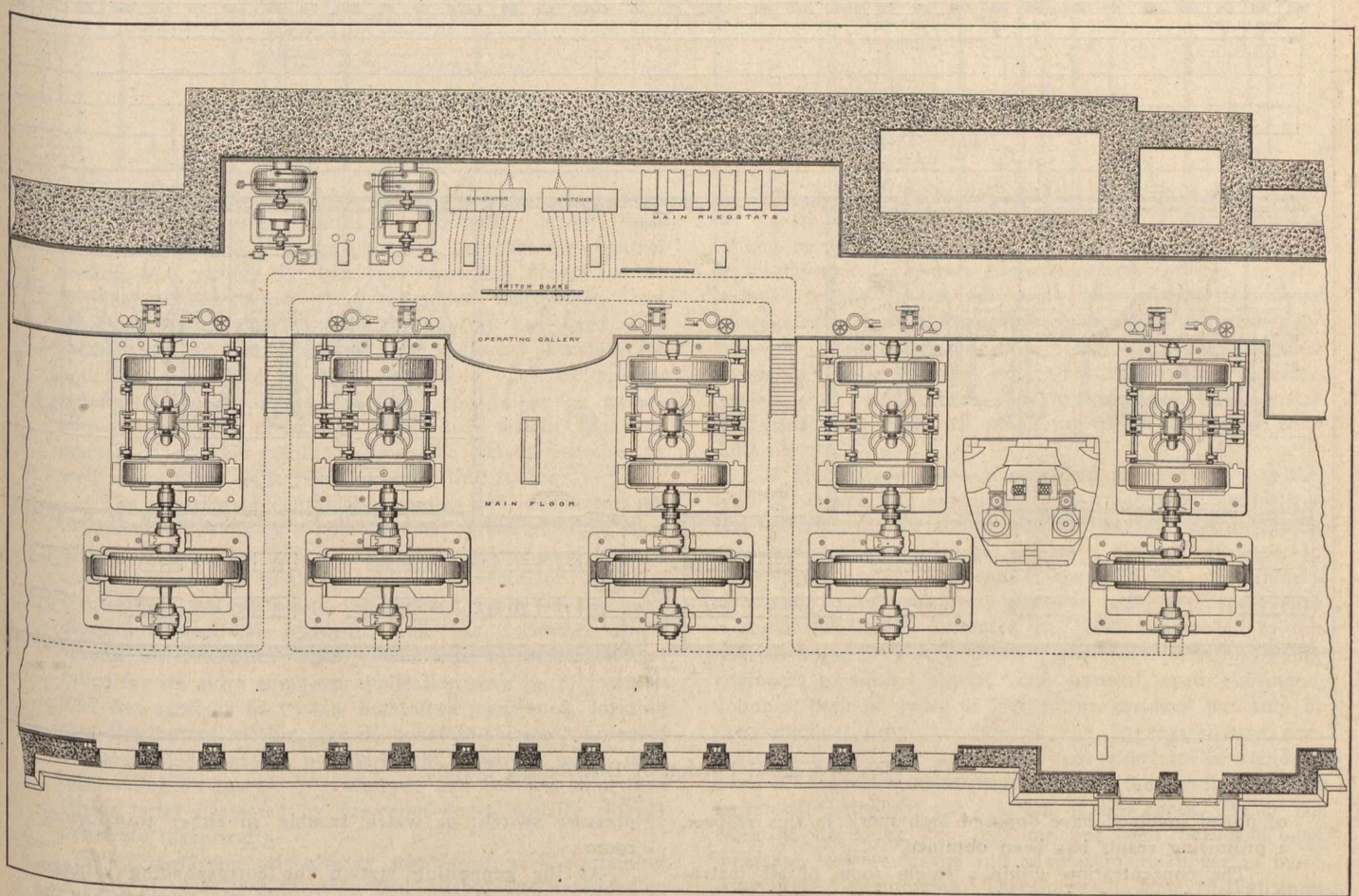
Plan of Electrical Works.



Section through Transformer Room.

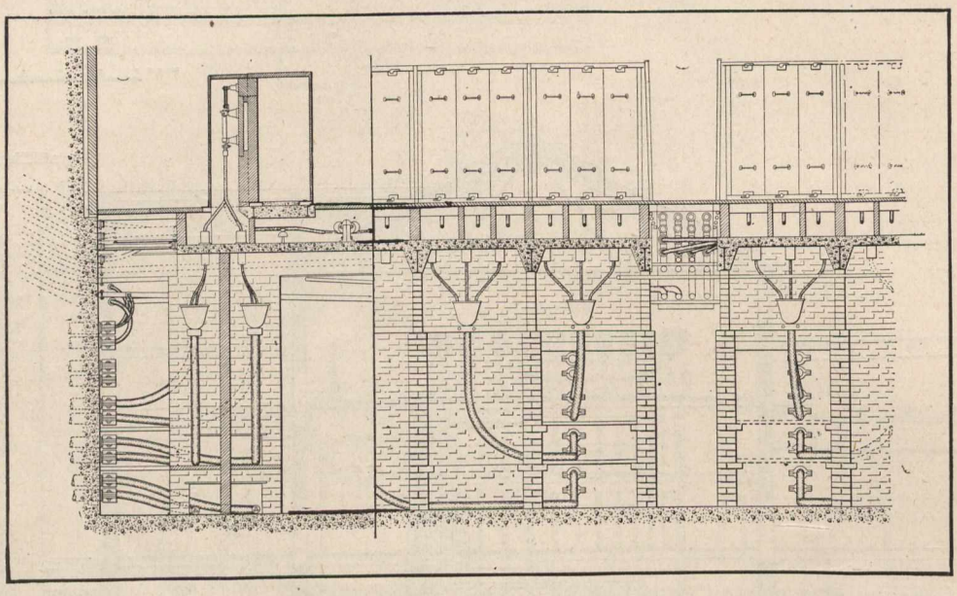


Section through Control Chamber.



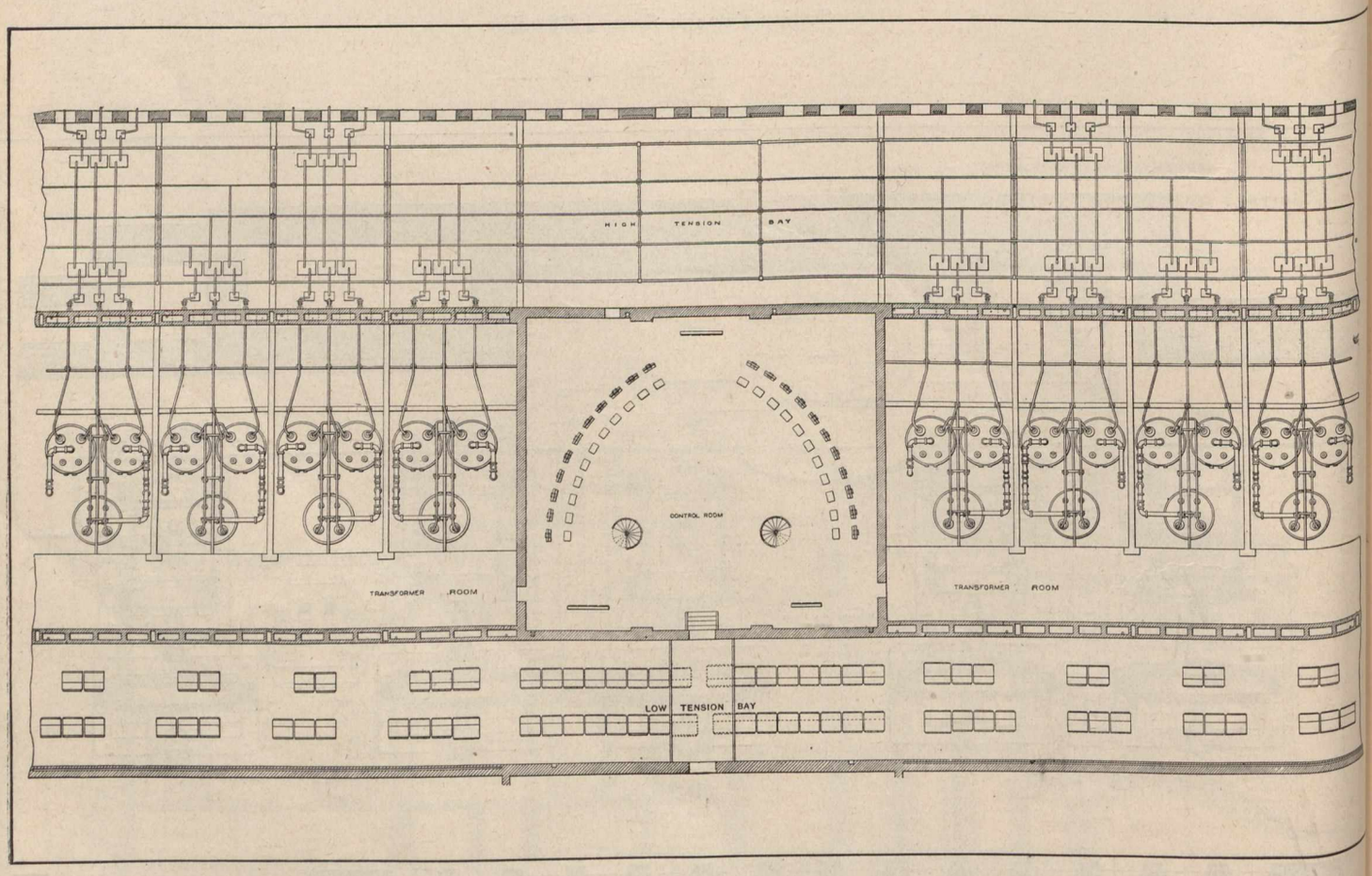
Plan of Generating Station, Units 2 to 6.

number of chief operators, is, next to simplicity of arrangement, the prime requisite of efficiency of organization and of economy of operation. It is frequently possible so to arrange small plants of a few units as to centralize at a single operator, but with a plant of this scope that result is manifestly impossible. Two alternatives are then open: the division of the plant into several parts, each about its sub-centre constituting a complete plant in itself, and the whole dependent upon successful co-operation for unity of result; or classification and centralization of responsibility according to kind. In this case the latter has been adopted, and, notwithstanding that the number of units and aggregate of power involved have opposed high merit in this respect, a promising result has been obtained.



Cable Bell Compartments and Barriers.

The concentration within a single room of all instruments and control—the brain of electrical operation—provides the operator in a quiet and secluded place both full information and perfect control of every electrical circuit and situation of the system, and enables him to stop, start, regulate or synchronize each unit; to throw its output through its transformers to its transmission as if from a complete isolated plant or to throw it upon either bus-bar while supplying its transformers from the same or the other bus-bar. The location of this room high up at the geometrical centre of the distributing station places the operator at a point of vantage surrounded by four classes of apparatus. Thus located he may with few steps survey his entire field; look down upon switches, bus-bars and arresters of the high-tension; see at a glance every low-pressure switch; or watch trouble in either transformer-room.



Plan of Central Portion of Distributing Station.

At the generating station the corresponding vantage-point is the gallery, where on one side the operator has the motor-driven rheostats and a few paces distant the com-

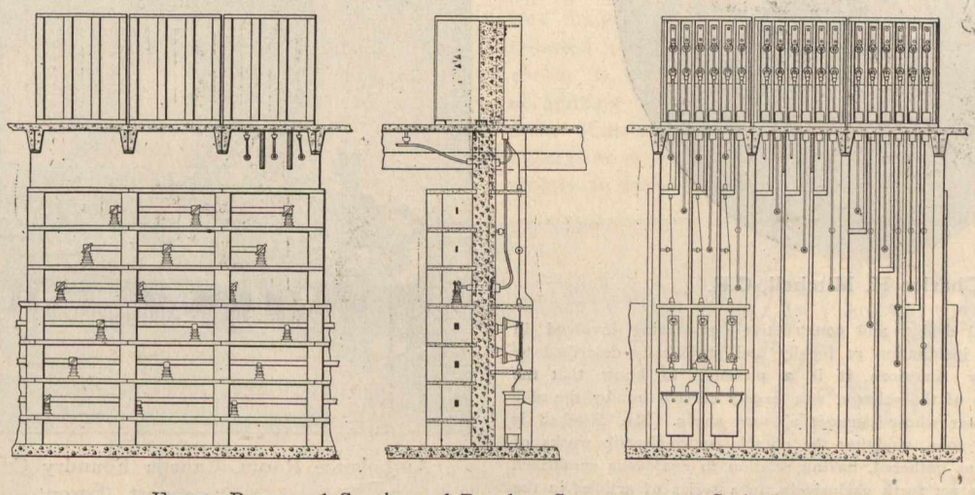
mutators and governors of the exciters, and on the other side in plain sight the row of main governors with their adjuncts; while from the little switchboard before him he has electrical control of penstock gates, and, when necessary, manual control of turbine speeds, exciter pressure and field charge. Moreover from this position he can see all generators and turbines, and, by signal, at least, can direct his assistants; little, in fact, is likely to call him to the main floor unless it be an occasional refractory journal or collector brush.

In accomplishing the centralization of switchboard simultaneously with the broad and symmetrical distribution of main circuits and switches already described, distant electrical measurement and control have necessarily been employed to an unusual extent. Pressure and current transformers, essential to the many instruments and relays beyond those neccessary at generating station and high-pressure room are mounted in the bus-bar chamber. The innumerable and long conductors, necessary to extend over the intervening distance from those to the many instruments of the switchboard and to convey back the power from relays and control buttons to automatic switches have been gathered into substantial cables and laid in metal conduit.

The basement of the central bay along its low-pressure side forms a wiring chamber supporting a railway track upon the main floor above. Through this wiring chamber transverse to the general direction of the main cables and a height of 23 feet by masonry fire-walls. Each individual transformer is in a boiler-iron casing designed to withstand 150 pounds per square inch explosive pressure. Each case communicates through an eight-inch pipe from its top with a special drain for free vent in case of accident, as proposed before the Institute some time ago; but here the supply is cold oil instead of water as then proposed. With these precautions it is believed that the transformers have been surrounded with an environment unprecedented as to safety.

The power from each generator is conducted to its switch through three single-conductor braided cables carried by line insulators and isolated by shelf barriers in a subway beneath the floor. From the switches the three conductors pass to a bell chamber, where, between individual barriers, they are united into two parallel three-conductor lead-covered and armored cables before entering the tile ducts of the cable tunnel. Around the few bends at manholes each cable remains within its compartment, between horizontal or vertical barriers as required. At each point where a circuit enters the distributing station, a manhole maintaining the same segregation and communicating with the bus-bar chamber is provided for the change from three-conductor to single-conductor cable. After entering the building the cables pass between vertical barriers as before beneath and through the floor to the switches above.

Bus-bar structures are composed entirely of concrete, with mortised reinforced-concrete shelf-barriers between



Front, Rear and Section of Bus-bar Structure and Switches.

opening at its centre into the control section, these cables and those for both continuous and alternating current local service are carried into the basement beneath the control section, and, rising through the recording floors, end at terminal boards below their respective instruments and relays. Carried thus far, distant control has been still futther applied by the use of motor-driven rheostats for both generators and exciters, electrically operated circuit-breakers for field circuits, and speed controllers for governors whereby, as previously mentioned, turbines may be started, stopped or regulated from the control chamber as well as from the gallery at the generating station.

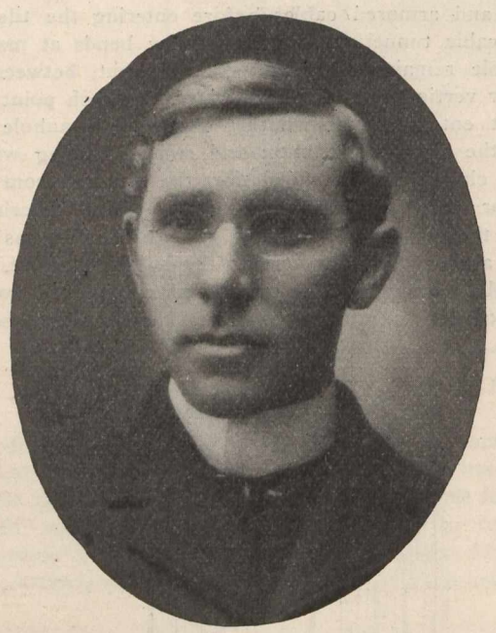
The isolation of electrical apparatus and conductors by incombustible walls or barriers against spread of oil or arcs, for protection from fire and from each other, is of importance proportional to the power and investment involved. Neglect of this precaution has caused many of the most disastrous electrical accidents, and has recently taught several bitter lessons. Some rather extreme measures here taken for its more complete application may be of interest. The five sections or rooms, heretofore mentioned, forming the distributing station, are of concrete-and-steel fireproof construction, separated by full-height masonry walls, with intervening air-spaces. No windows and but few doorways (these latter protected by fire-proof doors, usually closed) penetrate these walls.

The transformer pits already mentioned, each containing a bank of three transformers, are isolated and extended to bus-bars. Connecting leads pass through the wall forming the centre of the structure, and thence in compartments formed by vertical barriers of the same material, directly up to the switches above. Instrument transformers are also installed within similar individual compartments, and these whole structures, like those of the switches, are closed by fireproof doors. Control cables are laid in metal conduit throughout their courses except in the wiring chamber beneath the track, where they are arranged upon metal shelf-pans filled with dry sand into which connecting conduits dip.

Of the features here presented, it is believed that the type of intake, the symmetry of arrangement, centralization of control, and almost perfect isolation of apparatus represent, to some degree at least, distinct advances in power-plant design; and, while few works of such dimensions may be built for many years, if ever, the purposes and methods thus briefly presented may, until superseded by the next advance, be of service as suggestions to other designing engineers of simil-- works. The unusual, even enormous, volumes, both of water and of power, involved not only in the individual units, but also in the aggregate, have presented new problems heretofore unprovided for in standard sizes of apparatus, thus necessitating the development of larger capacities and the creation of new types. Hence the work of designing and building has been burdened with incessant test, re-design and adaptation unknown in more conventional engineering. Therefore, it is believed that upon

no similar work in this country, since that of the Niagara Falls Power Company years ago in the infancy of electrical power, has devolved such a burden of investigation, invention and original design.

It has been suggested by an officer of the Institute that any account of this work would be incomplete without mention of those mainly responsible for it. Justice to all is here impossible, but a few may be named. Mr. O. B. Suhr has from the beginning been in charge of the engineer corps, and to him is largely due the harmony of design. Mr. V. G. Converse, Mr. C. H. Mitchell, and Mr. J. B. Bailey are chiefs of the electrical, mcehanical and field departments respectively, and Mr. J. R. Harsch of the clerical work of the engineers.

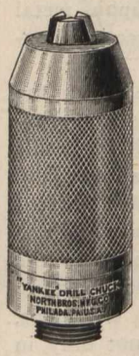


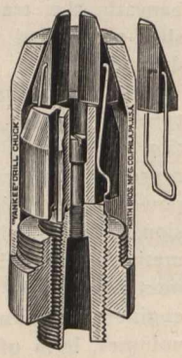
Charles H. Mitchell, C.E.

While the original design and constructive engineering involved in the really magnificent installation so lucidly and graphically described by Mr. Nunn, was purely American, it is a pleasure to know that the *mechanical* engineering of the scheme, was largely carried out by the able young Canadian engineer whose portrait appears above. Mr. Mitchell is now on a six months' tour, studying the notable hydro-electric works of Europe. The data thus gathered, having relation to analogous conditions in this country, will be set forth exclusively, in a series of articles in the columns of "The Canadian Engineer."

DRILL-CHUCK IMPROVEMENT.

The drill-chuck, as illustrated below, was designed to meet the demand for a tool-holder which can be adjusted by hand. It is accurate, durable, and guaranteed to hold true; is compact, strong, well proportioned, and of simple construction. The body is made of the best grade





machinery steel, while the jaws are made of drill-rod steel, not liable to break. In hard service this chuck is very efficient, and will practically hold a drill as tight after long and continued use as it did when new. It is especially adapted for light and rapid drilling where accuracy is required. North Bros. Manufacturing Co., Philadelphia, are placing this valuable little tool on the market.

FIRST AID TO THE INJURED.

In our January issue we described very fully the latest first aid methods in treating persons shocked by electricity. Through the interest of Mr. Gray, first aid superintendent at the above works, we are enabled to give an illustration of local class practice in connection with the very efficient system in vogue at Davenport. Mr. Gray—who stands third near the wall to the left—is conducting exercises in (1) the recognition and treatment of shock, (2) applying temporary splints to broken limbs, (3) controlling severe hemorrhage, (4) different methods of inducing artificial respiration.

The organization of the first aid corps is carried out with almost military precision. In each department of the works, including the office staff, one or more men have been selected, and given a course of lectures by the works doctor. Upon passing an examination in the theory and practice of first aid, they are each entitled to wear a Red Cross Badge, which is worn on the left arm during working hours; thus making it an easy matter to locate them in case of accident. When an accident takes place, the first aid men in the department where it occurs, take the injured person to the ambulance room, where they straightway attend to him, and at once send for the doctor if deemed necessary.

Ambulance Room, Canada Foundry Company's Works, Davenport, Toronto.

The following is a list of appliances and material in the ambulance room; which are furnished by the company, and are free of access to members of the corps only:

Operating table.	Hot water bags.
Stretcher.	Hospital bed.

Instruments for performing minor operations:

Forceps.	Scissors.
Needle holders.	Tourniquets.
Needles.	Scalpels.

Ligatures (silk and silk worm gut).

Solutions for dressing and antiseptic purposes:

Carbolic acid.	Boracic acid.
Picric acid.	

Evaporating lotions:

Alcohol.

Material for dressing wounds:

Antiseptic gauze.	Collodion.
Absorbent cotton.	Cocaine solution.
Bandages.	Green soap.
Antiseptic powders.	Adhesive plaster.

Severe illnesses and even deaths have been prevented by these humane Red Cross organizations, and to our knowledge much good has been accomplished by this famous foundry company's corps. Both the staff and the company are to be congratulated on their noble work.

Every industrial establishment of magnitude in Canada should have an efficient ambulance corps.

DESCRIPTIVE METALLURGY OF IRON AND STEEL

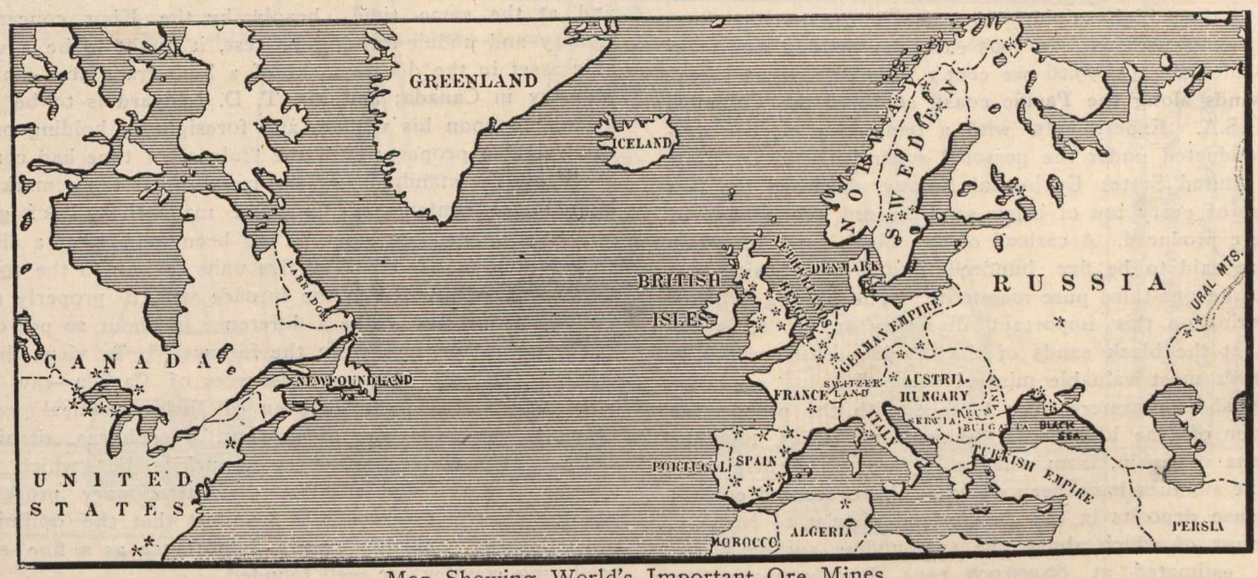
BY SAMUEL GROVES.

III.

ORES OF COMMERCE.

At the present time (January, 1906), five great iron ore producing centres furnish more than three-fourths of the world's supply, viz., Lake Superior district, U.S.A.; Spain, of which Bilboa Province is the most important; England, chiefly in the Cleveland district of Yorkshire; Swedish Lapland, and the Minette region of Germany and France, comprising Luxemburg, the adjacent portions of Lorraine, and the department of Meurthe-et-Moselle. Russia for the time being* has ceased to count. The following is a reliable† estimate of the world's workable ore deposits and the present annual production, consumption and exportation:

	Workable Ore fields Million Tons.	Present Annual Output Million Tons.	Present Annual Home Consumption Million Tons.	Present Annual Exportation Million Tons.
United States	1,100	35	35	..
Great Britain	1,000	14	20	..
Germany	2,200	21	24	2
Spain	500	8	1	7
Russia and Finland.	1,500	4	6	2
France	1,500	6	8	..
Sweden	1,000	4	1	3
Austria-Hungary ...	1,200	3	4	..
Other countries	..	5	1	2
Totals	10,000	100	100	16



Map Showing World's Important Ore Mines.

*Stars indicate locations.

* Revolution.

† Report of Professor Törnebohm,—chief of the Swedish Geographical Survey,—to the Swedish Government in 1905.

Having taken this generalized view, we can now descend to particulars.

Ore may be defined as **a mineral or rock from which metalliferous matter of economic value can be extracted at a profit.**

The compounds which constitute the chief iron ores of commerce exist in nature as **oxides**; that is, the iron (Fe) is chemically combined with oxygen, together with an admixture of mineral matter—lime, alumina, magnesia, silica, carbonic acid, phosphoric acid, bisulphide of iron, manganese, etc., and is found in geological strata of the earth, either in rock formation, kidney-shaped lumps, soft, pulverized layers, or as crystalline grains in beds of drift sand. The mineral matter associated with the oxide of iron in the ore is known as **gangue**; and the larger part of the metallurgical process—converting the ore from a mineral condition into a metallic state—consists in getting rid of this extraneous earthy material.

The iron ores in use commercially may be classified as follows:

Oxides.	Hydrates.	Carbonates.
Magnetite	Brown hæmatite	Spathic.
		Clayband.
Red hæmatite		Blackband.

Let us consider briefly the chemical constitution, physical properties, source and use of these ores in the logical order of their iron contents.

Magnetite.

Magnetic iron ore, or magnetite ($Fe_3 O_4$) contains in its pure state 72.41 per cent. of iron and 27.59 per cent. oxygen. It is the richest of all ores. In pre-scientific days this ore was popularly known as "loadstone," meaning "leading stone," from its power of acting as a magnet; hence the name "magnetite." In the lump form it is generally dense, hard, and comparatively free from the ordinarily adhering metalloids, which accounts for its extensive use in the manufacture of high-class tool steel and fine cutlery; the celebrated Dannemora iron used in Sheffield was made from this ore. Magnetic iron ore is widely distributed over the globe, and is indigenous to the archaic rocks, in which no organic remains are found, thus accounting for its characteristic freedom from phosphorus. It is sometimes found in the shape of dark, iron-grey, cubical or octahedral crystals embedded in slaty rocks, but mostly in massive veins as in Sweden and India.

There was a time when "tonnage" steel-makers, especially in the United States, depreciated and almost despised magnetic iron ores, even though they may be high-grade and otherwise perfect, because it had been found by experience that the hard magnetic ores would not mix satisfactorily with the soft haematite ores in the blast furnace, since they had different fusion levels, and the former needed more fuel to dissociate the gangue and reduce the iron. The United States Steel Corporation shut down all their magnetite mines simply because they could make greater profit out of the more easily reduced and less costly haematites. But recently, the exigencies of competitive trade in high-grade steels has led to the sending out of search parties with dip-needle and stadia into every nook and corner of the earth. Hence, startling discoveries are constantly being announced. One day it is a solid

mountain of iron in Mexico, another it is thousands of millions of tons of magnetic, crystalline grains of iron in the black sands of the Pacific coast, then a wonderful seam of rich "gray" magnetite, thirty feet thick and five miles long, on a mountain range in Talledega county, Alabama. The latest evidence seems to point to Canada as possessing the richest, most extensive and easily accessible resources of magnetite suitable for high-grade steel-making.

For centuries the Dannemora iron ore mines of Sweden have produced the purest magnetic iron ore known to exist, limiting the output to 50,000 tons per annum, and selling at a price almost prohibitory. This magnetite contains on the average about 50 per cent. metallic iron and from 0.0025 to 0.005 phosphorus. It requires very little flux in the blast furnace, since the gangue is principally limestone, the natural flux. These mines have been worked for at least four hundred years. Recently Russia has appeared on the scene as a formidable rival, for the Ural Mountains contain immense beds of magnetic iron ore (60 to 65 per cent.), and practically free from phosphorus. The political disturbances of late on the shores of the Black Sea have, however, not only hindered, but practically stopped this thriving ore trade with Europe and America.

In the Lake Superior region, magnetite is comparatively scarce, the small output being practically limited to one of the Champion mines, and the Michigamme Mine in the Marquette range, Michigan. In the Eastern States, however, these ores are more plentiful, but low-grade and high in sulphur. In 1904 over 1,630,000 tons of low-grade magnetite was mined in the United States, chiefly in the Lake Champlain district of New York State and in New Jersey; and, as the concentrationary, desulphurizing and nodule-forming process of T. C. King, operated by the National Metallurgical Company, Newark Bay, is now in successful operation, there is a likelihood of increased ore mining activity in the latter State, where large deposits of inferior magnetite exist, but which have hitherto been of little commercial value, owing to their high sulphur contents: in the pyrites form as high as 48 per cent. In 1905 extensive beds of rich magnetic oxide ($Fe_3 O_4$ 79.06 per cent.) were discovered in the black sands along the Pacific coast, south of the Columbia river, U.S.A. Experiments with a temporary electric furnace, conducted under the personal supervision of Dr. Day, of the United States Geological Survey, disclosed the fact that out of every ton of black sand treated 683 pounds of iron were produced. A carload of this black sand, of which there are said to be five hundred immense deposits, was found to be one-third pure magnetite. "The Mining World," commenting on this important discovery says: "It is believed that the black sands of the Pacific coast constitute the world's most valuable mineral source."

English ironmasters, face to face with the prospective exhaustion of the high-grade British ore mines, together with those of Spain, from whence of late years their most important supplies have been obtained, have secured control of immense deposits in the Dunderland district of Norway, the amount of which above the surrounding surface level alone is estimated at 80,000,000 tons, largely magnetite, containing 40 to 45 per cent. of iron, and low in phosphorus. This hard ore has to be crushed, magnetically separated, and briquetted. Some $10,000,000 has been spent on the enterprise already, and the whole plant is expected to be in active operation this summer (1906), mining 5,000 tons per day. Another illustration of England's perpetual youth.

In the western hemisphere at the present moment, the most encouraging outlook is in central Ontario, Canada. Seventy miles north of the Georgian Bay, in the Nipissing district, along the west branch of Vermilion river, and extending some thirty or forty miles, is one of the richest magnetic iron ore deposits ever discovered. Expert evidence shows that cropping out 250 feet above the bluffs are more than 10,000,000 tons of magnetite, containing 60 per cent. metallic iron, 0.05 to 0.07 per cent. phosphorus, very low sulphur, and without a trace of titanium,—the bane of so many Canadian ores; while below these levels are slightly inferior merchantable grades, estimated conservatively at 140,000,000 tons. Shipments of these ores by the Canadian Northern Railway down to the new piers at Georgian Bay will commence this year at freight rates which will permit delivery from the mines to pier and across the waters to Lake Erie ports at $1 per ton, which is **50 to 60 cents less** than from the western end of Lake Superior. And not only has the Dominion magnetic iron ore in quantity, but in **quality** also. About 110 miles east of Toronto by rail and 45 miles from water navigation, at Weller's Bay, on Lake Ontario, is one of the richest deposits of magnetite in existence, estimated at the very least at 4,000,000 tons. The following analysis is taken from the official report of Prof. W. G. Miller, Provincial Geologist (January 6th, 1906). In this report crude, sand-like ore, gathered on the surface and magnetically separated and concentrated, is said to contain:

	Per cent.
Metallic iron	71.01
Sulphur	0.11
Phosphorus	0.016

"It will be seen that the metallic iron in the magnetite after concentration is only a little over one per cent. below the theoretical or absolutely pure ore." The report says further: "Coarse sample of crude **lump** magnetite was crushed to ten-mesh by Prof. Kirkpatrick (School of Mining, Kingston), and separated magnetically. . . . Composition:

	Per cent.
Metallic iron	67.46
Sulphur	0.129
Phosphorus	0.01"

This bed of magnetite, richer in iron by 20 per cent. than the famous Dannemora ores, would doubtless have been cornered long ago by eager ironmasters of the United States had it not been for the high percentage of sulphur. But now that desulphurization can be achieved successfully, and at the same time cheaply, by the King concentrationary and nodule-forming process, it ought to be a valuable asset in the development of a high-grade steel-making industry in Canada; and Mr. T. D. Ledyard is to be congratulated upon his wisdom and foresight in holding on to this valuable property until the "fulness of time had come."

From the standpoint of the metallurgist the remarkably high metal contents of Canadian magnetites is of great economic importance, since "it has been found that a difference (above 60 per cent.) of five units of iron to the 100 in the burden of ore fed to the furnace will, if properly controlled and utilized, make a difference of about 20 per cent. in the output of iron from the furnace." * In view, therefore, of the vast iron ore resources of Canada—raw material which has hitherto been of little practical value, owing to the admixture of sulphur, phosphorus, titanium, and other excessive refractory impurities, but which can now be removed by effective concentrationary processes and the electric furnace—it is manifest that the optimistic predictions of Canada's future importance as a fine steel producing country are well founded.

(Continued.)

* * *

HOW TO POLISH METAL.

A liquid metal polish formula was recently given as follows in the "Blacksmith and Wheelwright": Take eight ounces of Spanish whiting, which must be perfectly free from grit, and put it into one quart of gasoline. Shake up the whiting and gasoline well. The whiting will settle immediately, leaving the liquid as clear as water. To remedy this, and, further, to make it a better polishing agent, add to each quart of the mixture thirty-two drops of oleic acid—no more, no less. Shake again, and the whiting will not settle. Apply to gold, silver, nickel, brass, glass or any kind of metallic surface with a piece of cotton flannel, rubbing well. Polish with a piece of same cloth.

* W. P. Ball, Journal Am. Inst. M.E.

CANADA ON THE WORLD'S HIGHWAY

BY ALFRED J. ROEWADE,

Consulting Engineer, Civic Designer, Chicago, Ill., U.S.A.

III.

THE QUEBEC BRIDGE: A CRITIQUE.

To contemplate new transportation lines for the world's traffic is one thing; to maintain and improve those already existing is another, and often equally important thing. Hence I beg as an addendum to the previous articles under this heading to call attention to a danger threatening Canada's oldest, and probably most important, trade route, namely, the waterway from the sea to the Great Lakes.

It has up to date been taken for granted that the St. Lawrence river would be kept navigable for ocean ships to Montreal, from whence the canal route to the lakes begins. This great route, on which so much genius, work, and money has already been expended, and the completion of which is expected to tax the country's resources in the future, is threatened with a serious set-back by the building of a fixed bridge 165 miles from Montreal, near the city of Quebec.

It is a generally acknowledged fact that whenever great enterprises like the Quebec bridge are contemplated a number of side problems butt in, demanding serious consideration. It is a common practice to keep as many as possible of the minor side problems out of sight in order to simplify the main scheme, and thus accelerate its adoption. This practice is eminently correct so long as more or less temporary solutions are aimed at; but a different course becomes necessary when problems of great prospective importance are involved. Among the side problems which ought to have been seriously considered before finally adopting the Quebec bridge was that of overhead clearance for vessels of the largest type. It must be admitted that the ideas in technical circles with regard to this problem are rather vague and hazy. The question is: What is the height of the rigging of the future ships? In the time of the sailing ship it was approximately equal to the length the hull; but now that the steamship has superseded the sailing vessel on the ocean the proportional height is considerably lower—how much is commonly regarded as a matter of guesswork. In some quarters it is even regarded as unimportant, because, if the rigging of a steamship is too high to pass obstacles overhead, it can be cut down.

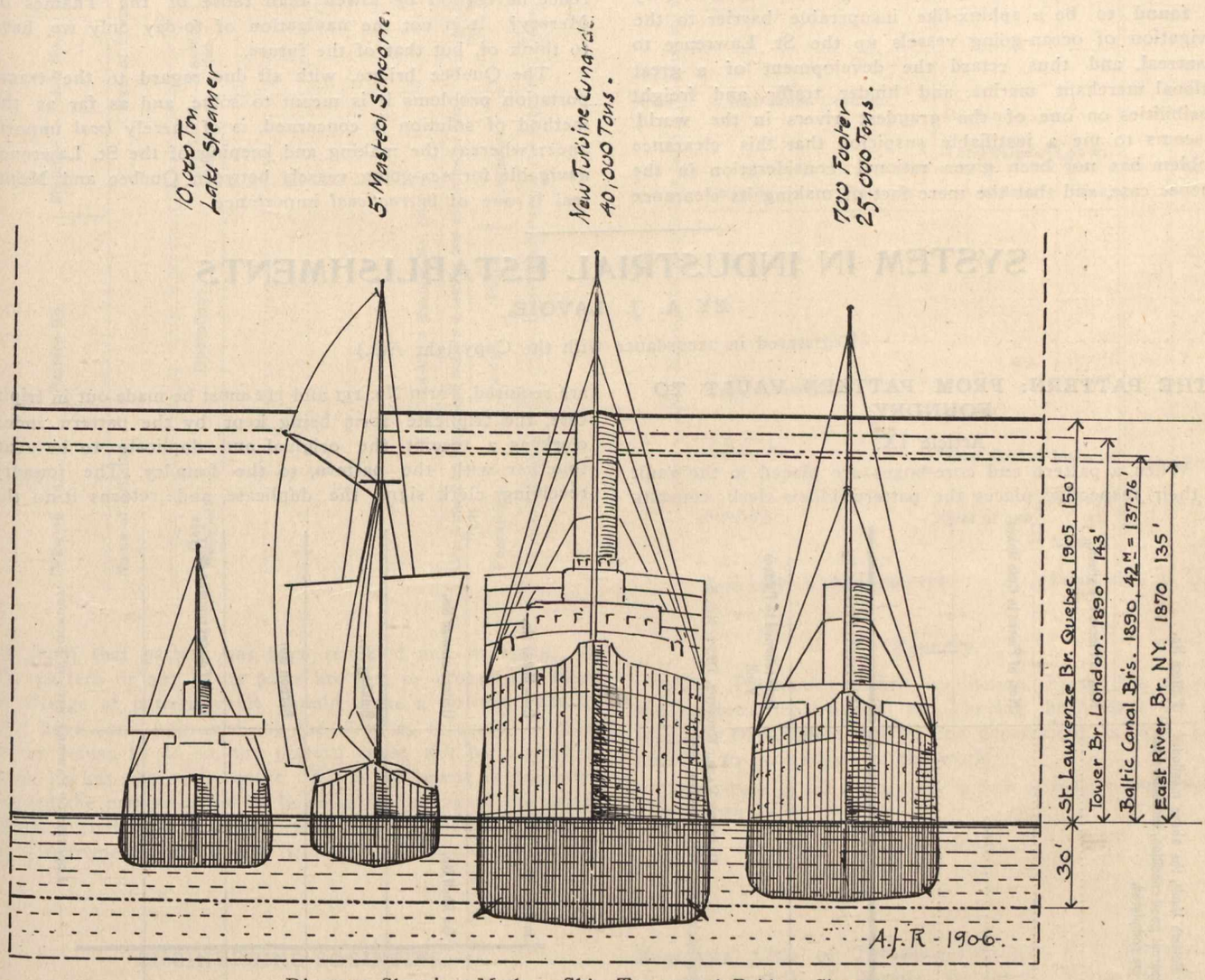


Diagram Showing Modern Ship Types and Bridge Clearances.

Yet this is a mistake, for the structure and dimensions of the modern steel rigging do not allow of such easy handling; besides, the funnels of the largest modern steamships have already reached a height which forbids their passage under any of the fixed bridges over waterways, which generally are supposed to have clearance enough for any ship afloat. The lack of sufficient clearance for the future ship types under bridges like that at Quebec will, it is feared, result not in a lowering of the rigging, but in the employment of smaller vessels for carriage of freight and passengers; and this means *a reduction of the waterway to a lower class.* The danger in this lies in the fact that the little ship and the ship of moderate size do not count at the present stage of evolution in mercantile marine, because it does not pay. It is the large ship which is the economical one in regard to power and manning expenses; hence, the harbor which cannot admit the great modern

ship is out of the competition for ocean traffic; is but an inland port—a harbor for the coasting trade.

The first fixed waterway crossing of any importance in regard to ocean navigation was the East River bridge at New York (1870). Its clearance was fixed at 135 feet above high water, and this was deemed ample for all future needs. It was still considered so twenty years later, when practically the same clearance was adopted for the crossings of the Baltic Canal. In recent years, however, it has been found that the ships upon which the German army relies for auxiliary purposes in case of war are unable to pass through the canal under the existing bridges, for which reason costly rebuilding is said to be under contemplation. Another example is the New York bridge, crossing a side branch of the harbor which it has repeatedly been suggested should be filled in and used for other purposes. Important facts these, worthy the serious consideration of legislators, granting right of way across Canadian rivers and streams. When the Quebec bridge is finished it may be found to be a sphinx-like insuperable barrier to the navigation of ocean-going vessels up the St. Lawrence to Montreal, and thus retard the development of a great national merchant marine, and hinder traffic and freight possibilities on one of the grandest rivers in the world. It seems to me a justifiable suspicion that this clearance problem has not been given rational consideration in the Quebec case, and that the mere fact of making its clearance a few feet higher than previous bridges has been deemed satisfactory.

Navigation of the St. Lawrence river is of more importance than that of any other waterway so far spanned by immovable bridges, for there is water depth enough miles above the Quebec bridge upon which to sail the largest vessel afloat or in contemplation. The standard steamship of to-day is the 700-footer, of about 25,000 tons capacity, and the number of ships of this class is ever increasing. The St. Lawrence can, at a comparatively insignificant expense, be made to float these immense vessels to Montreal; the bridge clearance, therefore, should not be less than that which will pass these ships safely under all conditions. Even larger ships than these are being constructed, viz., the new Cunarders of 800 foot length and 40,000 tons capacity; and still larger vessels are anticipated by the proposed or executed new docks and harbor works at London and Liverpool. In view of the boundless possibilities of the Dominion should the standard for St. Lawrence navigation be lower than those of the Thames or Mersey? It is not the navigation of to-day only we have to think of, but that of the future.

The Quebec bridge, with all due regard to the transportation problems it is meant to solve, and as far as the method of solution is concerned, is of merely *local* importance; whereas the making and keeping of the St. Lawrence navigable for sea-going vessels between Quebec and Montreal is one of *international* importance.

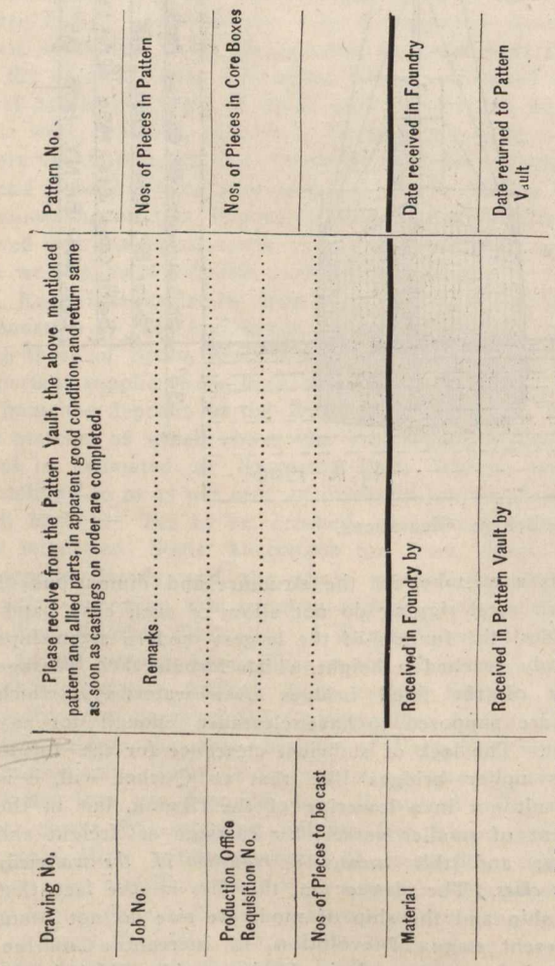
SYSTEM IN INDUSTRIAL ESTABLISHMENTS

BY A. J. LAVOIE.

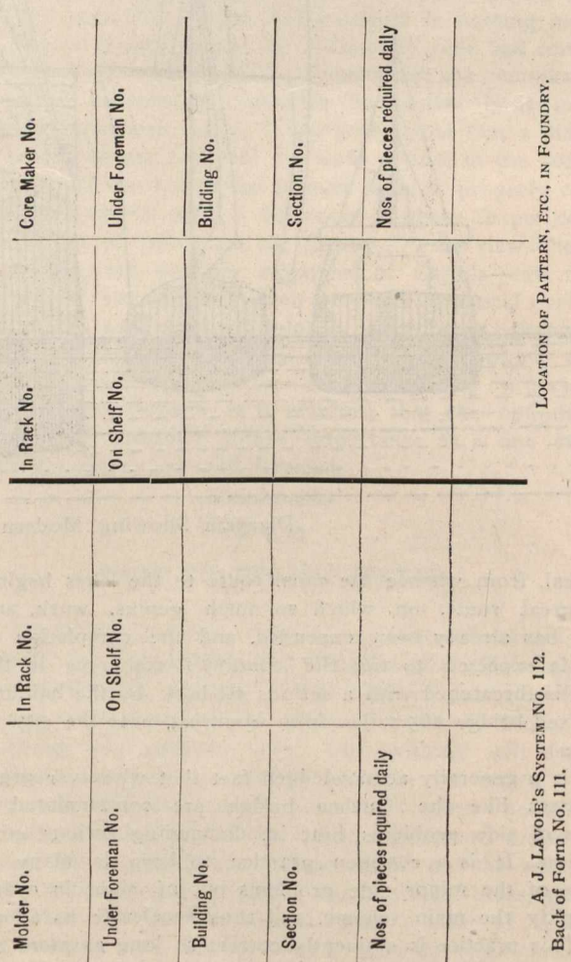
THE PATTERN: FROM PATTERN VAULT TO FOUNDRY.

Article IX.

When a pattern and core-boxes are placed in the vault in their respective places the pattern index clerk consults

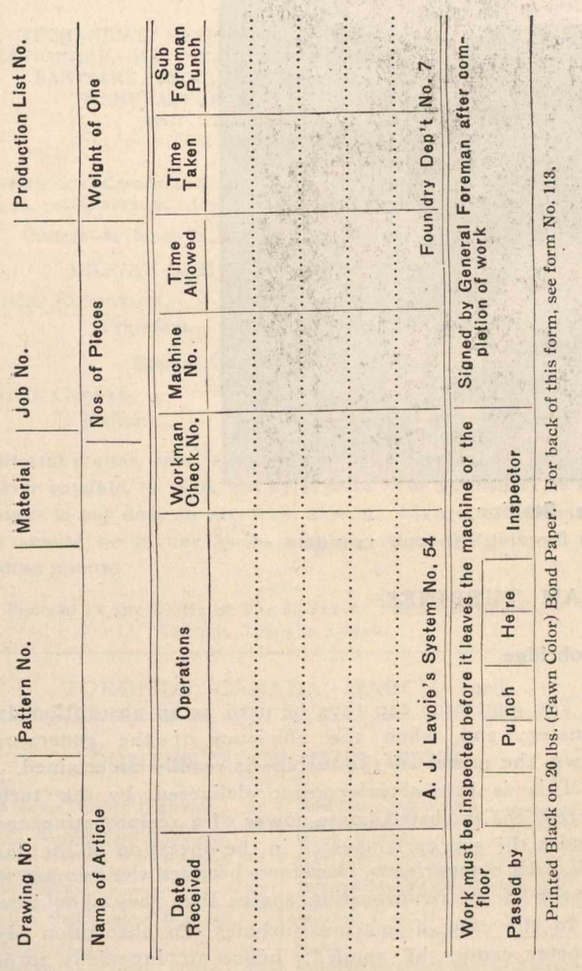


order to ascertain if this particular pattern should be sent his file of Production Office requisitions (Form No. 29) in to the foundry to have castings made off same. If castings are required, Form No. 111 and 112 must be made out in triplicate, the triplicate form being kept by the pattern index clerk as a receipt, the original and duplicate to be sent, together with the pattern, to the foundry. The foundry receiving clerk signs the duplicate, and returns it to the



pattern index clerk, who files same with triplicate after indexing in numerical order under pattern number. The foundry index clerk will mark on the original form the

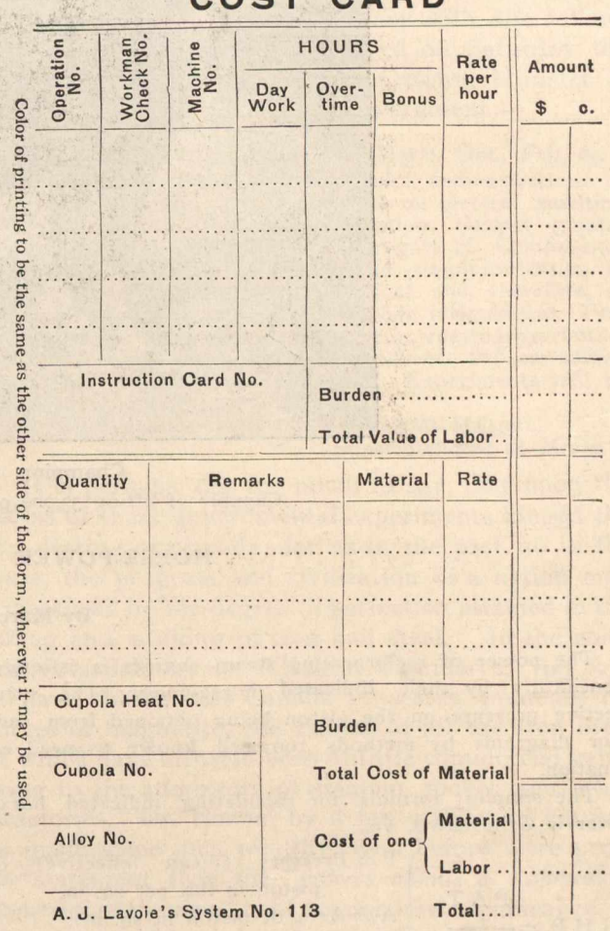
place where the pattern or core-boxes are to be sent, getting this information from the instruction card, Form No. 11 and 12, if any has been issued, or from job card No. 45 and 113 and No. 54 and 113. When the castings are completed the foundry index clerk will return the pattern, core-boxes, etc., to the pattern vault, and have the man in charge of the pattern vault sign the original Form No. 111, keeping same



as proof that pattern has been returned and accepted. If the pattern or any of its parts are lost or broken the man in charge of pattern vault should make a written report, and have same approved by the foundry foreman. If the latter refuse to do so, the pattern must not be accepted until he has approved report. When the report is properly signed the pattern is not to be repaired, or any of the parts replaced, but report must be sent to the Production Office, in Department No. 4, who will consult the Engineering Office, in Department No. 3, and take their advice on the subject. Very often a pattern is only needed once, and in this case it is not necessary to have any repairs made.

Labor.

It must be kept in mind that the laborers who are handling these patterns should make out their usual time cards, Form No. 9 and 20.



Foundry.

The Production Office requisition, Form No. 29, and the pattern, core-boxes, etc., having been sent to the foundry, Department No. 7, this department is now in a position to do its part of the work.

NOTE.—Form 45 and 113 is similar to form 54 and 113, except that it is printed on 100 lb. board.

(Continued.)

ENGINEERING SOCIETIES.

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

Canadian Mining Institute.—President, George R. Smith, Thetford Mines, Quebec; secretary, H. Mortimer-Lamb, Montreal, Que.; treasurer, J. Stevenson Brown, Montreal. Preliminary notice is given that the annual meeting for 1906 will be held in the City of Quebec, March 7, 8 and 9. Further particulars will be published as soon as the programme is completed.

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

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

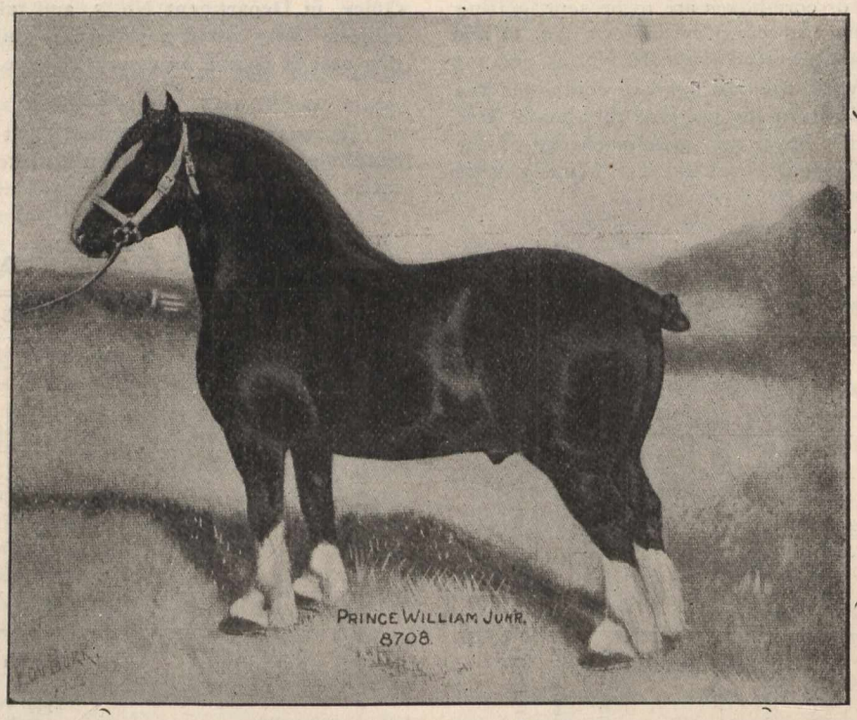
Canadian Railway Club.—President, S. King, Montreal; secretary, James Powell, Montreal; treasurer, S. S. Underwood, Montreal.

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

Canadian Association of Stationary Engineers.—President, W. A. Sweet; vice-president, Joseph Ironside, Hamilton; secretary, D. Outhwaite, Toronto; treasurer, A. M. Dixon, Toronto.

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

Canadian Electrical Association.—President, A. A. Wright; first vice-president, R. G. Black; second vice-president, John Murphy; secretary-treasurer, C. H. Mortimer.



Champion Clydesdale Stallion,
Capable of lifting 33,000 pounds one foot high in one minute.

HORSE-POWER OF STEAM TURBINES.

By Marcus R. Shoobridge.

The power of reciprocating steam engines is estimated scientifically by their **indicated** horse-power. The mean effective pressure on the piston being obtained from indicator diagrams by methods too well known to need explanation.

The simplest formula for calculating indicated horse-power is Grimshaw's, viz.:

$$\text{I.H.P.} = \frac{P\,A\,T}{33{,}000}$$

P = Pressure (mean effective) on piston in lbs. per sq. in.
A = Area of piston in sq. ins.
T = Travel of piston in feet per minute (twice the stroke × number of revolutions per minute).

Example—What is the horse-power of a 12 x 30 engine when running at 90 revolutions per minute with 40 lbs. mean effective pressure?

Here P = 40,
A = 12 x 12 x 0.7854 = 113.0976,
T = 2.5 x 2 x 90 = 450,

$$\text{and } \frac{P\,A\,T}{33{,}000} = \frac{40 \times 113.0976 \times 450}{33{,}000} = 61.68 \text{ I.H.P.}$$

In calculating the power of a steam turbine the indicator and methods applicable to the reciprocating steam engine are useless, the only method applied until lately being some form of absorption dynamometer. Turbines other than marine are generally used in connection with electric generators, and by means of the voltmeter and ameter the output of electrical energy developed by the generator is easily and accurately ascertained. This may be expressed in horse-power by the following formula:—

$$\text{E.H.P.} = \frac{V \times I}{746}$$

V = Volts at the terminals.
I = Amperes current in the outer circuit.

DATA.

The **Ampere** is the unit of electrical **current.**
The **Volt** is the unit of **electromotive-force**, or pressure of an electric current.
The **Watt** is the theoretical unit of electric **energy.** = 1 ampere x 1 volt.
The **Kilowatt** (K.W.) : practical unit of electric **energy** = 1000 watts.
And, **Electric horse power** (E. H. P.) = 746 watts.
Thus 10 amps. x 100 volts = 1000 watts = 1 K.W. = 1.34 E. H. P.

The generator can thus be used as an absorption dynamometer; and, when the efficiency of the generator is known, the power of the turbine is readily ascertained.

This is the actual power delivered by the turbine, whereas the indicated horse-power of a reciprocating engine includes the energy consumed in the operation of the engine itself. All comparisons, therefore, between the two are more in favor of the reciprocating engine than they should be.

In the case of marine turbines an absorption dynamometer cannot be applied; hence an ingenious form of electrical transmission dynamometer, or torsion meter, has been invented by Mr. Johnson, of Messrs. Denny & Brothers, Dumbarton, Scotland, which is giving satisfactory results. The following extract from "The Times Engineering Supplement," January 10th, 1906, clearly describes the invention.

The principle of this instrument consists in the accurate measurement of the torsional deflection or twist which shafts undergo while transmitting the power from turbine to screw, and as the deflection of the shaft is necessarily small, the delicacy of measurement required has to be correspondingly fine. The instrument consists of two light wheels firmly fixed on the shaft at a measured distance. Each wheel carries a permanent magnet which projects radially outwards from the wheel, and as the shaft rotates the magnets are carried round in front of a series of windings of fine wire which are spaced at known distances (about 0.02 in.) apart, close to the pole of the magnet as it sweeps past. The effect of the passing magnet is to induce momentary currents in the windings. The coils are connected through resistances to a telephone receiver so wound that the electromotive force from any coil of one wheel operates in an opposite direction to that from any winding in the other. The result is that if the two magnets pass their respective coils simultaneously no current flows, and the telephone is silent. When the shaft receives a twist under the torque applied by the turbine one magnet is in advance of the other, and, as the currents no longer neutralize, the telephone emits a sound. By a switching arrangement the coils opposite one wheel are successively brought into circuit until the telephone is again silent, and the displacement of the two coils which no signal is read off directly as the spacing of the coils is known, and consequently the twist in the shaft is revealed. From this measurement, in conjunction with the modulus of elasticity of the steel, and the speed, the transmitted power may be calculated. This instrument has been tested on ten turbine steamers built by one firm, and an average accuracy of 99 per cent. in the torsion readings was obtained.

This means that an engineer, to be abreast of the times, must add to his old-time knowledge of indicator practice and methods of calculating the horse-power of reciprocating engines, a scientific knowledge of electric measurements by means of voltmeter, ameter, torsion meter, etc., for testing and determining the power of modern stationary and marine turbines, which are so rapidly coming into use.

The Canadian Engineer.

ESTABLISHED 1893.

With which is Incorporated

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SAMUEL GROVES, Editor. J. J. SALMOND, Advtg. Representative

Editorial matter, cuts, electros, and drawings should be sent whenever possible, by mail, not by express. The publishers do not undertake to pay duty on cuts from abroad. Changes of advertisements should be in our hands not later than the 10th of the preceding month.

PRINTED AT THE OFFICE OF THE MONETARY TIMES PRINTING CO., LIMITED, TORONTO, CANADA.

TORONTO, CANADA, MARCH, 1906.

CONTENTS OF THIS ISSUE.

ANNOUNCEMENTS, ETC.

The Editor of "The Canadian Engineer" (S. GROVES) has been admitted to partnership in the firm of Biggar-Samuel, Limited, with a seat on the Board of Directors.

Just upon going to press (February 27th) has come to hand C. H. Mitchell's first article on "European Hydro-Electric Developments," dated Nice, February 2, 1906. It is descriptive of fine water-power plants on the River Rhone, delivering electric energy to the city of Lyons, France. Mr. Mitchell is a graduate of the Toronto School of Applied Science, and a member of the University Senate.

On February 5, 1906, we received with pleasure the following unsolicited testimonial from the Canadian Westinghouse Company:

"I have also noted with interest the great improvement which has taken place in the general reading matter in your paper, and feel that this must have resulted in its being read by a larger class of people and with increased interest, and the Westinghouse Companies' Publishing Department in view of this fact increased our advertising space, as you may perhaps have noted. With best wishes for the continued prosperity of your paper,

Yours very truly,
(Signed), J. H. KERR,
Secretary."

Our list of subscribers and advertisers is growing steadily but surely.

CANADA'S TRIUMPH IN ELECTRIC SMELTING.

During the last six months, "The Canadian Engineer," has stood almost alone among the leading Engineering Journals* in its optimistic expression of belief in the ultimate success of the Electric Furnace for the smelting of the refractory iron ores of Canada. It was with no small degree of elation, therefore, that we read on Monday morning, February 26th, the following copy of a telegram despatched on Saturday the 24th, to the Hon. Frank Oliver, Ottawa, Minister of the Interior to the Dominion Government:—

Sault Ste. Marie, Ont., Feb. 24.

To Hon. Frank Oliver:—Successful demonstration of all points stated in my memorandum on electric smelting of Canadian ores requiring investigation. Output greater than figure adopted by Harbord in report of Commission. Successful smelting of magnetite and desulphurization of pig. Successful substitution of charcoal, and, therefore, of peat for coke. Consumption of electrode insignificant. Production of nickel pig of fine quality from roasted pyrrhotite. Forty tons of pig have so far been produced. Process admits of immediate commercial application. Experiments will be completed in about two weeks.

(Signed), EUGENE HAANEL,
Superintendent of Mines.

It is perhaps, not too much to say, that upon the success of these governmental experiments hinged the very destiny of Canada; for as in the past, so in the future, the progress and civilization of a nation may be measured by the degree of perfection attained in the making and working of iron and steel. In the comparative article on the "Ores of Commerce," (pp. 89), we have shown that Canada possesses immense resources of magnetite, the richest of all the iron ores, but which have hitherto been of little commercial value owing to the admixture of titanium, nickel, and other refractories. Dr. Haanel by a few strokes of his pen has made some men wealthy who before were poor. His statement that the "*process admits of immediate commercial application*," is of tremendous significance. It means that within a decade, miniature Sheffield's and Pittsburgh's, only without their smoke, will be found near our numerous water falls and rapids; busy as beehives sending their finished products of iron and steel, over three smokeless, electric trans-continental railways, to the Atlantic on the one hand, for shipment to Mexico and the rest of the South American Republics; and, on the other, to the Pacific, for shipment to Japan, China, and the other populous countries in the Orient. If commercially, Canada stands third in the world to-day as regards per capita exports and imports combined,—Belgium and Great Britain being first and second respectively—what may be expected ten years hence, when she has developed into a great industrial country; which is her manifest destiny! Of a truth,

Peace hath her victories,
No less renowned than war.
Milton.

and the triumph in electric smelting, which has just been achieved at Sault Ste. Marie, under the auspices of the Dominion Government, is not only a record of which they may justly be proud, but it is one of the greatest object lessons showing the possibilities of wise governmental initiative ever presented to the world.

* "Engineering News," (December 7th, 1905), and "Iron Age," (October 6th, 1905), in the United States; and the "Iron and Coal Trades Review," (July 21st, 1905), in Great Britain, treated the Canadian enterprise with utter incredulity, and we had almost said contempt. A look in at the cerebral processes of the gentlemen who edit the journals aforesaid, would, just now, be an interesting psychological study.—EDITOR.

LICENSE CERTIFICATES FOR STATIONARY ENGINEERS.

In things essential, unity;
in things doubtful, liberty;
in all things, charity."

We have been favored with a draft of the " Proposed Amendment to present Ontario Act concerning Stationary Engineers." This document was accompanied by an explanatory leaflet containing an historical sketch of the movement behind the bill, and giving reasons why it should receive the assent of the Ontario Legislature and become law. The promoters say:—

The proposed license bill will bear the closest kind of scrutiny by legislators, manufacturers, the general public, or the engineers, ... They challenge honest criticism from any source. They believe in this compulsory agitation, not because it is a fad, but because they know it is dead right.

Lowell says that only two kinds of people never change their opinions; fools and dead men. And Emerson says, "consistency is the hobgoblin of small minds." A year ago, "The Canadian Engineer," opposed a similar bill, on the grounds that it would establish a monopoly; and work hardship on the owners of small plants. The present management believes in *protection,* and denies that the enactment of this measure would do injury to owners of miniature power installations, since it would not apply to plants of less than 50 horse-power.

Having cleared the ground, we now, without hesitation, endorse the principle of this proposed bill. The law demands that all mine managers and foremen shall submit to examination and be certificated before taking charge of a mine and its operations. Why? Because an incompetent man, unacquainted with the nature of explosive gases; ignorant of the strength of materials used in the construction of tunnel supports; and devoid of a practical knowledge of mechanical laws, might easily cause a deplorable loss of life. An incompetent man in charge of a mine is a menace to the State. It has been estimated that a man's value to the State is based upon the fact that men earn upon an average $600 a year, and a man's value is a capital whose interest amounts to $600 a year; hence, every time a laboring farmer, every time a productive citizen dies, the community loses the capital whose annual interest is $600. Then there is the loss caused by destruction of property, and worse than all, the widows, orphans, and darkened homes! The man who is placed in charge of a power plant—costly engines and dangerous boilers—is in a precisely analogous position. Statistics show, that "from April, 1903, to May, 1905, there were twenty boiler explosions in Canada, each accompanied by a large loss of property, and all causing either loss of life or serious injury to many." In nearly every case, the verdict of coroner's jury and public investigation committee demonstrated that the accidents were due to gross negligence; caused either by moral insanity, alcoholic disorganization of brain centres, or manifest unfitness. From the standpoint, therefore, of self-preservation,which is the first law of nature, we concede that the case for the *compulsory* certification of men in charge of stationary engines and boilers is made out.

After a critical analysis of the various provisions of the bill, we fail to find any signs of arbitrariness, for the interests of all candidates are carefully safeguarded by a clause giving the right of appeal. The danger of forming an exclusive class or caste, is obviated by the necessity for having certificates renewed every two years. While the moral elevation and dignity of the engineman's craft will be greatly enhanced by the proposal to empower the board of examiners with authority to revoke at any time, the certificate of any holder proved guilty of "incapacity, drunkenness, or improper conduct."

Editorial Notes.

Abusing Club Privileges.

We are constrained to draw special attention to a deliverance in the February issue of one of our technical contemporaries, since it is the most flagrant example of the abuse of privilege that we have come across for many a day; and which, if allowed to pass without protest, would leave a lasting slur and stain on the technical press of Canada. That the editorial in question represents the pocket-nerve policy of our contemporary we doubt not, but we decline to have "The Canadian Engineer" bracketed in any such connection. Here is the editorial note in full:—

Granted Special Privileges.

At the meeting of the Engineers' Club of Toronto on January 11th, a motion was passed extending to the editors of "Canadian Machinery" and of other Canadian technical papers "the privileges of the club rooms for the ensuing year."

Does the average reader appreciate the significance of this little act of courtesy? It is of enough importance to note in passing, for it serves to illustrate a point that some readers, and particularly some **advertisers,** frequently fail to grasp.

The cloven foot is shown in the last sentence. "The Canadian Engineer," as the oldest engineering journal of Canada, declines to be included in any such category. We are keenly alive to the best interests of our advertisers, but prefer to do business in the proper place and at the proper time. That is why the editor—as a trained engineer—sought and was granted full membership; so that he could help by pen and voice to maintain the status and dignity of the profession of engineering. Our contemporary in this important matter, reminds us of the French Revolutionists who confounded liberty with license.

Book Reviews

Electric Power Plants, the Care and Management of.—By Norman H. Schneider, Electrical Engineer, "White City," Collingwood, Ohio. Published by Spon & Chamberlain, New York. Size 7⅝ x 5¼, 203 illustrations, 270 pp. (Price $1.50.)

This admirable little work is precisely what it purports to be, a practical handbook, written by a practical engineer, for those in charge of electrical plants who have not had a full electrical training. The author, who has evidently had a wide experience and been a close observer, here gives the reader the benefit of this experience, combining practice with just enough technicality to enable one who is not a trained engineer to understand the machinery and apparatus in his charge. The book, which has 203 illustrations, is written in a lucid style, concise, and to the point, and will doubtless be an invaluable aid to those for whom it is written.

Practical Trigonometry. By Henry Adams. Second edition. Revised and enlarged. London: Whittaker & Co., 2 White Hart Street, Paternoster Square. Size 7⅜ x 5, 69 pp. (Price 2s. 6d. net.)

Those familiar with this author's popular series on the "Designing of Iron and Steel Structures" and his unique little work, entitled "Strains in Ironwork," will treat anything coming from his pen with respect, for, as a popular expositor of abstract technics, Henry Adams stands almost

alone. Anyone who has had large experience in great workshops, especially in the designing departments, knows that in every branch of mechanical engineering structural work is beginning to play an important part. Without a knowledge of trigonometry and logarithms efficiency in the designing and planning of steel structures is **practically** impossible. Hence it is that the young man from college or the technical school, skilled in the science of **three-angle measurement,** will do quickly, and with greater chances of accuracy, calculations which would take the self-taught draughtsman or intelligent mechanic, with his decimals and fractions, even hours and days to accomplish. There is a multitude of men in engineering to-day with sound mechanical instinct, but with a lamentable lack of **mathematics.** It may be too late for such to ever become scholarly mathematicians, but not too late for them to become educated up to the point where they may become even specialists in given lines of practical work—in the laying out of structural work for example. It is for these that the book under review has been written. Mr. Adams is a past-master in the art of the instructor, and any young man who sits down deliberately to study the principles and solve the problems set forth in this little manual will come out of the ordeal with a foundation knowledge of applied trigonometry, with a knowledge of the **reasons why** for everything more thorough than the mental equipment of many a graduate, who has sipped here and sipped there, just enough to secure a pass. Here is an illustration of the author's wise method (p. 1):

"The old practical definition of an angle (amplified from Euclid) is, 'the opening made by the inclination of two straight lines to one another in a plane which meet together in a point, or would do if produced.' This is very well so far as it goes, but, with trigonometry in view, it will be much better to define it as **the opening between two radii,** so that naming an angle shall invariably call up the impression of a circle in connection with it." Section III. is about the most concise, yet luminous explanation of the meaning and use of logarithms (invented in 1614 by Lord Napier, of Merchistoun, Scotland, for reducing the labor of calculations) that we have seen. An excellent set of examples and tables of logarithms and natural sines add to the practical value of the book. To any of our readers who feel their need of a work on trignonmetry we strongly advise the purchase of this inexpensive little treatise.

Gems and Gem Minerals. By Oliver Cummings Farringdon, Ph.D., Curator of Geology, Field Columbian Museum. Chicago: A. W. Mumford, Publisher, 378 Wabash Avenue, 190. Size 11 x 8, 229 pp. Sixteen full-page colored plates (106 specimens) of gems and ornamental stones in their natural colors, 14 full-page half-tones, and 45 text illustrations. (Price $3, postpaid.)

Here is a delightful book, which should be in the possession of every lover of the beautiful in nature, especially of precious stones. Some of the best brains in the engineering world have expended their vital energy in designing machinery for extracting the diamond, the sapphire and the ruby from the deep and dark recesses of the earth. This attractively-bound volume tells where these costly gems are to be found; how they may be distinguished; how they are cut and polished to bring out their fire, brilliancy and wondrous beauty. But while it would grace the drawing-room table, for it is a veritable work of art in text, color, and interest, it may, in the coming days of the development of Canada's boundless mineral resources, be an almost priceless boon in the hands of the prospector, mineralogist, and surveyor. Startling are the stories of mineral wealth which come to us every now and then out of the mysterious Hudson Bay lands in the far North which are soon to be opened out to civilization and commerce through the enterprise now being championed by "The Monetary Times." The author is master of a lucid and attractive style, but has not hesitated to use scientific terms where accuracy and definiteness of exposition demanded, and very wisely has treated the whole subject from the mineralogical standpoint as the best basis for a thorough knowledge of gems. Our readers will not regret purchasing a copy of this charming book: the gem illustrations in colors are simply superb, and are alone worth the price. Dr. Farringdon is to be congratulated upon having given to the world probably the best low-priced work on gems and gem minerals in the language.

Machine-Shop Arithmetic. By Fred H. Colvin and Water Lee Cheney. Fourth edition. 1905. New York: The Derry-Collard Company. Size 6 x 4, 144 pp.. (Price 50 cents.)

We purpose reviewing this excellent work in our next.

The World-Wide Atlas of Modern Geography: Political and Physical. By J. Scott Keltie, LL.D., etc., Secretary Royal Geographical Society. Seventh edition. 1906. Edinburgh and London: W. & A. K. Johnston, Limited. Size 12½ x 10. 128 colored plates, and complete index. (Price 7s. 6d.) To be reviewed in our April number.

CATALOGUES AND CIRCULARS.

Chain Blocks.—The Yale and Towne Manufacturing Co., New York, N.Y. The triplex hoisting block made by this company is one of the good things in the mechanic arts. These, together with their duplex and differential chain blocks, are set forth in a neat little pamphlet, as also are their new electric hoists. Send for the booklet. 12 pp., 6½ x 6.

Drill Presses and Filing Machines.—The Henry & Wright Manufacturing Co., Hartford, Conn. During the past few years there has been no marked improvement in drill presses. The new ball-bearing features, however, of the presses made by the above company, and shown in their catalogue, have increased the capacity of the machines from 200 to 400 per cent.; hence, they are having a phenomenal success. 6 x 9, pp. 20.

Arc Lamps.—The Packard Electric Co., Montreal. A pamphlet descriptive of Jandus **interchangeable** arc lamps, which received the highest award (gold medal) at the World's Fair, St. Louis, at which all prominent arc lamp manufacturers were competitors. 3½ x 6¼, pp. 8.

Electrical Apparatus.—Canadian Westinghouse Co., Limited, Hamilton, Ont. This fine catalogue includes transformers, generators, motors, and single-phase railway apparatus, showing the application of same. 5 x 9, pp. 30. Circular 1107, automatic circuit breakers, carbon break; Circular 1126, type C transformers; Circular 1127, control apparatus and trolleys for single-phase railway systems.

Electric Mining Appliances.—The Jeffrey Manufacturing Co., Columbus, Ohio. Bulletin No. 11, entitled "The Application of Electricity to Mining" sets forth lucidly the advantages to be derived from the use of electrical machinery such as locomotives, hoisting machines, etc., in mining. 7¾ x 10, pp. 44.

Steam Locomotives.—American Locomotive Co., New York, N.Y. A paper read before the Railway Club of Pittsburgh, entitled "Four-cylinder, Balanced, Compound Locomotives," reprinted by the above company, with numerous illustrations. 9 x 6, pp. 32.

CORRESPONDENCE.

The Biggar-Samuel Co., Limited:

Enclosed please find my subscription for "The Canadian Engineer." I have been a little late in sending, but trust you will excuse. I may say that I enjoy the paper well, and profit by it in my daily labors, although as a pattern maker I must say you don't give much to the pattern shop, but you make it up in other lines, such as foundry work and general machine shop.

I remain, yours truly,

DAVID W. GOW.

Quinn Ave., Longueuil, P.Q., Feb. 20, 1906.

CANADIAN RAILWAY NOTES.

G.T.P. President Hays Delivers Interesting and Instructive Address before Canadian Club at Toronto.

By J. A. Macdonald, C.E., Ottawa.

Not for years have the railways of Canada had their general case put before the public in more skilful and interesting manner than in the recent address of Charles M. Hays, general manager of the Grand Trunk Railway, and president of the Grand Trunk Pacific Railway Co., before the Canadian Club of the Queen City. Although he rarely appears in the role of public speaker, his fame had preceded him, with the result that there was a record attendance of five hundred. Mr. Hays seized the opportunity of arguing the case for the railways on the many controversial points. Naturally he discussed the question of rates, and gave figures to show that the railway transportation in America is now the cheapest in the world. At the same time he asked if Canadians could expect as low rates with our limited mileage and population as were granted with greater mileage and population of the United States.

J. A. Macdonald.

Incidentally, he referred to the pressure on railway managers for costly improvement on the one hand and for lower rates on the other, with, at the same time, the necessity of paying interest on investment. He, therefore, urged his hearers not to do anything to prejudice the interests of the railways, who are so dependent on foreign capital for their investment. Turning to the Canadian question in particular, Mr. Hays made two or three significant remarks.

One was a plea for the construction of the section of new transcontinental railway north of Lake Superior. He also urged that the Dominion Government should in future devote money toward enlarging the facilities of lake and ocean ports instead of further improvements to canals, and that ocean ports should be nationalized. The waterways should be improved, and he knew of no country so wonderfully endowed with such means of regulating railway rates.

Swan River Extension.—The Canadian Northern Railway Co. will extend their branch from Swan River, on which work was begun last year, for some miles westward, between the main line and the Prince Albert section. The work will be proceeded with this year. The line will pass through a very fertile country, lying between the famous Quill Plain and Carrot River districts.

Peterborough After It.—Peterborough is hot-footed after the chance of being made the southern part of the new C.P.R. grain route from Victoria Harbor to connect with the main line. The application comes before the Railway Commissioners on Friday, and at a joint meeting of the Board of Trade and city council. Mayor Best, R. R. Hall, M.P., and President Charles, of the Board of Trade, were appointed a deputation to support the C.P.R.'s application to make the city the junction point with the main line.

Electrification of St. Clair Tunnel.—The announcement has been given out by the Grand Trunk Railway System that arrangements have been made for the adoption of electric traction in the St. Clair tunnel, the contract for which has been awarded to the Westinghouse Electric and Manufacturing Company: the work to be started at once and brought to completion as quickly as possible. The system that will be adopted is known as the alternating current system, with overhead conductors—the conductors in the interior of the tunnel being placed upon the walls, and in the railway yards they will be supported by steel bridges. The trams will be operated by alternating current locomotives, capable of hauling a passenger train on the grade at the rate of twenty to twenty-five miles an hour, and a freight train of 1,000 tons at the rate of ten miles an hour. The interior of the tunnel and the yards on both the United States and Canada sides of the St. Clair river will be lighted by electricity from the power that will be generated in the extensive power house that it will be necessary to erect.

The length of the tunnel proper is 6,025 feet, and of the open portals or approaches 5,603 feet additional, or more than two miles in all, one of the longest submarine tunnels in the world. It is a continuous iron tube, nineteen feet ten inches in diameter, put together in sections as the work of boring proceeded, and finally bolted together, the total weight of the iron aggregating 56,000,000 pounds.

Railways Got an Extension.—The railway companies have been enjoying an extension of time to comply with the legislation of 1903, calling for more safety appliances on cars. The new devices were ordered to come into use on January 1st, 1906, but the C.P.R. and G.T.R. made representations, asking for more time to prepare for the new methods. These railways point out that they have old cars which are not worth equipping with the improved brakes and couplings, and they request time to get out new cars. In addition to this they ask for an opportunity to secure legislation amending the law as it relates to ladders on the box cars. The law was not put into effect pending a decision on these points. The Board of Railway Commissioners controls the matter, and it is understood it will grant the request of the large companies for a little more time. Since the beginning of the new year the board has not met.

Canadian Northern Railway.—It is gratifying to be able to state that the earnings of the Canadian Northern Railway during the past year upon their lines within and without Manitoba have been most satisfactory, showing a large increase of net earnings, and that the earnings on the guaranteed bonds have been fully and promptly met by the company.

During the past year the following increased mileage has been constructed by the Canadian Northern Railway, that is to say:

	Miles.
Carman branch, Leary's Siding to Somerset	15.39
Hartney-Virden branch	37.46
Brandon branch, Brandon to Carberry Junction	25.51
Rossburn branch, Milestone to Rossburn	28..2
Dundee branch	4.16
Bird's Hill branch	4.45
Total	115.17

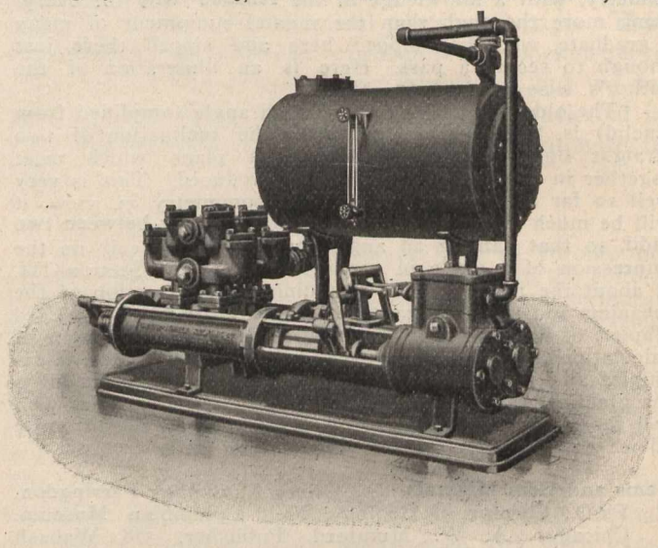
The chief engineer of the Department of Public Works, in his inspection report on these lines states that he found the same fully up to the standard of the other lines of the Province.

The report further shows that up to December 31st, 1905, the Canadian Northern Railway Co. had constructed 966.49 miles of line in the Province, and during the year 1905 had graded 96.45 miles, and concludes as follows: "It will readily be observed and appreciated that the railway policy of the present Government has done much towards opening up new stations hitherto unserved with railway facilities. The rates at present charged by the railway companies on their lines in Manitoba for the carriage of grain and merchandise continues—as a result of the efforts of the present Government—to give universal satisfaction.

AUTOMATIC FEED PUMP AND RECEIVER.

This apparatus is the outcome of a series of experiments by the Smart-Turner Machine Co., Limited, Hamilton, Ont., who some time ago put on the market an automatic feed pump and receiver, using their standard boiler feed pump for returning water of condensation in heating system, dry kiln, etc.

The illustration shows an outside packed pump with pot valve and receiver. The water of condensation in the heating system or dry kiln comes back to the receiver, and,



Feed Pump and Receiver.

as the water level rises in it, it lifts a float, which opens the throttle valves of the pump; the pump then draws the water from the receiver and discharges it into the boiler. Should sufficient water not come into the receiver to keep the pump going, the float closes the throttle and stops the pump until sufficient water accumulates to start the pump again. The pump being of the outside packed pattern, it is seen at a glance whether the plungers are properly packed or not. Each valve of the pump being in its own pot, they can be examined or replaced in two minutes. The gauge-glass on the receiver shows at a glance the level of the water, making the apparatus complete in every detail.

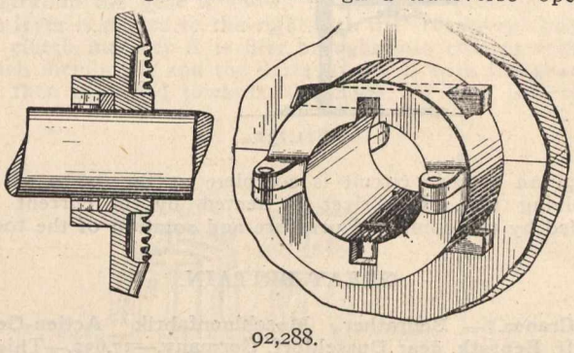
—To procure the greatest amount of work from an emery wheel and ensure safety in running, only the best grinders should be used. The arbor should be of sufficient proportion to easily carry the wheel adjusted on it. The following table will give an idea of the correct size of arbor: Wheels 6 in. in diameter and less, ½ in. arbor; 7 to 10 in. inclusive, ¾ to 1 in.; 12 to 14 in., 1¼ in.; 16 to 18 in., 1½ in.; 20 to 24 in., 1¾ to 2 in. In mounting a wheel, it should slip on the arbor easily, never force it on the arbor. Keep boxes of machine tight, so as arbor will not jump. Keep rests close up to wheel. The collars should be one-third the size of the wheel, and made slightly concave to touch the wheel only at their circumference; washers of paper or some other pliable nature should be used between the wheel and collar. The cutting surface of the wheel, to give good satisfaction, should be kept true. This can be done with a dresser or diamond tool. All emery wheels should be run at a surface speed of 5,500 feet per minute. By running at speed marked on the label of every wheel this can be attained. Running faster than this speed will cause it to glaze, burn the work, and a certain risk is involved. By running too slow, it wears the wheel unnecessarily, and does no more work.

INTERNATIONAL PATENT RECORD

CANADA.

Specially compiled by **Messrs. Fetherstonhaugh and Dennison**, Patent Attorneys, Toronto, Montreal and Ottawa.

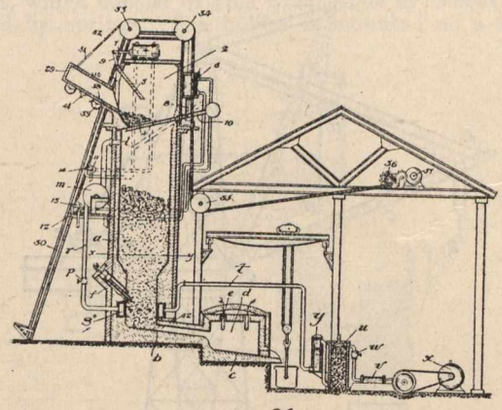
Device for Gripping Wheels to Axles.—Isidor Deutsch, Montreal.—92,288.—This invention consists essentially of a sleeve forming part with the wheel, and extending therefrom and encircling the axle, a slot from the inner wall of said sleeve longitudinally arranged with the axle, and a grip-block having a corrugated surface abutting the axle in said slot, a wedge inserted through a transverse opening



92,288.

through said sleeve registering with the inner end of said recesses and contacts with the inner end of said grip-block. This wedge forces the grip-block downwardly in the recess, and in order to ensure its gripping the axle, either the bed of the recess must be tapered or the axle, as the said wedge forces the said grip-block against the taper of either one or the other, as the case may be. This form of gripping wheels to axles has proved very serviceable under severe test.

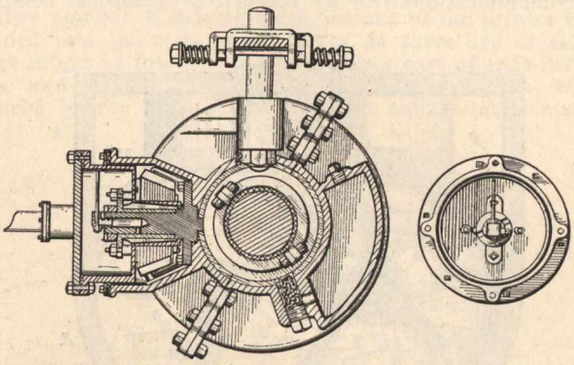
Electrical Smelting and Refining Furnace.—J. C. Kelly, Ottawa.—93,986.—The salient features of the invention are, first, that an auxiliary charging chamber is provided and automatic means are arranged for closing the central fusing chamber while the opening leading to the auxiliary charging chamber is open, and for closing the opening to the air of said auxiliary charging chamber before the opening between the auxiliary charging chamber and the central fusing



93,986.

chamber is opened. An annular heating chamber is provided around the lower portion of the central fusing chamber and means provided for gathering the hot waste gases from the central heating chamber and circulating them through the annular heating chamber. Means are also provided for utilizing the gases to produce power after they have passed through the annular heating chamber.

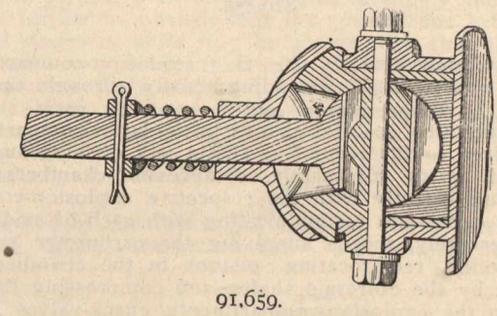
Transmission Device.—Isidor Deutsch.—93,923.—The gear casing as shown is mounted on an axle and supported by a flexible arrangement of shoes, through which a stud from the gear casing extends. Said flexible arrangement of shoes is supported on a fixed bar secured on the frame of the vehicle. One of the most important features of this invention is the lubricating arrangement for the pinion bearing, and in this it will be seen by referring to the drawings that a circular casing is shown in section, and secured to the face of the pinion. The pinion revolves on a fixed supporting stud from a strap encircling the axle; this stud is hollowed from the outer end, forming an oil chamber within. The opening to this hollowed portion from the said outer end is partially blocked, and a rod projects upwardly into proximity with the circular wall of said casing from an oil pan supported from said opening. In the rotation of the pinion the circular casing is carried therewith; consequently any oil contained therein switches against the upwardly projecting rod. This causes the oil to flow down the periphery of said rod into the pan, from where it pours into the chamber within the stud; from said chamber it flows through suitable openings to the bearing, working its way along to the thrust portion of the bearing,



93,923.

from which point it returns through passages made in the pinion to the circular oil chamber to be again used. The front view of said circular oil chamber, with the face plate removed, is shown.

Universal Joint.—Isidor Deutsch.—91,659.—This joint is suitable for automobile drives and all power-transmitting devices where flexibility is necessary. The invention consists essentially of a cylindrical casing in which is contained a plurality of socket members, the inner cup-shaped socket member being contained within the outer corresponding cup-shaped socket, and a slotted ball at the end of the shaft within the said socket members. A bushing is inserted in the slot in the ball, and a retaining-pin extends through the outer



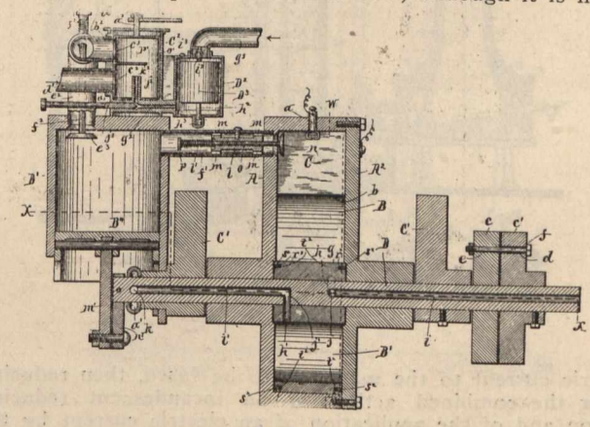
91,659.

casing, the socket members and said bushing. A cap is spring-held to the periphery of the outer socket member, thus preventing dust or grit entering through the shaft opening in said outer socket member. The advantage of this universal joint is that it retains the lubricant for a considerably longer period than any other form of joint known, and also provides a great flexibility. The arrangement of the parts is such that there is very little noticeable wear after long and severe service.

UNITED STATES PATENTS.

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

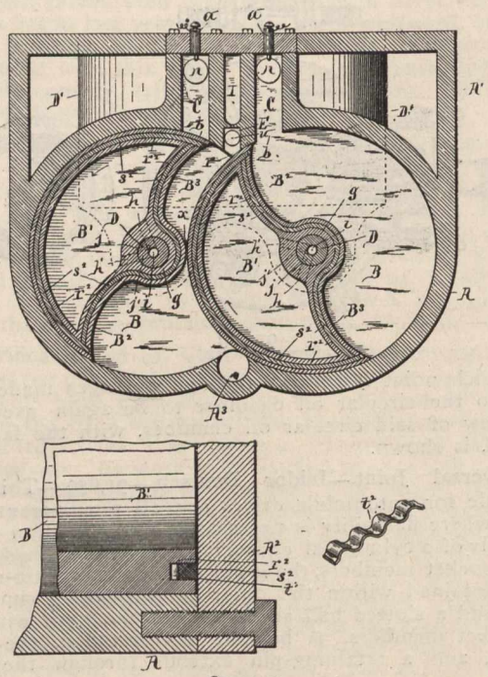
Rotary Explosive-Engine.—Frank Reynolds.—810,435.—The engine is adapted for various uses, although it is more



810,435.

especially designed for propelling automobiles and launches. The object is to produce a gasoline-engine which shall be

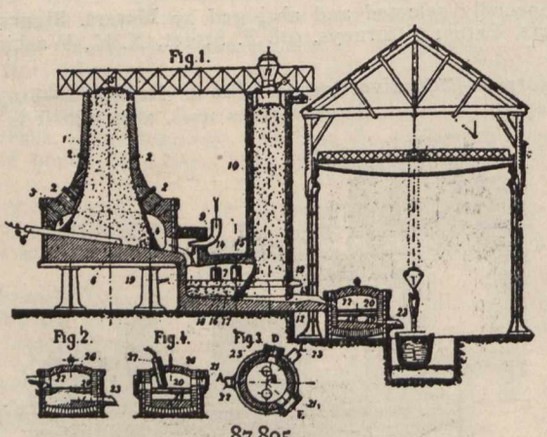
simple, strong, and durable in construction, safe, efficient, and reliable in its operation, and can be easily and conveniently controlled, and at the same time shall be inexpensive to manufacture. Furthermore, the object of the invention is to provide simple and efficient means for starting the engine. It consists of a case comprising two intersecting cylindrical compartments and formed with two separate explosion-compartments, each provided with a port affording communication with its respective cylindrical compart-



810,435.

ment, suitable igniters in the explosion-compartments, parallel rotary shafts extending axially through the said cylindrical compartments and geared to rotate in opposite directions, sectoral pistons in the latter compartments, and secured to the respective shafts and opening and closing said ports alternately, compression-chambers communicating directly with the respective explosion-compartments, a carbureter communicating with each of said chambers alternately, means supplying the carbureter with air and gasoline, reciprocating pistons in the chambers, and operated by the aforesaid shafts, and compressing the mixture into the explosion-compartments, check-valves in said chambers and explosion-compartments, and opened by the suction and compression respectively of the mixture, means automatically closing said valves, and exhaust-ports in the said case.

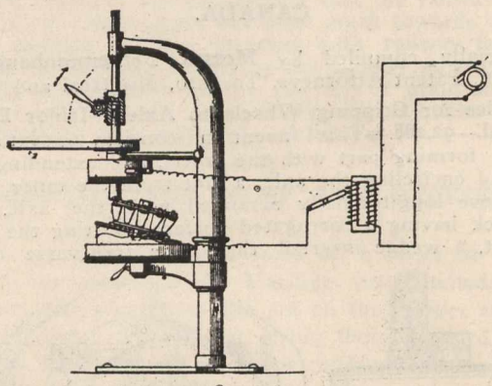
Electrometallurgy of Iron.—Henri Harmet, Sainte-Etienne, Loire, France.—87,895.—The continuous conversion of iron ores directly into iron and steel by three electrometallurgical steps, comprising, first, the fusing of the minerals in the presence of the hot gases derived from the second or reducing operation aided by the application of an



87,895.

electric current to the materials to be fused, then reducing under the combined action of an incandescent reducing carbon and of the application of an electric current by the passage of the fused and reduced materials through a column of said reducing carbon, and finally refining the mass by the application of an electric current thereto, substantially as and for the purposes set forth.

Electric Riveter.—Samuel Eveland, Philadelphia, Pa.—811,137.—A riveter comprising a form of sensitive drill in

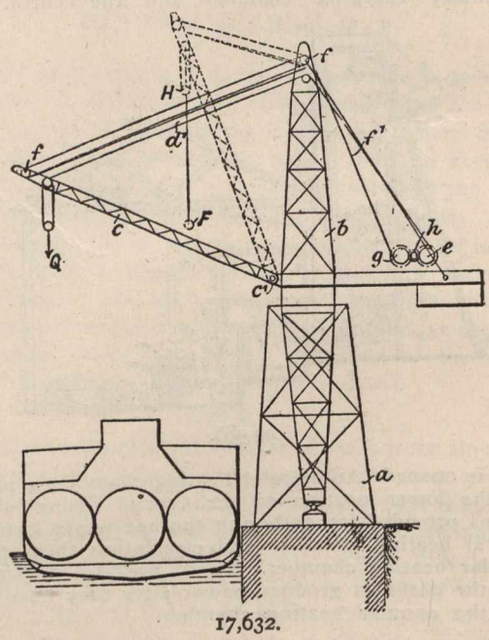


811,137.

which an electric circuit is complete at the point of the revolving tool. The rivet is heated by the current and headed by the combined pressure and rotation of the tool.

GREAT BRITAIN.

Cranes. — Benrather Maschinenfabrik Actien-Gesellschaft, Benrath, near Dusseldorf, Germany.—17,632.—This invention relates to cranes with jibs which can be drawn in, and has for its object to permit of the manipulation of the goods in a horizontal plane. In known cranes, having jibs which can be drawn in, the goods are lifted when the jib is swung in, and travel in the path of an ascending curve. The power expended in the lifting of the goods when the jib is swung in is thus wasted, because generally it is only required to move the goods in a horizontal direction. In order to carry out the invention, the lifting gear is coupled with the winding gear. If a suitable proportion of transmission between the lifting gear and the winding gear is chosen, the goods can be moved in a perfectly horizontal plane when the jib is swung; but the proportion of the transmission may be such that the goods are simultaneously lowered, and it is also possible to arrange it so that the goods are raised a certain distance if circumstances make this desirable. The accompanying drawing shows by way of example how the in-

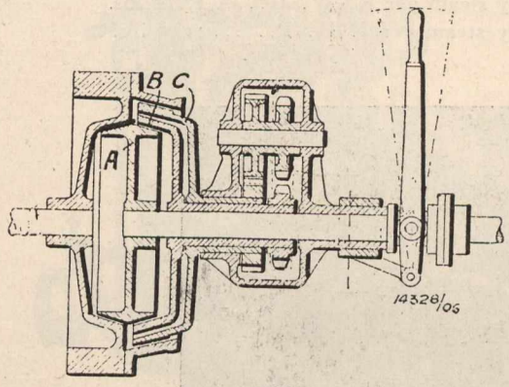


17,632.

vention may be carried into effect in the case of a rotary wharf or similar crane. *a* is a foundation frame in which is adapted to rotate a column *b*, to which is pivoted the jib *c* at a point c^1. The goods Q are suspended from the pulley *d*, the rope d^1 of which is carried to a drum *e*. The jib *c* is manipulated by a pulley *f*, the rope f^1 of which is carried to a drum *g*. These two drums are coupled in suitable manner, which is indicated in the drawings by a wheel *h*. How this coupling device is to be arranged in detail depends upon the conditions in each construction. Assuming, as shown in the drawing that the two drums *e* and *g* are driven uniformly by the wheel *h*, one rope will be wound up and the other will be wound off; and if the pulleys are suitably proportioned, the goods suspended at Q will move to F in a horizontal plane. In the absence of the coupling of the lifting gear with the winding gear, the goods would be raised approximately to the point indicated by H; therefore the new ar-

rangement, according to this invention, saves a force necessary to raise the load through the vertical distance between Q and H. The motor driving the drawing-in gear therefore has only to overcome the friction of the rollers, of the pin of the jib, and of the driving mechanism. The arrangement of the lifting gear and the winding gear, or the coupling between them, is preferably such that the two gears can be used independently of each other; in most cases, however, it will be sufficient to drive the lifting gear for the goods by a motor, and to adapt the winding gear of the jib to be coupled to the weight-lifting gear, so that the jib for a time joins the movement in a corresponding sense.

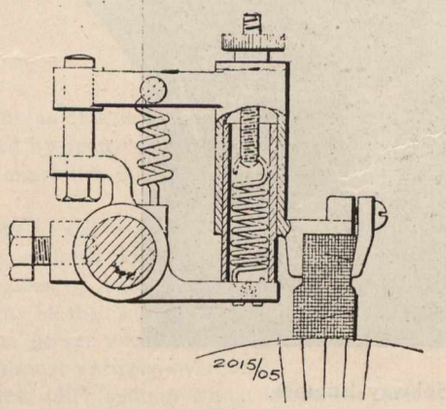
Reversible Transmission Gear.—Petri.—14,328.—In the illustration the gear is shown in the "off" position. When this lever is moved to the right into the "reversing" position the clutch member A is first brought into contact with the clutch member B and the parts A and B with the gear-box are then displaced towards the right, so that the clutch



14,328.

member C is brought into contact with the clutch surface on the flywheel, and is thus caused to revolve by the flywheel, The rotation of the member A is reversed by gear wheels, and transmitted by means of the sprocket wheels to the clutch members B and A, by which the shaft is thus driven in the reverse direction.

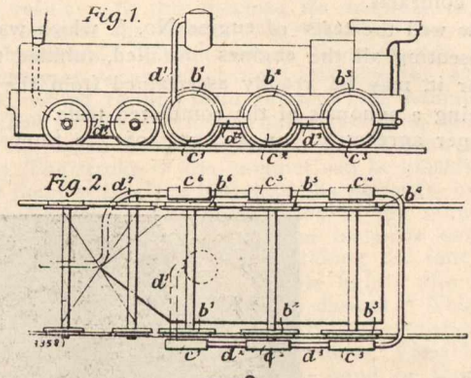
Brush-holders for Electric Dynamos or Motors.—Barker and Burleigh.—2,015.—A sliding holder is provided with two guides, which consist of pins which slide in sleeves and controlled by springs. The holder is mounted on a spindle in



2,015.

the rocker; the holder can thus slide on its support in such a manner that the motion of the carbon is radial to the commutator.

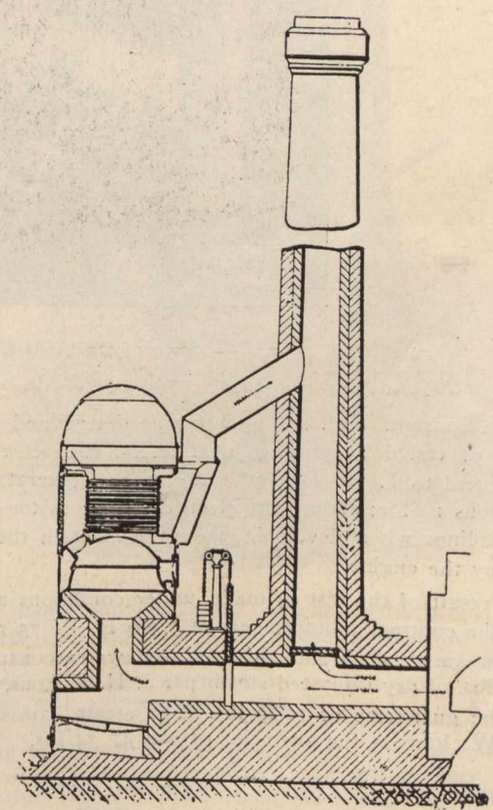
Turbine-Driven Locomotives.—J. Gray, London.—23,358.—According to this invention, the turbine is divided up into parts or stages, distributed one on each driving axle of the locomotive, and the steam from the boiler passes through the several stages in succession. The wheels carried on the driving axles are indicated by b 1—b 6, and mounted co-axially with the wheels on the respective axles are turbine stages c 1—c 6. These stages are supplied in series with steam from the boiler and are suitably proportioned so that only a comparatively small portion of the total energy is extracted in each unit and transmitted to the driving-wheel to which the stage is attached. The turbine forming each stage may be of either the impact or impulse type, or a combination of the two types, and it may be composed of a single stage or number of subsidiary stages. The revolving wheels of the stages are mounted directly on the axles, and the casings are fitted to the locomotive frame so as to allow for the movement which takes place between the axles and the frame in a manner well understood. The first turbine c 1 receives its steam from the boiler through a pipe d 1. From the first turbine the steam then flows through connections d 2, d 3 successively through the whole of the turbine stages. From the last turbine part c 6, a pipe d 7 leads the exhaust to the blast-nozzle, and serves to force the furnace draught in the usual manner. It will be obvious that this invention may be modified in many ways without departing from its essential features. For example, in the case of a locomotive having a large number of driving-axles, instead of the turbine being divided into twice as many stages as there are axles, one stage might be fitted to any convenient part of each driving-axle, and caused to transmit the energy to the wheels secured to the ends of the axles in any suitable manner.



23,358.

Further, instead of having all the stages of the turbine in series, as in the modification first described, it might in some cases be desirable to arrange the turbine elements so that each side of the locomotive is fitted with a complete turbine having the same number of stages as there are driving-axles. In this case the two turbines will be connected in parallel between the source of supply and exhaust. It will further be obvious that the connections between the several stages or units may be arranged so that these may be coupled in parallel if desired. In order to reverse the movement of the locomotive, the axles may also be fitted with separate reversing turbines, which may be arranged in separate casings, or in the same casing with the forward driving turbines, and similarly connected so as to utilize economically the available energy of the steam.

Method of and Means for Utilizing the Waste Heat of Furnace Gases.—Davies.—27,632.—This method consists in



27,632.

passing the gases into the furnace of a steam generator interposed in the path of the gases and their exit to the chimney.

INTERBOROUGH RAPID TRANSIT COMPANY: TEST OF SUBWAY ENGINES.

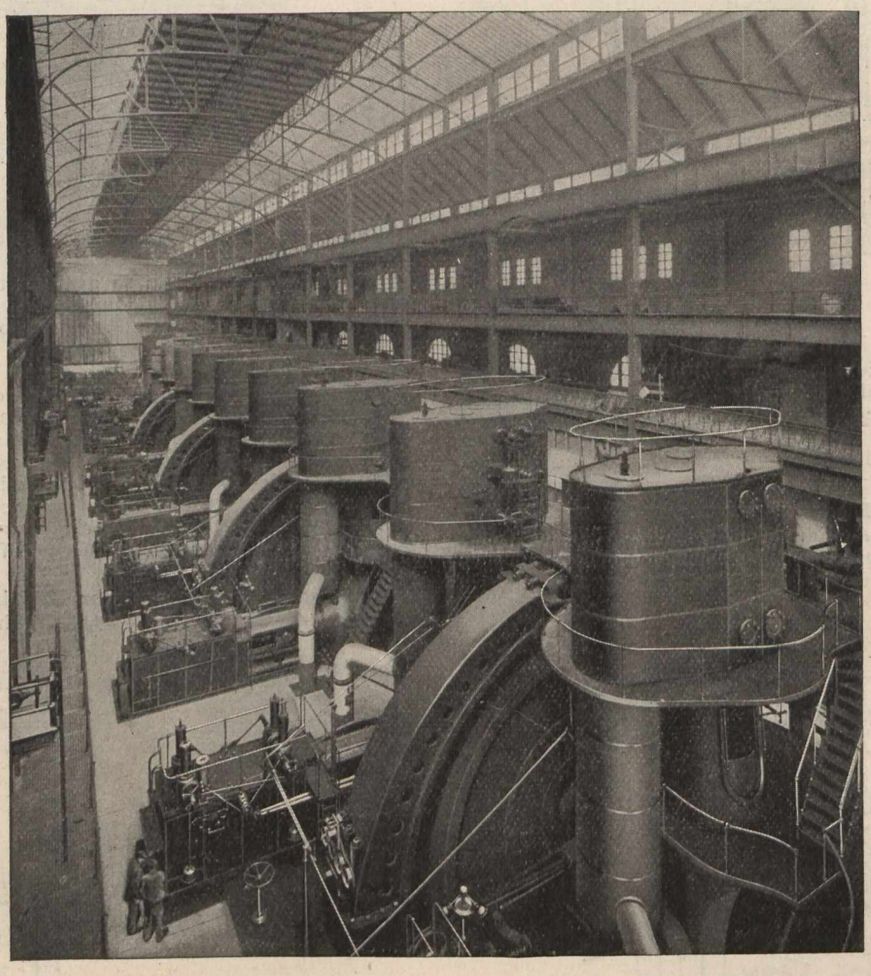
An interesting official fifteen hour test of one of the nine twin vertical-horizontal Reynolds Corliss engines, cylinders 42 in. and 36 in. x 60 in., which have been in operation at the 59th Street station of the Interborough Rapid Transit Company, New York city, since 1902, was concluded December 15th. The tests were conducted by the Interborough Rapid Transit Company and representatives of the Allis-Chalmers Company as a final determination of the fulfillment of the builders' guarantee and formally provided for in the original contracts.

How well the tests of engine No. 8, which was selected as representing all the engines installed, fulfilled the claims made for it, may be readily ascertained from the following data giving a synopsis of the completed tests.

As per agreement, on account of the impossibility of keeping a constant load, the power was determined by the readings of tested integrating wattmeters. These readings were reduced to I. H. P. by running the generator as a synchronous motor; adding the electrical input to the switchboard readings when developing power, to obtain the power exerted by the engine.

The result of the test so made, under conditions approximating the contract requirements of 7,500 H. P., 75 r. p. m., 175 lbs. steam pressure and 26-in. vacuum, was a consumption of 11.96 lbs. of dry saturated steam per I. H. P. hour, or well within the guarantee of 12.25 lbs. The steam consumption per K. W. hour at the switchboard was 17.34 lbs.

Duration	15 hours.
Load	5079.2 K.W.
Friction and generator losses	417.3 K.W. = 559.41 H.P.
Total load	5496.5 K.W.
I. H.P.	7365.3 H.P.
R. P.H.	75.02.
Steam pressure	175.18 lbs.
R. H. receiver	19.1 lbs.
L. H. receiver	19.27 lbs.
Vacuum	26.02 lbs. (actual.)
Temp. injection water	42.36 deg.
Temp. R. H. discharge	74.05 deg.
Temp. L. H. discharge	77.38 deg.
Barometer	30.50 lbs.
Water per hour	89.906 lbs.
Drips per hour	512 lbs.
Leakage per hour (boiler)	1.470 lbs.
Boiler level correction	60 lbs.
Net water per hour	87.864 lbs.
Quality of steam	100.28 per cent.
Dry steam per hour	88.110 lbs.
Dry steam per K. W. H.	17.34 lbs.
Dry steam per I. H. P.	11.96 lbs.



Five of the Allis-Chalmers' 1200 H. P. Subway Engines.

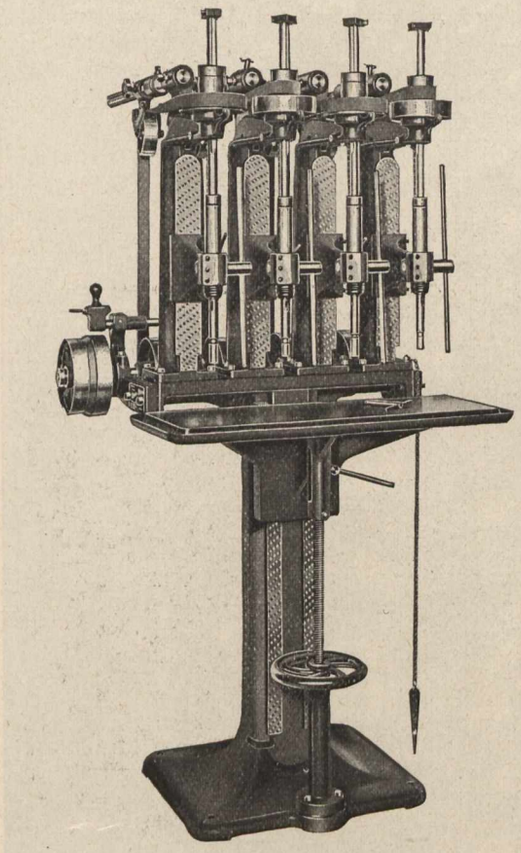
The final results allow for boiler leakage which was determined by a separate test of 24 hours duration. The steam was very slightly superheated during the test as being easier to make allowance for than wet steam, and a correction was made to reduce the superheated steam to equivalent dry saturated steam.

The vacuum was carried at 26.02-in, or as near the contract requirement as possible, but the barometer stood at 30.50-in. The vacuum was, therefore, equivalent to only 25.52-in. referred to 30-in. barometer; no correction was made, however, as none was provided for in the contract. Other tests at varying vacua show that if the vacuum had been carried enough higher to correspond to 26-in. vacuum when referred to 30-in. barometer, the steam consumption would have been about 0.09 lbs. better, or 11.87 lbs. per I.H.P. hour instead of the official figure of 11.96 lbs. This company is represented in Canada by the Allis-Chalmers-Bullock, Limited, Montreal.

BALL BEARING DRILL PRESS.

The surprising advance in machine improvement and construction which has been made in the past decade can show no more remarkable single example than The Henry & Wright Ball Bearing Drill Press.

When it is considered that such a commonly used tool as a sensitive drill press has stood practically dormant for the past twenty-five years as far as any improvement which affected its production in a given time is concerned, it is certainly unusual for a machine to suddenly appear which will produce as high as 200 per cent. to 400 per cent. more work in a given time than any other machine of its type on the



market, but as this is not only guaranteed by the makers, but attested by many prominent manufacturers who are now using the machines it must be accepted by the public as a fact.

A study of the machine makes the reason for the great advantages claimed apparent.

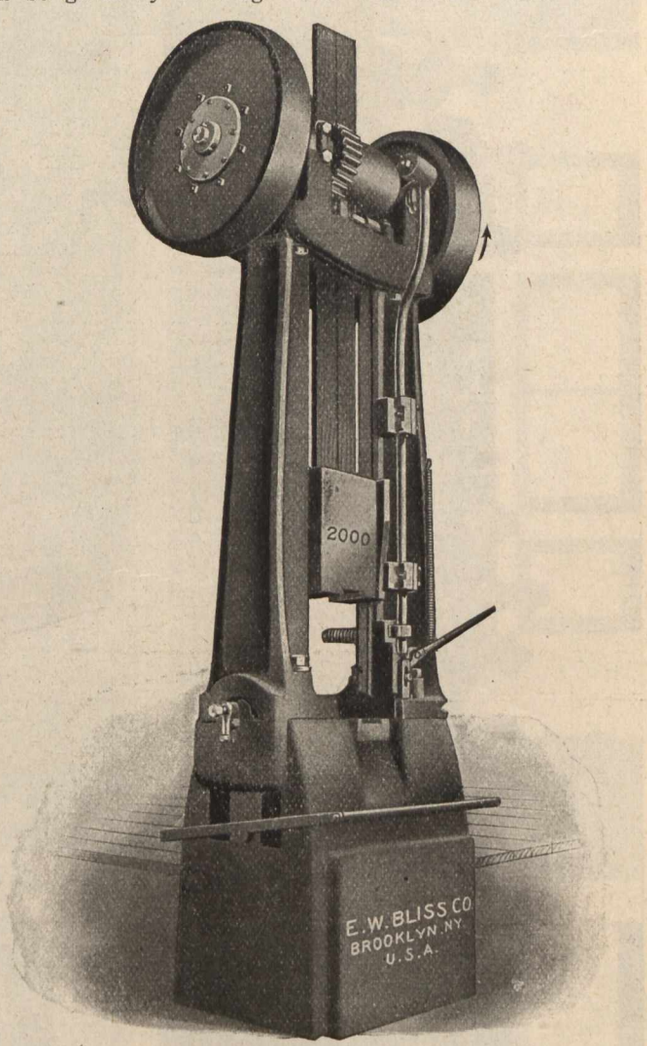
By means of ball bearings used throughout, the friction, which in the old style machine amounts to 75 per cent. of the power used in driving the machine to its limit, has been almost entirely overcome.

The new idler system which keeps the belt at a proper tension at all times, and which allows of the use of one continuous cemented belt instead of two laced belts; and the new balanced spindle drive which engages the spindles from two diametrically opposite sides in place of the old style feather drive engaging the spindle from one side only; the means for relieving the spindle from any belt strain and the compact design and accurate construction of the press, all lend assistance in obtaining the remarkable results shown and which can be but slightly appreciated by the statement that where the old style machine driven with 2, 2 1-2 or 3" belts will hesitate and even stop in driving a ⅜" carbon drill, this new machine will drive 55-64 high speed drills up to their full limit of speed without any hesitation or injury to the machine whatsoever, and will drive small drills at a speed that would be altogether unsafe for machines with the old style bearings, without any heating in the bearings whatsoever. The makers advise running the spindles at the following speeds, 600, 900, 1350, and 2025 r.p.m., and a comparison of these speeds with those usually considered safe for machines of this character will show to some extent how it is possible to obtain the results claimed.

The model shown is one of the latest, and shows the new pinion handle which allows an operator to obtain any leverage instantly without the adjustment of set screws as is usual.

THE "STILES" DROP HAMMER.

The accompanying half-tone illustrates the latest model of the "Stiles" friction roll, forging drop hammer. This hammer is an extra heavy machine, and is built for 1,000 and 2,000 lb. hammer heads, as well as smaller sizes. Heavier hammers are coming into use more and more every day, they being required to do with one blow what has heretofore required several—increased economy and efficiency being the result. In this machine the hammer is held up by clamps beneath the lifting rolls, instead of the stop used in many hammers. The action of these clamps in holding the hammer securely obviates entirely the side blow and shock, which results from catching the hammer on a stop fastened to one of the uprights, removing one of the principal causes of broken uprights, and uneven wear of the guides. The stroke of the hammer can be quickly changed to any point within the length of the uprights, by simply shifting the collar on the upright rod to the required position. The hammer can be almost instantly stopped at any point of the down stroke, by taking the foot off the treadle. By pressing on the treadle lightly the hammer can be made to descend as slowly as desired. This is very convenient when setting dies, and gives the operator complete control of the machine at all times. Variable blows can be given by working either the hand or foot levers



The rebound can always be caught in the proper manner, whatever the thickness of the dies, by adjusting the lower collar on the upright rod to suit. By depressing the treadle, and letting go of it when the blow is given, the hammer will automatically stop at the height at which it is set. If continuous blows are desired, it is only necessary to keep the treadle depressed, no treadle movement is required for each separate blow. As will be seen from the illustration the hammer is well proportioned; particular attention is called to the extremely heavy anvil. This is a solid casting, weighing 30,000 lbs., 15 times the weight of the steel hammer head. This ratio between the hammer head and the anvil is maintained throughout in all sizes of the "Stiles" drop, built by E. W. Bliss Company, Brooklyn, N. Y.

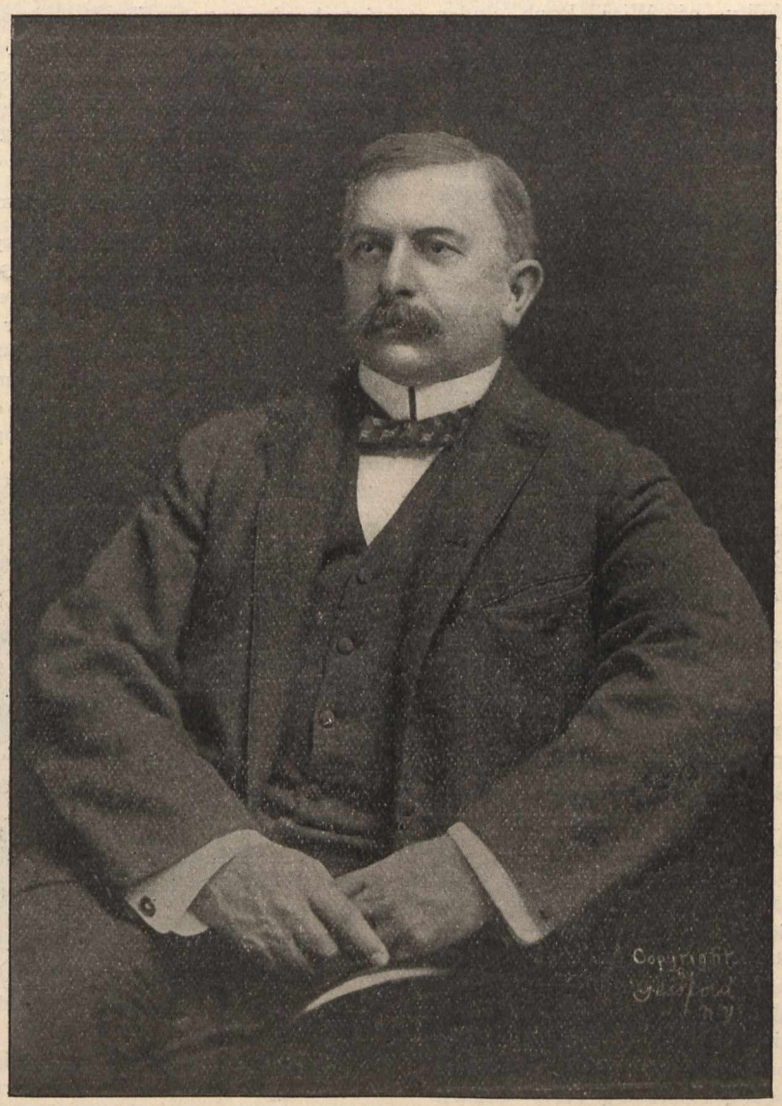
CANADIAN CIVIL ENGINEERS AT NIAGARA FALLS, JANUARY 31. Photo by Geo. P. Freeland, 436 Yonge St., Toronto.

CANADIAN SOCIETY OF CIVIL ENGINEERS

ANNUAL MEETING.

The twentieth annual meeting of the Canadian Society of Civil Engineers was held in Toronto, January 30th to February 2nd, 1906, and was an event of special interest, since it was the first time in the history of the society that any of its meetings have been held outside the city of Montreal, where it was founded February 24, 1887.

The headquarters were at the King Edward Hotel, but, through the courtesy of the Engineers' Club, most of the business meetings were held in their club room, 96 King Street West, which, though small, was free from the city din, while the ante-chamber and reading-room suite gave an environment of sociability and atmosphere of fraternity to the gatherings.



GENERAL FRANCIS V. GREENE,
Vice-President and General Manager Ontario Power Company.

The following is a partial list of members and others in attendance: A. W. Connor, A. F. Wells, E. G. Stairs, H. W. McAll, K. Gamble, N. L. Crosby, J. H. Ferguson, C. B. Smith, F. D. Featherstonhaugh, W. A. McLean, A. P. Walker, J. W. Greey, J. C. Crofts, A. E. Foreman, W. MacPhail, E. R. Fetherstonhaugh, S. Groves, P. W. Ball, C. H. Rust, W. Cross, R. F. Tate, J. W. Harkom, C. H. Vogel, M. J. Haney, S. Gagne, T. L. Somerville, C. D. Dill, Frank Simpson, W. T. Jennings, N. M. McLeod, E. A. Wills, E. B. Biggar, J. J. Salmond, A. A. Bowman, C. C. McLennan, G. B. Ashcroft, W. T. Ashbridge, W. Chipman, F. S. Keith, T. H. Hogg, E. A. Stone, John Williams, S. B. Clement, Gordon Sprodley, J. G. Sing, J. J. Bell, E. Wragge, R. C. Harris, J. M. Clark, J. Galbraith, F. B. Polson, W. A. Johnson, C. Campbell, R. J. Parker, Toronto; Geo. Holland, C. H. Sutherland, A. A. Belanger, G. E. Bell, E. Marceau, J. B. Porter, S. Howard, E. Brown, C. H. McLeod, R. J. Durley, H. L. Forbes, J. T. Farmer, Alcide Chausse, W. McL. Walbank, L. P. Michaud, J. G. G. Kerry, R. E. Hunter, G. Fiset, O. H. Cote, Montreal; G. C. Carman, Cornwall; J. Hutcheson, J. G. Macklin, T. J. Colwill, Guelph; E. V. Johnson, H. D. Lumsden, G. H. Richardson, C. H. Pinhey, A. R. DuFresne, H. W. Jones, Ottawa; Angus Smith, J. Davies Barnett, Stratford; J. W. Belcher, E. V. Moore, J. H. Larmonth, R. B. Rogers, W. J. Francis, Peterboro'; G. S. Kilbourn, J. C. Kennedy, Owen Sound; J. A. Culverwell, Port Hope; A. C. D. Blanchard, H. P. Rust, Niagara Falls, Ont.; E. I. Leonard, H. J. Lamb, London; F. J. Ure, D. T. Townsend, Woodstock; R. H. Squire, T. Harry Jones, Brantford; A. J. Grant, E. R. Johnson, Port Colborne; C. H. Ellacott, Linwood; J. D. Black, Gaspe; G. K. Addie, Sherbrooke; A. J. McPherson, Regina; E. G. Wilkie, Carleton Place; J. T. Bertrand, Isle Verte; J. A. Macdonald, Hermanville, P.E.I.; W. H. Breithaupt, Berlin; L. A. Vallée, Quebec; F. H. White, Boston; F. X. T. Berlinguet, Grand Mere; T. R. Wilford, Lindsay; C. E. W. Dodwell, Halifax; H. H. Moore, Calgary, Alta.; T. U. Fairlie, Kingston; E. J. Forrest, Walton, Ont.; J. D. Shipley, Leamington; John Irvine, Harriston; J. W. LeB. Ross, Morrisburg, Ont.; R. McDowell, Parry Sound; E. T. Brandon, Niagara Falls, N.Y.; G. A. McCarthy, North Bay; J. S. Armstrong, Rothesay, N.B.; E. G. Barrow, Hamilton; G. R. Duncan, Three Rivers; T. H. White, New York; J. W. Moffat, Slocan, B.C.; G. A. McCubbin, J. A. Bell, St. Thomas.

Thursday, January 30th.

The opening session commenced Tuesday morning, January 30th, at 10.30 in the club room of King Edward

Hotel. C. H. Rust, City Engineer of Toronto, occupied the chair in the absence of President Ernest Marceau. F. L. Somerville, president of the Engineers' Club of Toronto, extended a hearty fraternal greeting and hearty welcome to the society and visitors on behalf of the club, and offered the use of the club rooms during their stay in the Queen City, which was accepted. The reading of 1905 minutes by Prof. C. H. McLeod (Secretary) was followed by reports of General Council and the treasurer.

The numerical report indicated a total membership of 1,389—an increase of 128 during the year.

The Committee on the Award for 1904-5 recommended the presentation of the Gzowski medal to Mr. C. B. Smith, Ma.E., for his paper on the "Construction of the Canadian Niagara Power Company's 100,000 h.p. Hydro-Electric Plant at Niagara Falls, Ont."

The examiners appointed for the reading of students' papers recommended the following as the best papers in the several sections:

Mechanical—"The Durability of Wire Rope under Severe Conditions," by T. H. Schwitzer.

Mining—"Mine Accounts and Bookkeeping in Metalliferous Mining," by G. E. Cole.

General—"Distribution of Stress in Rivetted Connections," by C. R. Young.

There were no papers submitted in the Electrical Section.

On the request of ten members resident in Nova Scotia a branch of the society has been regularly formed at Sydney, C.B., in accordance with the provisions of the society's by-laws. Final action has not yet been taken in regard to the formation of a branch in Toronto. The formation of a branch in Ottawa is under consideration. On the suggestion of a member of the society resident in Winnipeg, a committee has been appointed to consider the matter of forming a branch of the society in Manitoba, and to take such other steps as may be considered desirable in the interests of the members of the society in that Province.

Members resident in Nova Scotia and in New Brunswick have also called the attention of Council to the importance of action along similar lines with a view to advancing the interests of the profession in these Provinces.

The attention of the Transcontinental Railway Commissioners has been called to the fact that persons not members of this society cannot legally practise the profession of civil engineering in the Province of Quebec, and by direction of the Council a circular letter was sent to all members resident in the Province of Quebec, requesting them to send in to the society the names of any who are practising illegally.

The financial statement showed the total receipts to be $11,378.04; expenditure, 10,057.74, leaving a balance of $1,320.30 in the hands of the treasurer.

After a brief socratic discussion on the reports, it was resolved that in future they should be printed and distributed at least one week prior to the annual meeting. The report of Library and House Committee, submitted by Prof. J. B. Porter, indicated that an up-to-date catalogue of library books was being printed, and that duplication, in large number, of important, costly technical works had already begun, the latter project being in the interest of out-of-town members, who hitherto had been unable to use the library except when visiting Montreal. In addition to these two important provisions it was announced that over 2,000 illustrated trade catalogues, embracing every branch of engineering, were now indexed and on file. R. B. Rogers and others expressed their appreciation of the work of the committee, whose report was adopted.

Standards Committee.

R. J. Durley of Montreal, in submitting the report of the Standards Committee, said the objective of the committee was to consider the possibility of doing something in line with the work which had been done in England and the United States towards establishing standards of structural forms and measurements, rail sections and sizes, methods of testing, etc. Mr. Durley declared that the committee deemed itself too weak a body to deal with such a vast question, and their labors had been largely devoted to the task of gathering data and information. He said the committee realized that Canada was in a rather peculiar position with regard to this question. For example, the rolled steel sections used in the Dominion are American sections, and they (the Committee) were unable to advise the setting up of a series of distinctive Canadian sections. As a final word, he said the committee were of opinion that any action the society might take to make the English and United States standards the same would be very beneficial to the engineering profession generally.

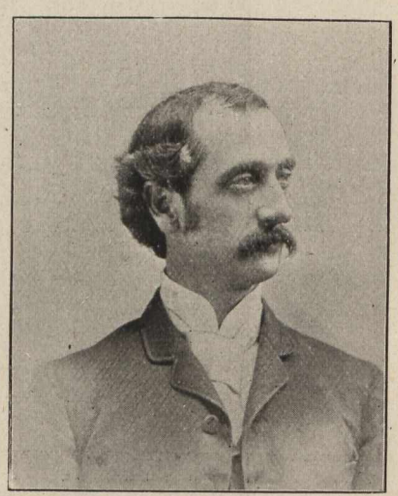
M. J. Haney asked if this could not be accomplished by legislation. Mr. Durley replied that the committee did not think itself strong enough for this. The standards set up in the United States had been formulated by the engineering societies generally, the various societies having dealt with their own special line of work; but the claims had not been endorsed the same way they have in England. Cecil B. Smith asked if the engineering standards in England and the United States were identical. The reply was that the data in the possession of the committee showed that none of the standards were the same. The chairman of the Standards Committee intimated that suggestions from any member of the society will be received with great pleasure.

At 2 p.m. an elegant luncheon was served in the banquet hall of the King Edward Hotel. According to programme, the afternoon session was to have been devoted to the address of President Marceau. His non-arrival, however, prevented this, and the visitors enjoyed the delightful winter's afternoon seeing the pleasant sights of Toronto.

In the evening at 8 p.m. Prof. J. B. Porter, of McGill University, gave an interesting lecture, entitled **"Diamond Mining at Kimberley, South Africa."** The address was illustrated with lantern slides, showing the various operations and methods of diamond mining.

Wednesday, January 31st.

The morn rose clear, the sky was bright, no cloud o'ershadowed the scene as at 8.30 a.m. 180 of Canada's chief civil engineers boarded a special train in the Union Station, generously placed at their disposal by the G.T.R., for the purpose of inspecting the great hydro-electric installations at Niagara Falls. A forty-minute stop was made at Hamilton, where, by the courtesy of the Hamilton Bridge Company, the visitors had an opportunity of seeing this



ERNEST MARCEAU, C.E.,
Retiring President.

plant, specially equipped for bridge building and general structural engineering. Upon arrival at Niagara Falls Station at 11 a.m. the party was met by Victoria Park Superintendent Wilson, and conveyed by special street cars to the brink of the Horseshoe Falls.

General Francis V. Greene, vice-president of the Ontario Power Company, together with his efficient staff, were in waiting with a royal greeting, and acted as guides down 150 feet of steps into the nobly-designed power house at the foot of the cliffs, up again to the unique spillway station above the roadway, and finally up to the commanding hillside plateau overlooking the Falls, on which stands the stately, artistically-designed and uniquely-equipped distributing station and offices, all comprising the finest hydro-electric installation in existence. By this time everyone was tired by the mental energy expended in trying to grasp the problems involved in this magnificent piece of hydraulic and electrical engineering and physical energy dissipated in climbing—what seemed to be—thousands of steps. But at this stage the magic cry went up, "Luncheon is now ready!"

At one o'clock upwards of 250 of the men who are making the great Canadian North-West — the railroad, harbor, canal and municipal engineers of Canada, together with distinguished Government officials—paired with the executive and departmental staff of the Ontario Power Company—marched into the eastern transformer house of the distributing station and sat down to a complimentary luncheon, served in splendid style, and in one respect quite unique, since it was **cooked entirely by electricity.** The company's large electric kitchen is equipped with a series of ranges, similar to gas appliances, and controlled by stops, but without dust, dirt, or odor of any kind. It was stated that fifty horse power was utilized in preparing this excellent repast.

MENU.

Olives. Chicken Okra. Radishes. Celery.
Boiled Kennebec Salmon.
Sauce Hollandaise.
New Bermuda Potatoes, Persilade.

Fillet of Beef Pique, Perigeaux.
French String Beans.

Lettuce and Piementoes.
Neufchatel Cheese.

Pistache Ice Cream.
Petit Fours.

Demi Tasse.

G. H. Mumm's extra dry.
Pomeroy Sec.
Scotch Whiskey.
Rye Whiskey.
Mineral Waters.
Cigarettes.
Cigars.

General Francis V. Greene, vice-president and general manager of the Ontario Power Company, was toast-master, and was supported by H. D. Lumsden, of Ottawa, the newly-elected president of the society; Ernest Marceau, the retiring president; Prof. C. H. McLeod, secretary; Superintendent Wilson, of Victoria Park; J. W. Langmuir, president of the Victoria Park Commission; Commissioners Robert Jaffray, G. H. Wilkes, and Colonel Raymond, of Welland; Paul N. Nunn and L. L. Nunn, engineers to the company; C. H. Rust, City Engineer of Toronto; V. G. Converse, chief electrician; S. Groves, editor "The Canadian Engineer," and others.

After the luncheon General Greene proposed "The King and President," and the assembly evinced their loyalty by singing lustily the British National Anthem. After referring to his pleasure at meeting the civil engineers, he spoke in high terms of the Park Commissioners. He said that, while he often thought they drove a very hard bargain with the company he could attest their unfailing courtesy and devotion to the interests of their Commission.

Mr. J. W. Langmuir, in responding to the toast, said:

The Commission did not always meet with the kind appreciation they had experienced that day. In starting out the Commission adopted two cardinal rules under which the water could be taken for power, namely, that only sound business principles should prevail in the granting of charters, and, secondly that having regard to the grand natural surroundings of Niagara Falls all surface works of construction should be made harmonious to the surroundings. He invited the most critical examination of the record of the Commission in respect to these two great principles, pointing out that while their rights to use water had been given for nothing on the American side of the river, substantial monetary considerations were exacted in every instance on the Canadian side, with the result that when the power companies were in full operation over $250,000 annually would be received for power franchises. He also acknowledged the generous manner in which all the power companies had met the requests of the commissioners in respect to the design and character of the buildings, irrespective of cost, and he concluded by expressing a hope that before the year 1907 closed we should see not only completed and in operation the greatest electrical developments in the world radiating from that great historical centre, and moving the wheels of industry for hundreds of miles beyond, but that we should also see the completed and restored park with the great cataract of Niagara, notwithstanding the small withdrawals for electrical development, flowing on with undiminished grandeur and beauty.

The chairman proposed the health of the engineers, Messrs. P. N. and L. L. Nunn, and said these two gentlemen had been the brains and nerve centres of the institution, declaring that they had engineered the plant from its birth, having made a life study of this type (horizontal shaft system) of water power development. Mr. P. N. Nunn responded on behalf of his brother and himself, and referred to the considerate and gentlemanly way in which they had been treated by the Park Commissioners and the financiers who had backed the project. Mr. C. H. Rust then called for three cheers for General Greene and his staff, and the assembly adjourned to the front of the building to be photographed.

At 2 p.m. the party boarded special cars again, travelled merrily along the Niagara river bank in sight of the turbulent waters of the upper rapids, disembarking at the entrance to the Electrical Development Company's elevator shaft. After gazing in awe at the freak concrete column, lying in broken pieces in the river—an engineering failure—the party, escorted by the company's engineers, went down the elevator 150 feet to the tail-race tunnel below; and as by dim, mysterious light they walked silently in single file, trying to imagine what would happen if the two-inch screen which separated them from the raging Niagara waters outside was to burst, it reminded one of Jules Verne's "A Thousand Leagues Under the Sea." After a journey of some 3,000 feet they emerged into the wheel-pit, 416 feet long by 22 feet wide, from which, with a deep sigh of relief, the adventurous engineers were hoisted in stone buckets up to daylight once again into a capacious steel power house in process of erection, in which will be installed eleven 8,000 k.w. generators of 12,000 volts each, stepped up at the distributing station to 60,000 volts. The company calculates upon delivering electrical energy for manufacturing purposes to Toronto in May next. We must not omit to state that the entire engineering staff of this enterprising Canadian company acted as guides, and the courtesy shown was highly appreciated.

From this point the party walked over the unwatered eleven-acre coffer dam of the last-mentioned plant away to the forebay and intake of the Ontario Power Company, which proved to be not only of unusual interest from a technical standpoint, but the screen-house and its promenade has the promise of being one of the most artistic and picturesque beauty spots in the vicinity of the Falls. After thus seeing the first and last of the magnificent plant of the Ontario Power Company, a brisk walk back brought the party to the power station of the

Canadian Niagara Power Company,

where three generators of 10,000 k.w. capacity each are furnishing power for commercial purposes, and two others are in course of erection. The wheel-pit is also being extended to permit the installation of six more units. The wheel-pit is 570 feet long and 18 feet wide, lined with brick and steel throughout, and is 165 feet below the power house floor, the plant being constructed on the **vertical shaft system,** with the turbine on the level of the tail-race, similar to that of the Electrical Development Company, a complete contrast to the Ontario Power Company's installation, which is on the **horizontal shaft system,** the head of water being carried through an 18 foot pipe for a distance of 7,000 feet.

Expressions gathered from many of the visitors showed that the day had been well spent, and that the outing had been a most enjoyable and profitable one.

Engineers' Club Smoker.

On Wednesday evening the Engineers' Club entertained the members to a smoker, at which the result of the election of officers for the ensuing year was announced as follows: President, H. D. Lumsden, Ottawa; vice-presidents, M. J. Butler of Ottawa, C. B. Smith of Toronto, and W. McL. Walbank of Montreal. Councillors—W. F. Tye, of Montreal; John Galbraith, of Toronto; Duncan Macpherson, of Ottawa; Phelps Johnson, of Montreal; W. H. MacLeod, of Winnipeg; G. H. Webster, of Manitoba; R. McColl, of Halifax; H. Holgate, of Montreal; John Kennedy, of Montreal; C. Fergie,

of Sydney, C.B.; E. A. Hoare, of Quebec; J. S. Dennis, of Calgary; E. Mohun, of Vancouver; R. A. Ross, of Montreal; L. A. Herdt, of Montreal; R. J. Durley, of Montreal; J. E. Hardman, of Montreal; J. B. Porter, J. G. G. Kerry, of Montreal.

The following were elected members of the Nominating Committee: C. E. W. Dodwell, of Halifax; C. B. Smith, of Toronto; J. Galbraith, of Toronto; C. H. Rust, of Toronto; G. H. Webster, of Manitoba; John Kennedy, W. McL. Walbank, of Montreal; J. A. Jamieson, of Montreal.

Thursday, February 1st.

This day was devoted to the reading of technical papers and the conclusion of business of the meeting. The papers read were as follows:

"Tide Levels and Datum Planes on the Pacific Coast of Canada,' by W. Bell Dawson, D.Sc., M. Can. Soc. C.E.

"Hydraulic Locks on the Trent Canal," by W. J. Francis, M. Can. Soc. C.E.

"Laying of the Six-foot Steel Pipe of the Toronto Waterworks," by C. L. Fellowes.

The reading of these technical papers was followed by the address of the retiring president, Ernest Marceau, entitled "The Origin of our Canal System." It was shown that the first recorded bit of canal work was a canoe-channel, about one mile long, between the St. Lawrence river and Lake St. Pierre, a small body of water on the Little River St. Pierre, half-way between Montreal and Lachine. This channel was started by a religious order in 1700. With this exception the first Canadian canals were built by the British army engineers, beginning in 1779; these were short canals on the St. Lawrence, serving as by-passes around rapids. Another beginning was made in 1798 at Sault Ste. Marie, where the North-West Company built a canal half a mile long, with a lock 38 feet long, 8 feet 9 inches wide, for 9 feet lift. The present canals of Canada are summarized in the following table:

CANALS OF CANADA.

St. Lawrence Route.

	Dimensions of Locks.	Water on Sills.
Lachine.....		
Soulanges.....		
Rapide Plat.....		
Cornwall	270 ft. x 45 ft. 0 ins.	14 ft.
Farran's Point.....		
Galops.....		
Welland.....		
Sault Ste. Marie.....	900 ft. x 60 ft. 0 ins.	20 ft.

Richelieu River Route.

	Dimensions of Locks.	Water on Sills.
Chambly	118 ft. x 22 ft. 6 ins.	7 ft.
St. Ours	200 ft. x 45 ft. 0 ins.	7 ft.

Ottawa River Route.

	Dimensions of Locks.	Water on Sills.
St. Anne's.....		
Carillon	200 ft. x 45 ft. 0 ins.	9 ft.
Grenville.....		
Rideau	133 ft. x 32 ft. 0 ins.	5 ft. 6 in.
Culbute (abandoned)	200 ft. x 45 ft. 0 ins.	6 ft.
River du Lièvre, 1886.....	160 ft. x 32 ft. 7 ins.	8 ft.

Resolutions.

The following resolutions were unanimously adopted:—

Resolved that the Canadian Society of Civil Engineers assembled in annual meeting, notes with active interest the effort being made in the direction of systematic forestry in Canada as shown in the Forestry Convention held at Ottawa last month, and endorses the ideas which have been proposed, such as the establishment of a Dominion School of Practical Applied Forestry in a forest reserve, giving a course in actual forestry to students who have qualified in technical schools, the preservation of head sources of important rivers by constituting them forestry reserves; the encouragement of the preservation of remaining forest areas in the older parts of the country, and of reforestation by remission or reduction of taxation on such areas.

Resolved that the council be instructed to represent to the Dominion Government the importance of action in the direction of a more complete co-ordination of the various surveys conducted by its departments and the adoption of such methods as will secure permanent records both in the field and in the office of all such work. In the opinion of the meeting the complete working out of a scheme will evolve very careful study not only of the valuable work now being done, but also of the methods which have been adopted by the Government of other countries, and should lead to the establishment of a general topographical and geodetic scheme for the whole Dominion.

A Toronto Branch.

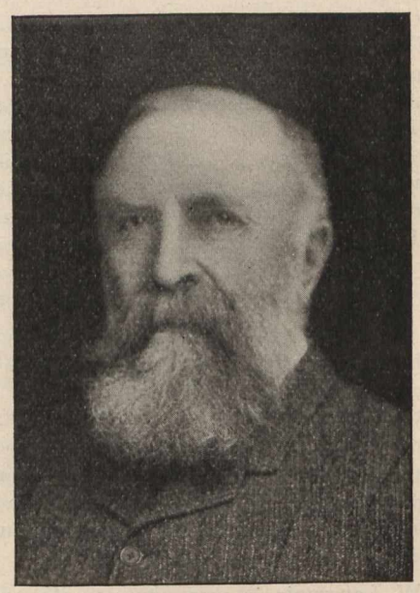
It was resolved, on the motion of C. B. Smith, that a branch of the society be formed in Toronto.

At 4.30 p.m. the engineers, together with their ladies, were received by the Lieutenant-Governor and Mrs. Clark at Government House.

Annual Dinner.

The annual dinner of the society, which was a most successful function, was held the same evening in the banquet hall of the King Edward Hotel. Many of the speakers referred in commendatory terms to the action of the council in departing from the custom of holding the annual meeting in Montreal, and expressed the hope that Toronto and other leading cities would be given an opportunity of welcoming the engineers at future annual gatherings.

After the toast of "Our Sovereign" had been loyally honored, C. B. Smith proposed the health of "Our Guests." The first speaker to respond was the **Hon. Henry R. Emmerson, Minister of Railways and Canals**, who commenced by saying that:



H. D. LUMSDEN, C.E.,
New President.

He felt quite at home among the engineers; because at his right he saw a member of the Society—his deputy, whose advice he sought on nearly all matters; while in the retiring president, E. Marceau, he saw one whom he frequently consulted in regard to those great deficit creators, the canals, which outstripped in this capacity even the Intercolonial Railway. He said there were more members of the Engineering Society connected with the Department of Railways and Canals than with any other public or private body in Canada. The members of the Society were pioneers in the progress of the country, being the forerunners of transportation and industry. Canada—declared Mr. Emmerson—is not yet even on the threshold of her greatness, she was only leaning forward to look through the door. During the next score of years there is a great work to be done by civil engineers in Canada, and the responsibility for Canada's destiny must rest upon individuals, and not upon any society. At the critical moment, the man in charge of great works must act for himself, without the opportunity of consultation with his fellows. During the coming year, Mr. Emmerson said, that over 1,500 miles of new railroads would be put down in Canada, and he referred to the fact that the United States has not a trans-continental railway, whereas we already have one complete, and two more are under construction. He referred to the time when he hesitated to let it be known that he was a Canadian, but said he, now his breast swelled with pride at being one, and he felt pity for those who are not citizens of the Dominion. Sir Wilfrid Laurier

never uttered a truer statement than when he said that the nineteenth century belonged to the United States, but that the twentieth century was Canada's; no longer do young Canadians have to go across the border to find a field for their brains, there is a field right here at home. Mr. Emmerson concluded by saying that he was willing to lend his aid to the engineers in the planning and carrying out of great works for the benefit of the Dominion.

Mayor Coatsworth greeted the engineers on behalf of the City of Toronto. He drew attention to the engineering problems of the city, and said that in Engineer Rust the city had a servant competent to carry them out. Canada's engineers had faith in the future, and were prepared to build, not for a day, but for years to come.

F. W. Campbell, Deputy Minister of Public Works of Ontario, spoke at some length, stating that while the Hon. Mr. Emmerson was looking after the great trunk lines--railways and canals—the Hon. Dr. Reaume and himself were giving their energies to developing and extending the tendrils which fed the railways and canals—the common waggon roads. After the visit to Niagara, said Mr. Campbell, it was difficult to realize the immensity of their possibilities, and predicted that within ten years every railway in Ontario would be operated by electricity. He paid a high tribute to Engineer Rust, and remarked humorously that if that gentleman carried out all the important projects promised by Mayor Coatsworth before the election he would rank as the greatest of living engineers.

Samuel Nordheimer thanked the society for the invitation extended to him, briefly and humorously.

In responding to the toast of "The Sister Professions," J. W. Tyrrell, president of the Ontario Land Surveyors' Association, said that since his first visit to the Hudson Bay territory he had been convinced of the great possibilities of that body of water as a route to Europe, and he rejoiced to know that the carrying out of contemplated railway projects would bring Canada's wheat fields one thousand miles nearer Europe by that route. F. L. Somerville, speaking as president of the Toronto Engineers' Club, welcomed with open arms the proposal to establish in Toronto a branch of the Society of Civil Engineers. Edmund Burke responded on behalf of the Ontario Association of Architects.

The toast of "The Society," proposed by M. J. Butler, Deputy Minister and Chief Engineer of the Dominion Department of Railways and Canals, brought responses from C. E. Jennings, Dr. John Galbraith, of the School of Practical Science, and M. J. Haney.

E. Marceau and W. B. McKenzie spoke to the toast of "The Retiring President and Council." C. E. W. Dodwell and G. J. Desbarats replied for "Our Visiting Members." Songs were rendered by A. Blight, A. Bowman and C. E. W. Dodwell.

Hearty singing of the National Anthem terminated this enjoyable social event.

Friday, February 2nd.

The final day was spent in visiting the larger engineering works of the city, among which were the following:

Transformer Station, T. & N. P. Co.
Canada Foundry Company.
Polson Iron Works.
Canadian Ship Building Co.
Pumping Station.
Street Railway Power House.
Electric Light Co.
Consumers Gas Company.

At Davenport works of the Canada Foundry Company, Limited, a luncheon was served in their fine new office building, designed by Beaumont Jarvis, the famous Toronto architect; and constructed almost entirely of concrete.

In concluding this account of the first annual meeting of this important organization of Canadian civil engineers held outside Montreal, we must not omit to mention that, through the courtesy of the Toronto Street Railway, persons wearing the society button were carried free over the company's lines. On the whole, the arrangements for the various social events were carried out with marked success by the local committee, of which C. H. Rust was chairman, and C. B. Smith, secretary. The cordial spirit in which inspection privileges were granted by the great corporations and the courtesies and privileges extended on every hand during the four sessional days was a striking testimony to the public importance and technical standing of the Canadian Society of Civil Engineers.

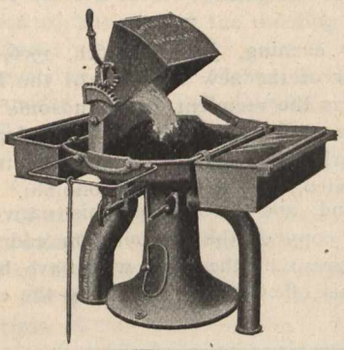
PRESENTATION AT SYDNEY, C. B.

On Friday evening, January 26th, 1906, Mr. Edward Holth, designer of the new rail mill of the Dominion Iron & Steel Co., was the recipient of a handsome testimonial by the engineering staff on the occasion of his leaving the company after nearly five years' service; for a trip around the world, via Mexico, to California, Honolulu, Japan, China, etc., to England, and to Norway, his native land. The following is a copy of the presentation address: "We, the remaining fragment of the staff, who have been associated with you in this office while conducting the engineering development of the plant to its present stage, wish to express our pleasure in having known you and in having had your guidance and instruction in our profession. We recognize that you have carried to completion a great task, in a manner so quietly and harmoniously that those associated with you could not fail to appreciate it. Having been a draughtsman for many years you have not failed to accomplish the work in a manner most satisfactory to both the company and those who have helped you to carry out your ideas; and in parting with you, we very sincerely express our regret, and take pleasure in presenting you with this souvenir, which will serve as a memento of your harmonious relations with all, and of our appreciation of your many estimable qualities."—Sydney Post.

Edward Holth, M.E.

DOWN DRAFT FORGES: STATIONARY, AND PORTABLE.

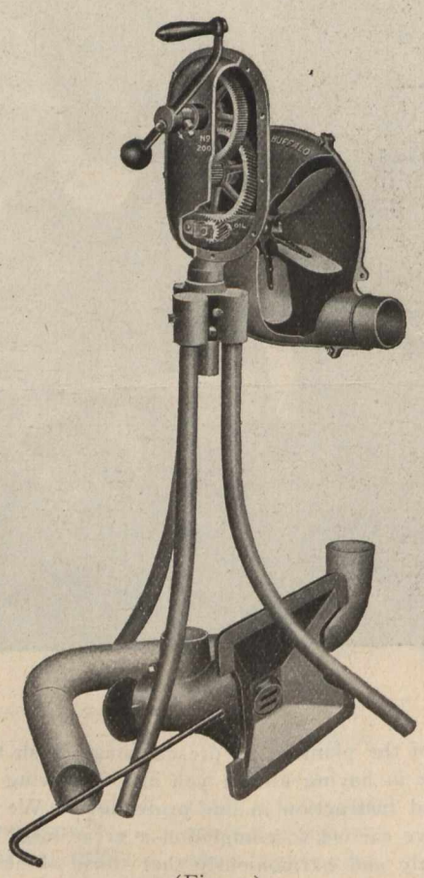
Down draft forges were placed on the market ten years ago by the Buffalo Forge Company, and have since been improved by them each year. With a down draft forge the smoke is drawn from the fires through an overhanging cast iron hood, which connects by a cast iron pipe to a salt glazed sewer pipe underground. This sewer pipe is connected to a fan, and in this way gases are drawn away independent of atmospheric pressure conditions. Throughout the course



(Fig. 1.)

of the gases the material used is proof against chemical action, so that once installed this system lasts a life-time. With all pipes underground, the ducts are safe from damage through carelessness. Overhead hoods are thus eliminated, and the shop presents a much neater appearance. Where heavy work is done the space overhead is available for a travelling or jib crane.

The blast is supplied to the forges through an underground pipe in a similar manner, and, although in this case



(Fig. 2.)

it is not necessary to provide against any chemical action, anybody familiar with forge shop practice will readily appreciate the advantages thus gained. The power to drive a blower depends upon the amount of air delivered, and much power is wasted through leaky pipes, and leaky joints in galvanized iron pipes. With underground ducts this danger is eliminated and the connection from the underground pipe to the blast gate is a cast iron piece fitted with a machine joint, so that there is no danger of leakage at this point. The demand for a portable forge of this nature has brought out a clever invention of mechanical and natural draft in the Buffalo No. 666 Forge, (Fig. 1.) With this machine the dense clouds of smoke that pour into the smithy from the original forge are entirely done away with. The suction side of the fan is connected to the hood, and on the discharge side of the fan a small pipe is carried to the stack to form an induced draft. When the blast is on and the fire throwing off the densest smoke, the down shaft action is at its height; the fan draws every vestige of smoke, sparks, etc., etc., into the hood at the base of the stack, whence the greater part escapes up the chimney. The remaining part of waste gases is drawn through a back connection to fan, and having received a supply of fresh air through a suitable opening is returned to the tuyere through blast pipe.

This forge is equipped with the Buffalo No. 200 Hand Blower, (Fig. 2), which is guaranteed by the makers for a period of five years from date of sale, and is also guaranteed to produce more air per revolution than any other hand blower built. This guarantee seems reasonable when it is considered that the casing is designed on the same principle as large fans for cupolas, and for heating and ventilating, which are manufactured by the same concern.

* * *

INDUSTRIAL NOTES.

The Alberta Engineering and Construction Co., Edmonton, Alta., N.W.T., are desirous of acquiring the agency for a first class grade of cement, which can be delivered at Edmonton at a reasonable figure. This enterprising company, under the management of R. P. Keely, M.M.E., have a distributing base for their line of gas producer engines, concrete mixers, stone crushers, tile, concrete block, and moulding outfits, with great possibilities for business in the West. We wish them every success.

Waterloo, Ont., is to have an up-to-date brick manufacturing plant.

The Pratt & Whitney Company are about to establish a branch at Dundas, Ont.

The Polson Iron Works Company have moved into their new office, the work on which has been done almost entirely by themselves.

The Canadian Portland Cement Company have ordered from the Robb Engineering Company two 150 h.p. boilers for their plant at Marlbank, Ont.

Owing to increasing business Messrs. Sheldon & Sheldon, of Galt, have found it necessary to make extensions to their premises, and are remodelling the present plant.

The Robb Engineering Company has received an order, through Mr. Martin J. Heller, of San Francisco, for a 150-h.p. tandem compound engine for the Nipissing Mining Company, Cobalt, Ont.

The Cataract Power Company are just completing the installation of new Westinghouse dynamos and German turbines to give them 14,000 h.p. additional capacity at their plant at DeCew Falls.

The Garlock Packing Company, Hamilton, has been appointed Canadian agent for the celebrated pulley covering manufactured by the Warren Company, of Chicago, and the sales so far have been very encouraging.

At the recent Smoke Abatement Exhibition held under the auspices of the Royal Sanitary Institute, Meldrum Bros., Limited, were awarded the silver medal for their refuse destructor, this being the only award of any kind for refuse destructors.

Allis-Chalmers-Bullock, Limited, of Montreal, have removed their sales office for the Maritime Provinces from Halifax to New Glasgow. This is considered a more central locality for the great steel, iron and coal industries, with which a large portion of their business is done.

The Massey-Harris Company have decided to erect a very large building at Brandon next summer, and Brandon will be made one of the chief distribution points for the province.

The B. F. Sturtevant Company, of Boston, Mass., has just received orders for the installation of standard economizers in the power plants of the Young-Hartsell Mills Co., Concord, N. C., and D. B. Martin, Limited, Toronto Junction, Ontario.

Dodge Manufacturing Company, of Toronto, report business in their various lines as particularly brisk, the company's Montreal branch especially coming in for a substantial increase in volume over anything heretofore on record. The sale of Dodge Split Iron Pulleys (machine moulded) is increasing by leaps and bounds.

The Westinghouse Electric & Manufacturing Company have received an order from the United Railways & Electric Company, of Baltimore, for one hundred No. 101-B four motor equipments complete with all details. This is in addition to a recent order for two hundred motors of the same type.

The Canadian General Electric Company has sold the remaining 11,000 shares of its authorized capital to English bankers at 120. The price, $1,320,000, has been paid over. Under the agreement, the stock is to be listed in London, and not a share of this stock will be offered in the Canadian market for a term of years.

Another section of the contract for the electrification of the street car system of St. Petersburg has been awarded to the American Westinghouse Company. It covers the roadbed and rails of that section, and involves $1,675,000. The power would be generated at Imeta Falls, Finland, and will be transmitted 120 miles.

The Economical Manufacturing & Supply Company, Limited, of Toronto, are installing machinery for the manufacture of the perfect hollow set screw, illustrated in our issue of October, 1905. The life-saving feature of these set screws commends them, as they do away entirely with the protruding heads, which are not only dangerous, but illegal.

The Wanskuck Company, Providence, R.I., and the Miramichi Pulp & Paper Company, Chatham, N. B., who have previously used economizers of other makes, have just placed orders with the B. F. Sturtevant Co. for the installation of standard economizers. In both power plants these economizers are to be installed in connection with Sturtevant induced draft apparatus.

The Westinghouse Electric & Manufacturing Company have recently closed a contract with the Southern Power Company, at Charlotte, N. C., for a large and complete power equipment consisting of eight 3000 k.w. water wheel type alternators, with a complement of transformers, exciters and switchboards. This is the largest contract for electrical apparatus placed in the South for some years.

The California Gas and Electric Corporation has just placed an order for one 13,000 h.p. Doble tangential water wheel unit, with the Abner Doble Company, San Francisco. It will be of the double-wheel two-bearing type, and will operate at a speed of 300 r.p.m., driving a 5500 k.w. Westinghouse generator. The same company has also placed an order for a Bethlehem nickel-steel hollow forged shaft, with two 16-inch Doble ring-oiling and revolvable shell bearings.

The annual report of President J. W. Duntley to the shareholders of Chicago Pneumatic Tool Company, New Jersey, shows that the company has had a very prosperous year. The largest sales since the company was organized were made last year, the profits amounting to 9.15 per cent. available for dividends. Foreign operations have been increased by the organization of the International Compressed Air and Electric Company, Berlin. The company has also acquired the plant of the Canadian Pneumatic Tool Company, of Montreal; also the Philadelphia Pneumatic Tool Company, Philadelphia. During the year many marked improvements have been made in the plants controlled by the company.

The Aikenhead Hardware Company have moved into their new and commodious premises at 17, 19, and 21 Temperance Street, Toronto.

Among recent sales made by the Allis-Chalmers-Bullock, Limited, Montreal, were thirty of the latest type improved coal cutters, to the Dominion Coal Company, Glace Bay, C. B.; two compound steam driven air compressors to the Acadia Coal Company, Stellarton, N. S., and a 425 k.w. alternating current generator for the corporation of Parry Sound.

Capitalists in the American Steel Foundry Company are said to have organized a company named the Dominion Steel Car Company, Limited, for the manufacture of steel cars for Canadian railways. The plant will cost $500,000, and will be located at Montreal West. Construction will begin in the spring, and it is expected to have the works in operation with about 500 employees by the middle of the summer.

The Sydney Foundry and Machine Works have lately erected an addition to their plant 100x45 ft., to be used as a forge and boiler shop. They have installed a one thousand pound steam hammer, a set of heavy power plate rolls, capable of rolling one and one-quarter inch plate, an air compressor, and full outfit of pneumatic drills, riveters, etc. They have also installed a number of small tools in their machine shop, and intend putting in considerable new heavy machinery during the present year.

The year 1905 has been prosperous for the iron and steel industries in Cape Breton. The output of pig iron was 162,000 tons, and of steel 163,500; of 80-pound rails since June, 1905, 44,000 tons, and rods for the year 47,100 tons. The balance of the steel output has been made into blooms and billets, most of which material has found a market in Canada. A shipment of 30 tons of rails has been made to the Boston Elevated Railway for experimental purposes on the sharp curves of that road. During the year two blast furnaces were continuously in operation, and in November a third was placed in use. The Nova Scotia Steel and Coal Company, Limited, had a prosperous year, with an output of 120,000 tons of coke, 58,000 tons of pig iron, and 22,000 tons of steel.—Consular Report.

The Westinghouse Machine Company filed a bill of complaint on February 9th, in the Circuit Court of the United States for the District of New Jersey, against the Allis-Chalmers Company, alleging that the Allis-Chalmers Company, in the manufacture and sale of its turbine, is infringing Patent No. 655,414, issued to Mr Charles A. Parsons, August 7th, 1900. This invention was made jointly by Parsons, Stoney and Fullagar, and is for steam turbine ring of blades covering the method of construction used by the Allis-Chalmers Company for securing the blades and vanes in their respective holding elements. An assignment of the entire rights under this patent was secured by the Machine Company from Chas. A. Parsons on January 10th, 1905, both Stoney and Fullagar having assigned their interest in the same to Parsons prior to the assignment of the patent.

MARINE NEWS.

Vernon H. Brown & Co., agents for the Cunard Line, will move from 29 Broadway to the Battery Park Building, 24 State Street, New York, on April 1st.

The monster battleship "Dreadnaught," which, when finished, will have a cost of $7,500,000, was launched at Portsmouth, on February 10th, by King Edward.

Capt. Joseph M. Stover died at Sombra, Ont., recently. He was a popular captain in the 60's and 70's. His last command was the steamer "James C. Woodruff." He retired from the lakes several years ago.

The Motor Boat Club of America, having challenged the Motor Yacht Club, (the present holders), to race for the International Motor Boat Cup, the contest will be held in British waters, probably at Cowes, some time between the 6th and 18th of August, this year.

RAILWAY NOTES.

Three overhead bridges will be required for the proposed C. P. R. line between Victoria Harbor and Peterboro', Ont.

Over $250,000 will be spent by the C. P. R. this year on new telegraph lines and extensions, and improvements of the present system, west of Lake Superior.

The Toronto Street Railway Company has ordered 5,000 tons of 90-pound girder rails from the Lorain, Ohio, plant of the United States Steel Company. This, with 1,000 tons on hand, will enable the company to re-lay 42 miles of system.

Resident Engineer Somerville, of the Grand Trunk, stated that three steel bridges will be required to carry electric cables over their rails. Two will be in the vicinity of Niagara Falls, and one at Bronte. The cost of the bridges would be from $2,000 to $5,000.

The Federal Department of Railways has approved the plans for a 2,000,000-bushel wheat elevator at Port Colborne, the plans for which have been prepared by Mr. Jamieson, of Montreal. Tenders for the construction of the elevator will be called for early this year.

The commissioners of the Temiskaming Railway have informed the Ontario Government of their intention to electrify the railway from North Bay to the Blanch River, 38 miles north of New Liskeard. This will mean the electrification of the first 151 miles of the road. The power will be obtained from the waterpowers along the route.

It has been decided that the G. T. R. shops in Stratford will be enlarged and a boiler and plate shop erected. The dimensions of the boiler shop will be about 225x120 feet; and those of the plate shop about 125x50 feet. A rough estimate of the cost, exclusive of machinery, is between $75,000 and $100,000. When the new buildings are completed the works will provide accommodation for 1,500 men, and it is expected to have this number employed by next winter.

The Grand Trunk Pacific Branch Company is asking for incorporation for the purpose of building branch lines to connect with the transcontinental railway. The directors of the company will be practically the Grand Trunk Pacific directorate. It is proposed to build branch lines to Halifax, St. John, Montreal and Ottawa, in Eastern Canada. Among western connections will be a branch to Calgary, Battleford, Brandon, Regina, Hudson Bay and Vancouver. The intention is to build twenty-three branches in all.

The annual report of the Ottawa Electric Railway Company shows that the business of the road has steadily increased year by year. Last year the number of passengers carried was 9,891,000, and the receipts were $449,633. The net profit for the year was 14.3 per cent. Of this amount 10 per cent. was paid in dividends and bonus and the balance, $44,000, was applied to the reduction of plant and profit and loss accounts. It is claimed that the percentage of profit of the last year's business is the best ever shown by a street railway in Canada, the Montreal road coming next with a percentage of 11.25.

MINING MATTERS.

A refinery to treat silver ores will be established at Hamilton.

It is stated that one hundred years will probably see the exhaustion of the world's present iron ore sources.

The Granby Consolidated Mining, Smelting and Power Company, Granby, B. C., one of the larger mining interests in British Columbia, has recently added another converter stand, complete with hydraulic cylinder for operating the same, to those already installed. The new equipment was purchased from the Allis-Chalmers Company, Milwaukee.

The Allis-Chalmers-Bullock, Limited, Montreal, the Canadian representatives of the Allis-Chalmers Company, Milwaukee, recently received an order from the Canadian Forty Mile Gold Dredging Company, of Toronto, Canada, for a special gold dredge equipped complete with 5 1-3 cu. ft. buckets. The contract covers the entire machinery equipment complete, ready for operation, including electric light plant, two boilers, 100 h.p. each, engines, pumps, etc. The dredge will be ready for use early in May.

It is reported that Mackenzie & Mann have purchased a ten thousand dollar option on an iron mine at Hutton, Ont. and that a huge smelter will be erected in Toronto for the treatment of the ore. The location of the smelter is said to be in Ashbridge's marsh, at the mouth of the Don, and color is lent to the rumor by the fact that the James' Bay branch of the Canadian Northern will enter Toronto by way of the Don valley, going as far south as possible in the direction of the marsh. It is said that $5,000,000 will be expended in the erection of the smelter.

LIGHT, HEAT, POWER, ETC.

A power dam costing $250,000 to generate 2,575 horse power, on the Maitland River, about four miles from Goderich, probably will be commenced within a few months.

The City Council of Sherbrooke, Quebec, has decided to instruct the city solicitor to take proceedings to force the Power, Light and Heat Company of Sherbrooke to sell its plant to the city at a price to be fixed by arbitration.

Mr. John Knox, on behalf of the Western Counties Electric Company, recently purchased from Alfred John Wilkes and George H. Wilkes, the entire stock and assets of the Brantford Electric & Operating Company, Limited.

The Provincial Light, Heat & Power Company will construct a new power house to develop water power on the Soulanges Canal near Cedar Rapids. Plans for the electrical equipment are being prepared by R. S. Kelsch, C. E., Montreal.

Syracuse, which is fifty or sixty miles farther away from Niagara than Toronto, is likely to enjoy the advantage of having power delivered there much before the latter city, as the Niagara, Lockport, and Ontario Power Company has acquired the right of way for transmission lines.

The Canadian Westinghouse Company is now at work on a large order for the British Columbia Electric Railway Company. They are putting in a 1500 k.w. generator, and installing the plant at a sub-station with transformer, roller converters, and switchboard. The value of the contract is $90,000.

For the first time since the first power plant on the Canadian side of the Falls was put in operation one of them was shut down by the ice jam on February 5th. The power company was idle for about seven hours because of the quantities of ice in the forebay crowding into the racks at the intake. The run of ice in the river is very heavy and a big ice bridge has formed in the gorge below the Falls.

Plans and profile have been registered by the Toronto & Niagara Power Company in Welland registry office for a power transmission line commencing at a junction with the Toronto & Niagara Power Company's main line on the farm of H. Coon in the township of Pelham, and continuing westward over the farms of H. Coon, Willis Bros. and Chas. McGlashan, to the township of Gainsboro, (a distance of one mile.) The line will run to Brantford.

The report of the light department of the City of Kingston, Ont., shows that the city's light, heat and power plant earned a surplus over all expenditures of $5,674 for the year 1905. During the year there was spent out of the earnings $25,000 on capital account and $10,000 for repairs and betterment of the plant; at the same time there was a reduction in price of light, heat and power to consumers from the rates charged by the private company of $4,500.

Arrangements are being made for transmitting electric power from Hannawa Falls, N. Y., to Brockville, Ont., via Ogdensburg and Prescott. The line will come to Ogdensburg, N.Y., without fail, it is stated, and if sufficient inducements are held out, a cable will be laid across the river between Ogdensburg and Prescott, Ont., and continued to Brockville. It is estimated that the electricity can be generated at Brockville at a cost of about $35 per horsepower.

PERSONAL

John Milne, of Hamilton, has been appointed a member of the Hydro-Electric Commission, in place of P. M. Ellis, of Toronto, the latter having resigned.

It is officially announced that Mr. James A. Milne, who has for a number of years been comptroller of the Allis-Chalmers Company, Milwaukee, has accepted the position of general manager of Allis-Chalmers-Bullock, Limited, Montreal, Canada, to become effective on or before May 1st, 1906.

Mr. Milne is a native of Canada, having been born at Waterdown, Ontario, in 1872. After completing a public school and collegiate course, he began his business career at Toronto in 1888. During the ensuing four years he was with Robert Simpson & Company, and Wyld, Grasett & Darling, of that place; but in 1892 he removed to Chicago, entering the employ of Garson, Pirie, Scott & Company. Subsequently he worked for Reid-Murdock & Company, and the Chicago Packing & Provision Company—for the latter as chief accountant. Then he became associated with Jones, Cæsar & Company, chartered accountants of Chicago and New York, and it was this connection which brought him into touch with the Allis-Chalmers Company. In August, 1901, he entered its employ, as chief cost clerk, and one month later was appointed acting comptroller, being formally elected to that position at the meeting of the board of directors, in May, 1902. Since the early part of last autumn, Mr. Milne has been one of the directors of Allis-Chalmers-Bullock, Limited, and the fact that he still retains Canadian citizenship, and is deeply attached to his early associations, has been an important factor in influencing him to heed a recall to the Dominion.

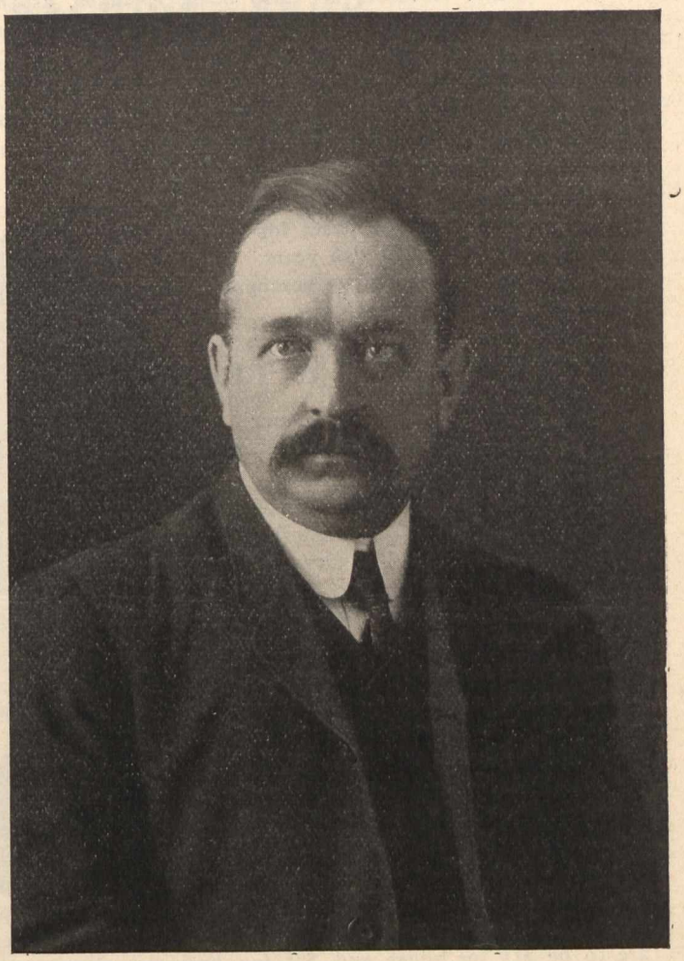
The Canadian company is conducted as an entirely separate organization, but, in addition to its own production, sells

James A. Milne.
Gen. Manager, Allis-Chalmers-Bullock, Ltd., Montreal.

the products of Allis-Chalmers Company in the Dominion of Canada.

The Allis-Chalmers-Bullock, Limited, of Montreal, is an allied interest of the Allis-Chalmers Company, and owns a large manufacturing plant located at Montreal, the direct management of which will now be assumed by Mr. Milne.

The Electrical Development Company of Ontario, at its annual meeting in Toronto on February 6th, elected Sir H. M. Pellatt president, and Frederic Nicholls, vice-president.



Alcide Chausse.
President Province of Quebec Association of Architects.
Elected at annual meeting in Quebec on Jan. 25th, 1906.

Mr. G. F. Spry, for six years foreman of the boiler department of the Polson Iron Works, has gone to Collingwood to a similar position with the Collingwood Shipbuilding Company. Before leaving he was presented with a travelling case and a gold headed umbrella by the men in his department.

MUNICIPAL WORKS, ETC.

Peterborough, Ont., council, will purchase a new stone crusher. Tenders will be asked.

A new pumping station, to cost about $25,000, will be considered by Moncton, N.B., council.

Winnipeg carried by-laws for $600,000 for a municipal gas works, and for $150,000 for the General Hospital.

The Public Works Department, Ottawa, is calling for tenders for six lighters and excavating at Parrsboro', N. S.

Kingston, Ont., has a surplus of $4,605 from its waterworks, after paying working expenses and interest on debentures.

Calgary, Alta., is promised that the Great Northern Railway, the Grand Trunk Pacific Railway, and the Canada Northern Railway will all have lines running into the town.

The town council of Cayuga met recently and settled the terms of the agreement with the Windsor Glass Machine Company of Pittsburg, who will commence the erection of a $60,000 plant on the first of March.

Brandon, Man., is to have a Transfer Railway connecting the railways in the city.

Goderich, Ont., will vote to guarantee $35,000 bonds towards building another elevator, in addition to the one being rebuilt. Other elevators are also being planned, as the deepening of the harbor will lead to more grain coming in.

Montreal will ask for power to borrow three hundred thousand dollars for pavements; the Board of Trade has asked the council to improve the fire protection service; the city has been empowered to purchase St. Helen's Island from the government for $200,000.

Ottawa has notified the Ottawa Electric Company of the cancellation of the contract for street lighting; this will take effect at the end of two years. The municipal electric plant will be governed by a commission, consisting of the Mayor and two aldermen.

TELEGRAPH & TELEPHONE

Edmonton, Alta., town council is considering the installation of a telephone system. R. S. Kelsch, Montreal, has been engaged on the matter.

The Gold Rock Telephone Co., Dinorwic, Ont., has been organized by Archie Campbell, and will operate between Gold Rock, Wabigoon, Dinorwic, Deyden and the Grand Trunk Pacific.

The Bell Telephone Company is arranging for the installing of a plant at Arcola, Man. It is the intention of the company to run its long distance lines from Souris to Arcola, thence to build a line to Regina. Also to turn at Arcola and run north and connect with the main line.

It is stated that the Ontario Government is considering the question of controlling the operation of telephones in the Province. In this connection it is said that the Bell Telephone Company will be compelled to exchange traffic with farmers' lines. The question of rates will also be considered.

Brantford, Ont., has granted a twenty-one year franchise to the Canada Automatic Machine Telephone Co. Rates are to be $15 for house and $25 for business phones, the Bell rates being $25 and $35. The company must start service within one year, and the city can buy out the company at any time after three years.

A bill has been introduced in the British Columbia Legislative Assembly by Price Ellison, being designed to put all telephone companies operating in the province under public control. Facilities for the interconnection of all operating lines are provided and the rates are to be controlled by the corporation councils within all municipalities and by the lieutenant-governor-in-council in the unorganized districts.

The Grand Trunk Railway has not renewed its contract with the Bell Telephone Company for a long-distance service, it being the intention of the railway company to install a long-distance service of its own. It has short services now from Toronto to outside towns with little expense attached to the operation, and will also extend over the lines of the Grand Trunk Pacific as fast as the railway is built and put in operation.

NEW INCORPORATIONS.

Dominion.—A. Prud'homme & Fils, Montreal, $145,000; A. Prud'homme, G. Prud'homme, H. Godwin, S. Beaudin, Montreal; A. M. Bissonnette, St. Joseph de Soulanges, Que.

The British Columbia Coal & Coke Co., Toronto, $12,000,000; J. S. Lovell, W. Bain, R. Gowans, E. W. McNeill, W. F. Ralph, Toronto.

Pratt & Whitney Co., of Canada, Dundas, Ont., $100,000; R. C. McKinney, New York; L. B. Morgan, Plainfield, N.J.; C. L. Cornell, Orange, N.J.; H. Bertram, A. Bertram, Dundas, Ont.

Darling Bros., Montreal, $250,000; A. J. Darling, G. Darling, E. Darling, G. H. Butcher, G. W. MacDougall, Montreal.

The Abittibi Mining Co., Montreal, $10,000; G. Langlois, G. Deserres, J. U. Emard, J. M. Wilson, J. M. Fortier, L. N. Dupuis, S. Lichtenhein, Montreal.

The Reinforced Concrete Company, Montreal, $200,000; D. Loynachan, T. J. Donoghue, Montreal; J. T. Bethune, A. W. Powell, Ottawa; J. L. Goffette, Montreal.

Erie and Ontario Dredging Co., Welland, Ont., $96,000; D. Scott, Ottawa; E. A. C. Pew, G. S. Pew, Toronto; E. J. Hingston, S. J. Dark, Buffalo, N.Y.

Ontario.—The Silver Leaf Mining Co., Toronto, $5,000,000; J. H. Spencer, C. A. Foster, L. J. West, M. A. Hodgson, D. W. Coulter, Toronto.

The Temagami Silver Mining Co., Sturgeon Falls, $150,000; G. Gordon, J. Bradford, J. D. Cockburn, C. T. Kirby, G. P. Cockburn, Sturgeon Falls, Ont.; A. B. Gordon, Sudbury; T. Urquhart, Toronto.

Canadian Dredge and Construction Co., Midland, Ont., $150,000; J. Playfair, D. L. White, D. S. Pratt, P. Potvin, Midland; W. J. Sheppard, Waubaushene, Ont.

The Northern Ontario Copper Co., Sault Ste. Marie, $500,000; J. A. Montague, O. B. Jury, U. McFadden, A. C. Boyce, W. E. Gimby, Sault Ste. Marie.

The Croesus Mining Co., Ottawa, $500,000; S. Ogilvie, D. L. McGibbon, G. O. McMurtry, Montreal; T. Lewis, J. F. Smellie, Ottawa.

The Clarks Standard Developing Co., New Liskeard, $40,000; J. J. Grills, R. B. Herron, W. V. Cragg, J. L. Brown, New Liskeard; T. Clark, Hudson, Ont.

The Canadian Cobalt Silver Mining Co., Ottawa, $250,000; T. Birkett, T. Lindsay, H. H. Lang, D. Macnair, A. A. Taillon, W. D. Hogg, W. F. Powell, R. F. Shillington, Ottawa.

Lake Shore Oil and Gas Co., Brantford, $1,000,000; F. M. Lowry, Pittsburgh, Pa.; E. Sweet, J. H. Hewitt, H. S. Hewitt, J. Ruddy, Brantford.

The Smith's Falls Foundry and Malleable Co., Smith's Falls, $100,000; A. Foster, A. Stephens, W. A. G. Farrell, M. Ryan, D. F. Wood, Smith's Falls.

King Cobalt Mining Co., Toronto, $300,000; A. MacGregor, H. W. Page, J. P. MacGregor, E. Alexander, D. L. Tarlton, Toronto.

The Jessie Fraser Copper Mining Co., Niagara Falls, $250,000; E. E. Fraser, W. H. Ward, A. S. Murray, D. W. Mitchell, Niagara Falls, Ont.; J. T. Lindsay, North Bay; J. M. Mitchell, Tarryall, Col.

Brantford Roofing Co., Brantford, $100,000; D. McHenry, C. L. Millhouse, South Bend, Ind.; W. D. Schultz, G. C. Schultz, G. S. Matthews, A. H. Elliott, Brantford, Ont.; J. Cobbledick, Exeter.

The Crown Mining Co., Leamington, Ont., $1,000,000; F. S. Moss, J. H. Conover, C. L. Coultis, E. Winter, G. A. Brown, Leamington; W. J. Clearihue, Detroit, Mich.

Great Western Power & Manufacturing Co., Peterborough, $200,000; J. D. Flavelle, W. M. Flavelle, Lindsay; C. B. McAllister, F. J. Bradd, G. M. Roger, Peterborough.

The Capital Scale and Iron Foundry Co., Ottawa, $40,000; R. B. Gorman, F. Miller, A. E. Dittman, L. J. Kehoe, J. Y. Moxley, E. P. McGrath, W. Thackray, Ottawa.

The Anthony Wire Fence Co., of Canada, Windsor, $100,000; D. P. Anthony, C. B. Anthony, T. C. Harris, J. C. Hiteshu, Tecumseh, Mich.; J. W. Nixon, Holloway, Mich.

Canadian Lock Nut Co., Toronto, $300,000; A. G. Slaght, T. L. Monahan, L. G. Haszard, E. C. Spereman, Toronto; F. Playter, Boston, Mass.

Manitoba.—London Fence, Limited, Portage la Prairie, $250,000; E. Brown, J. S. Willmott, Portage la Prairie; A. E. Blashill, H. G. Gray, London, Ont.; D. Fleming, A. E. Hinds, E. Loftus, Winnipeg, Man.

New Brunswick.—The Stratton Babbitt and Car Bearing Co., Fredericton, $190,000; J. R. Stratton, Moncton; R. A. Borden, Moncton; E. N. Jones, St. John; E. Simpson, Petitcodiac; J. D. Ross, Moncton.