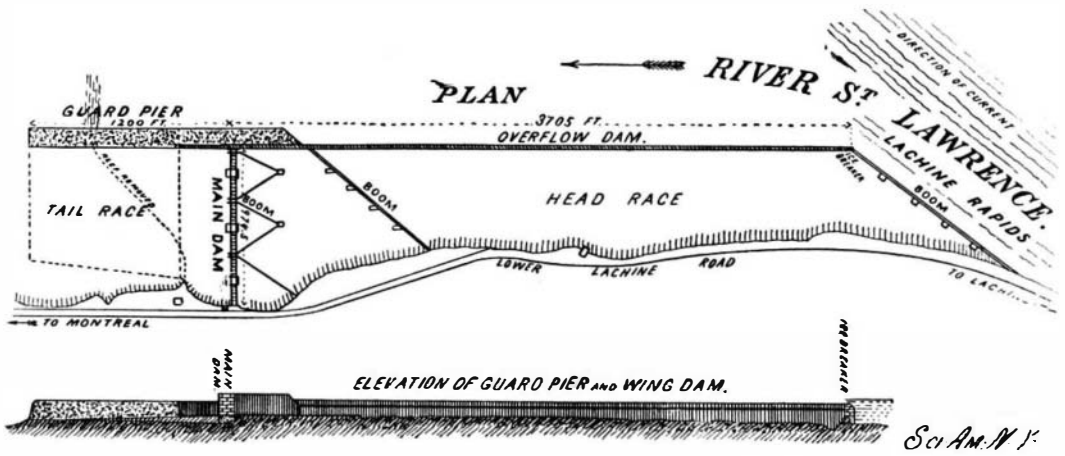
THE LACHINE RAPIDS ELECTRIC LIGHT AND POWER PLANT.

It may be said that the thriving city of Montreal is indebted to the natural barrier of the Lachine Rapids for its existence. The St. Lawrence River can accommodate large ocean-going vessels for the first 600 miles of its length; but here its waters rush through a series of formidable rapids which are quite impassable to deep sea craft. History records how one Jacques Cartier, in his attempted voyage to China, was halted at this spot. The obstacle which stayed the doughty sailor subsequently determined the location of the present splendid city to which reference has been made, and after a lapse of three centuries and a half the vast source of energy presented by the rapids has been impressed into the service of Montreal.

We republish an extremely interesting and historic map, which, together with the smaller map, which has been prepared from later surveys, shows the location of the Lachine Rapids with reference to the surrounding country, and incidentally suggests the origin of the name by which the rapids are known. The original map was prepared by the British, after their occupation of Canada, from the surveys of the French engineers. It is said that the rapids were named La Chine by the explorer La Salle in honor of China, with which his business interests had been identified.



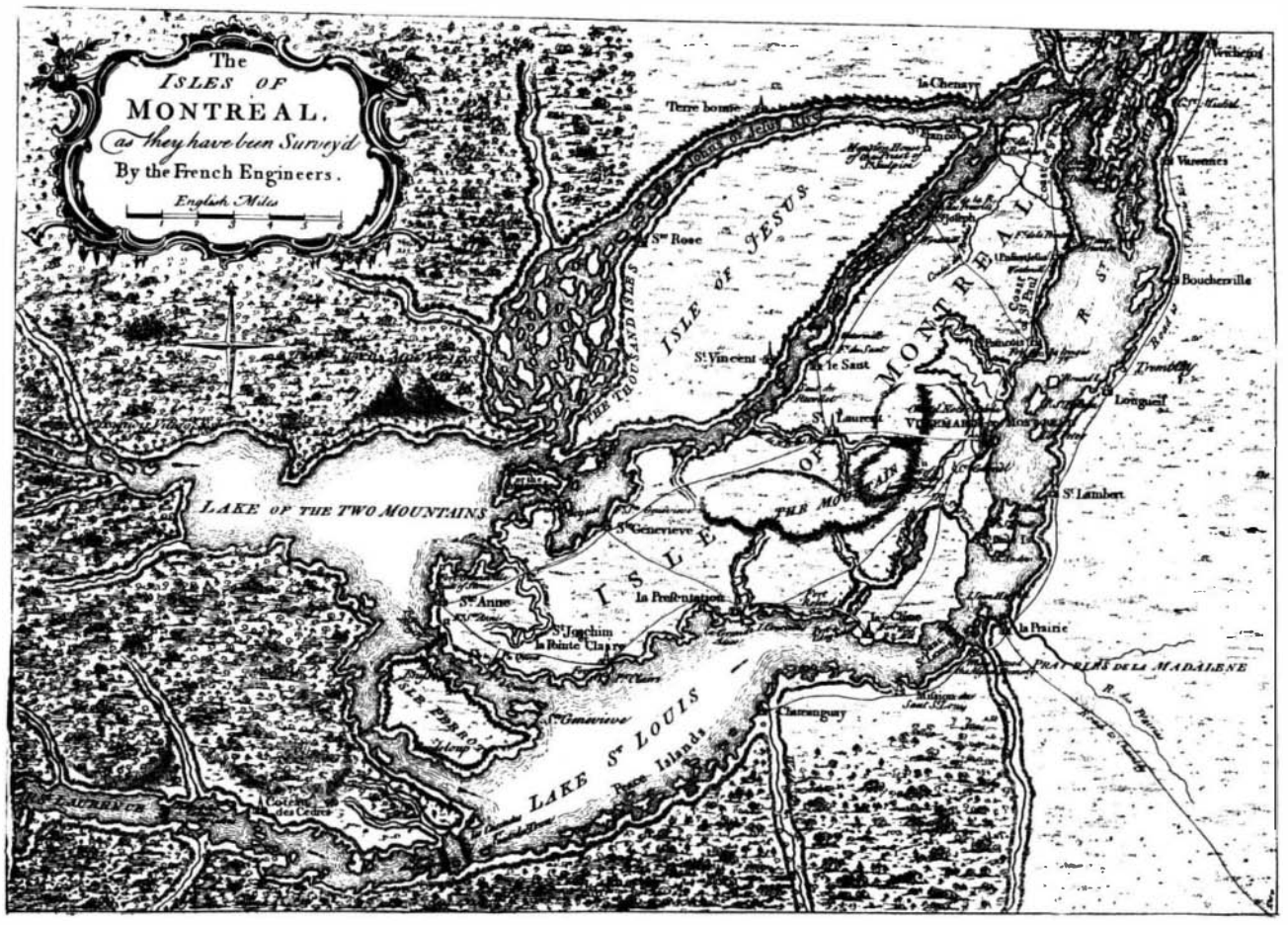
PLAN AND PROFILE OF THE LACHINE POWER PLANT.

The idea of developing the rapids for water purposes is not by any means a new one. As far back as 1868 a company was formed called the St. Louis Hydraulic Company, in which a number of Montreal's then prominent citizens were interested. But the objects that the two companies had in view were altogether different. That of the original company was to create water powers with factories and mill sites at the rapids, which practically meant bringing mills out of the city and establishing them in the bed or on the banks of the river; whereas the present promoters started out with the intention of transmitting the power to already established factories, wherever situated.

The undertaking was one of considerable difficulty, and one which indirectly as well as directly met with much opposition. To commence with, over 225,000 cubic yards of rock had to be taken out of the reclaimed bed of the river after the temporary cofferdams had been built. One of the most serious obstacles was a troublesome reef of considerable size, which was the cause of many scientific and expert opinions as to the impossibility of carrying out the scheme because of backwater, until the unwatering of the river bed exposed the reason for the phenomena concerning which so much had been said.

It is needless to trace the gradual growth of the work, but before proceeding to a description of the plant as completed, passing reference may be made to a matter which gave rise to considerable discussion among engineers. This was the possibility of the accumulation of frazil and floating ice. In response to many objections to the plan on this score, the engineers of the company, W. McLea Walbank and T. Pringle & Son, issued the following statement: "We do not anticipate any trouble from frazil. By the plan proposed, a reservoir or lake of still water will be formed at the head of the rapids, which will freeze over early in the fall, and as it is a well established theory that frazil will not form on the cover, none will form in this reservoir. There only remains then to deal with the anchor ice and frazil forming in Lake St. Louis and the rapids above us. The current in our proposed head race will be only two feet a second, and as the current in the river will be some 15 or 20 feet a second, no more water can be drawn through our headrace than we allow to pass through our wheels; a sort of water dam will be formed at the intake, where the frazil and ice will rise to the surface, and by the swift current in the river will be deflected and carried into the south channel." As far as could be judged last winter, this was exactly what occurred.

The head race is 4,000 feet long and 1,000 feet wide at the main dam on which the power house is built, the depth being 13 feet. It was almost entirely blasted out of solid rock, the blasted rock being used to riprap the wing dam separating the head race from the turbulent waters of the Lachine Rapids. The bottom of the tail race is about 9 feet lower than the head race, and 1,400 feet wide, so that ample provision is made for carrying the water away from the wheels. The main dam and power houses, an illustration of which is given, are of especial interest. There are 43 flumes in the main dam, between which the massive piers of cut stone present a very solid appearance. In each of these flumes, excepting three waste weirs, two 300 horse power turbine wheels are placed. At the mouth of each flume are two vertical sliding gates, and as a protection against floating ice and driftwood three separate booms are provided, one at the entrance to the head race, another about 700 feet from the power house and a third system of booms in zigzag line just above the gates. The wing dam, parallel to the shore and about 1,000 feet distant therefrom, is a mile in length. It is built of 12 by 12 inch timbers, filled with rock, and faced with 3 inch plank.



ANCIENT MAP OF THE ENVIRONS OF THE LACHINE RAPIDS.

The equipment includes 750 kilowatt generators and 72 improved cylinder gate wheels, each 54 inches in diameter. Under the average 14 feet head of water obtained, these wheels will develop 300 horse power per wheel. At present only 48 of them are actually in position, although the balance are on the ground, and will be put in shortly. They are put in, in sets of six, that is to say there are at present eight, and later there will be twelve sections, each section consisting of six turbines geared to one jack shaft for driving one large generator, and each section being provided with an electro-mechanical governor for regulating the speed. The power is transmitted from the turbines to the generator shafts by means of mortise bevel gears carefully finished. Each dynamo has revolving fields and stationary armature, and the two parts are so built that one can be moved relatively to the other, in order to give access to all parts for repairs. They have self-oiling and self-aligning bearings.

Each dynamo has a capacity of 750 kilowatts on a non-inductive load and an approximate voltage of 5,000 volts. They have 40 poles and a speed of 175 revolutions per minute; so that the electrical output of the dynamos to the mechanical power on the shaft (including in this one-fourth of the mechanical power required for the exciter when feeding four dynamos) will be about 95 per cent. The dynamos operate in parallel, and when the turbines are adjusted for equal outputs at the same speed, each dynamo carries its own proportion of the total load.

The six exciters are direct current, multipolar, belt-driven dynamos, each of capacity to excite simultaneously the fields of the four alternators when they are running at 10 per cent less than full speed. The armature is iron-clad, with separately formed insulated coils; the brushes, carbon and the machines are mounted on rails with tightening screws. The Canadian General Electric Company, a branch of the American General Electric, guarantees the dynamos and all other work put in by them for a period of one year.

The power house is a fireproof building 1,000 feet in length, composed of three dynamo houses and turbine sheds. A section of the interior is shown in one of the illustrations given. It is of steel framework, the dynamo houses being of pressed brick, while the turbine sheds are steelwork studding, with two thicknesses of inch plank, over which is three-ply felt covered with corrugated iron. The floors of the dynamo house are steel beams and concrete covered with slate one and a half inches thick. An electric traveling crane capable of carrying twenty-five tons runs the whole length of the building, and will be used for handling the heavy parts of the machinery.

Starting from the power house is a pole line which carries the electric power to the outskirts of the city, where it passes underground to the substation. The transmission line is very substantially constructed, the poles being iron lattice, embedded in concrete, with 6 × 6 chamfered cross arms of red pine, carrying six wires of No. 0 B. & S. bare copper. These are supported by double petticoated porcelain insulators, jointed to the steel frame and securely fastened to take up a tension of the line due to one inch of sleet or ice.

The distance from the power house to the Lachine Canal, near the Wellington Bridge, where the wires are attached to a specially designed terminal pole, is about 30,000 feet. From this point the wires are gathered together and formed into a cable covered with paper and lead, and, passing through the manhole and under the Lachine Canal, at a depth of about 33 feet below the coping of the canal, as shown on drawings, it continues thus through the streets of Montreal into the substation. This line is provided at four points with a specially designed Wirts lightning arrester.

There will be in each of the power houses at the rapids a switchboard, taking care of four generators and two exciters, and so constructed that any exciter may be operated in either power house and the whole system work in parallel. It will connect in the tower to the terminal board, from which any machine can

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be switched onto any line. There will also be a substation switchboard in the city which will subdivide the power that is brought in in large units into smaller units, to be distributed as demanded in the city proper, the voltage being continued at the high tension, namely, 4,000 volts, and transformed in manholes in the various sections of the city to 112½ or 225 volts for the secondary distribution. The power house will be protected by a system of electrical pumps and stand pipes and will be heated by electricity.

The work of placing the wires underground in the city was undertaken and successfully carried out by the National Conduit Company, of New York, 500,000 feet of cement-lined iron pipes being laid.

Mention has been made of the substation in the city. This is a handsome pressed brick building situated at the corner of McCord and Seminary Streets. The engineers of the undertaking are T. Pringle & Son and McLea Walbank, of Montreal, to whom great credit is due for the successful carrying out of a difficult engineering work.

The company is offering power and light for manufacturing and private use at a price which will make Montreal a very desirable city for manufacturers, and enable many more families than at present to obtain electric light in their homes. A reduction of 33⅓ per cent on existing prices for electric light has already been announced, while for power purposes the company is offering a rate which is 20 per cent below the present price.

As an instance of the appreciation of the new power which the local manufacturing interests are showing, it may be mentioned that the Dominion Cotton Company, the largest company of the kind in Canada, has decided to substitute electricity for steam power in its mills, and has made a twenty years' contract with the Lachine Hydraulic and Land Company for the supply of electric power from their plant.

OPENING OF THE NEW HOME OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

In a country which is pre-eminently distinguished by the magnitude and skill of its engineering works, the opening of the new house of the American Society of Civil Engineers will have more than a passing interest.

The American Society of Civil Engineers was founded November 5, 1852. In respect of the very strict conditions which govern admission to membership, it is claimed that this society stands first among the kindred societies of the world. The candidate for admission must have an unsullied professional record, and must furnish credentials attested by parties of public repute. He must have been for a stated number of years in charge of some important public work or must have otherwise distinguished himself by his services in promoting the advancement of the science and practice of engineering. The purpose of the society is the advancement of engineering knowledge and practice, and its members consist of civil engineers in all branches of practice, such as municipal, military, hydraulic, naval, mining, marine, and electrical. Meetings are held semi-monthly at which professional papers are presented and discussed. These papers are subsequently published by the Society in volumes termed "Transactions," of which thirty-eight have been issued to date. The Society also publishes a monthly periodical termed "Proceedings." Complete copies of "Proceedings" and "Transactions" are sent to every person connected with the Society; also to many other societies, libraries, and technical publications. The papers presented to the Society, of which over eight hundred have been published to date, have covered every branch of engineering, general and specific. These papers are of value not only to the members but to the public, in that they are frequently drawn upon by the general press to keep the public in touch with the great problems and enterprises of the times.

During its existence the Society has accumulated an extensive engineering library, and the necessity for its expansion was one of the causes leading to the building of the new house. It is a strictly professional library, in which there are now some 22,000 volumes. The present roll of members includes some twenty-one hundred engineers in all grades, and it embraces representatives of the profession in all parts of the world, a large number of foreign engineers being connected with the Society. The strict requirements for admission to full membership and the fact that the roll includes practically every engineer of note in the country render corporate membership in the Society the highest professional indorsement attainable.

For some time after organization the Society meetings were held in the office of the Croton Aqueduct Department in Rotunda Park, New York, which was located in what is now City Hall Park, facing Chambers Street near Center Street. In 1867 it moved to rooms in the Chamber of Commerce building, 63 William Street, and as its membership increased moved successively to enlarged quarters; in 1875 to the southwest corner of Broadway and Twenty-third Street, and in 1877 to the house No. 104 East Twentieth Street. In 1881, the house No. 127 East Twenty-third Street was purchased, to which a large addition was made in 1889, and the work of the Society has since been carried on at that place. The increasing size of the library, and the necessity of providing adequate accommodation for the increasing number of members, have led to the construction of the present very handsome house. The project was first started in the spring of 1895, and the present site, 220 West Fifty-Seventh Street, was purchased and actual work begun in the fall of 1896. The cost of the building is $200,000, the society's assets being about $250,000, and its present gross income over $40,000.

The new building, located on West Fifty-seventh Street, near the Carnegie Music Hall and opposite the Fine Arts building, covers a plot of 50 by 110 feet. It is a choice example of French Renaissance. It is built in Indiana limestone richly carved, and both within and without it does considerable credit to the architect, Mr. C. L. W. Eidlitz. On the first floor are the reception room, coat room, and the offices of the secretary, as well as a large room intended for a convenient meeting place for members for social and business intercourse. On the second floor are the reading room and auditorium, the latter having a seating capacity of over four hundred. On the third floor space is reserved for a museum and model room, and here also

NEW HOME OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS, NEW YORK CITY.

are the offices of the clerical force. The fourth floor is devoted to the stack room, which has a total capacity of over one hundred thousand volumes. The stacks are similar to those used in the new Congressional Library at Washington. An electric book lift runs to the reading room on the second floor. In the basement are janitor's quarters and large storage and publication rooms. The building is steam heated throughout and lighted by electricity, the energy for which is provided by two gas engines of 25 horse power each. As this society is purely a scientific body, the building is in no sense a club house. Its use is exclusively for the advancement of the science of engineering, and it is the first building erected in America to be devoted to the exclusive purpose just named.

The Society formally threw open the doors of the new building on Wednesday, November 24, when the members and invited guests assembled in the auditorium, where addresses were delivered by Benjamin M. Harrod, President of the Society; Gen. William P. Craighill, late Chief of Engineers, United States Army; President J. G. Schurman, of Cornell University; and Joseph H. Choate, of New York City.

Gen. Craighill gave a brief review of the history of the Corps of Army Engineers from the date of its formation in 1802. He stated that Gen. Washington, though a surveyor, was not strictly speaking an engineer, and the revolutionary army was dependent upon the services of foreign military engineers, chiefly French, who as late as 1816 were engaged in designing the defense of the country. West Point military school was established largely with a view to remedying this defect, and since its establishment it has turned out a body of men who, for thorough grasp of their profession, were unsurpassed in any country. Referring to the proposal to establish a code of ethics to govern the engineering profession, Gen. Craighill considers it quite unnecessary, the observance of all the due courtesies and proprieties of the professional man being insured by the simple keeping of the golden rule, "Do unto others as you would they should do unto you."

President J. G. Schurman, of Cornell University, said that the profession of civil engineering was essentially American, inasmuch as it was closely concerned with all that is specially characteristic of American civilization. In the Old World—in London, Paris or Berlin—it is the matchless works of art and architecture that leave a lasting impression. In America, it is the splendid works of engineering that fill the visitor with admiration and leave an abiding impression. Our vast and daring feats of construction, as shown in bridges, buildings, railroads and water works, have given us the stamp of an engineering race. This is now recognized as essentially one of the learned professions. The schools of engineering rank with those devoted to the so-called learned professions, and justly so, for the same degree of culture is required in them as in those devoted to the law and to letters.

Joseph H. Choate paid an eloquent tribute to the engineer's profession, and in comparing it with those of medicine and the law, he dwelt upon the advantage and solid satisfaction to be derived by the engineer from the fact that his work was based upon known facts and the clearly ascertained and unchanging laws of nature, whereas that of the law at least was based largely upon tradition, opinion, and judgment. The profession is enduring as the ages. The lawyer's fame dies with the silencing of his voice in death; the name of the engineer is as lasting as the imperishable works which are the monuments of his skill.

Mr. Choate referred to the city of New York under its new charter and thought that within its 360 square miles were contained more engineering problems—soon to demand solution—than were contained in all America fifty years ago. If the city is to be successfully administered, it was absolutely necessary that all municipal works should be controlled by engineers; at least he would express the hope that they might never be put under the administration of lawyers who were as ignorant of civil engineering as the speaker.

Mr. Choate concluded by stating that in view of the present meeting he had been reading one of the most fascinating works that had ever come into his hands, and he evoked genuine enthusiasm by giving the title as Smile's "Lives of the Engineers."

The Palace Motor Car.

A member of the Automobile Club de France has just had a steam "house car" constructed to his order by M. Jeantaud, the Parisian builder of motor cars. The car is propelled by a steam motor of 30 horse power. It is 25 feet long and is over 8 feet in width and height. The outside is painted a pale green, and the entrance to the interior may be gained either by folding doors at the side or by the door at the rear. Down the side of the car runs a corridor with doors opening into the different rooms. The first room is used during the day as the salon and at night as a sleeping room, a couple of divans being turned down to form a bed. Every spare inch is devoted to cupboards. Another room of the same size is to be used as a dining room, and when not employed for this purpose the partitions at the back and side may be folded up, thus forming a large salon. There is also a lavatory and bath room, and behind this is a kitchen containing a range, a cupboard for the cooking utensils, and under the floor is a safe for the provisions. On the top of the car seats are provided for three or four persons, and here also are carried the supplies of water and food. Enough fuel can be stored away to run the car for three hundred miles. The fore part of the vehicle is supported by the tractor of the Dion type.

A Hint to Manufacturers and Merchants.

The importance of registering trade marks at the Patent Office does not seem to be sufficiently realized by manufacturers and merchants in this country or abroad. Persons adopting a word, phrase or emblem to distinguish their specialty of manufacture, whether it be on dry goods, groceries, food products or preparations of any kind, will derive more benefit by registering them than many seem to realize. Full information as to the necessary procedure to obtain trade mark protection may be had by communicating with this office.

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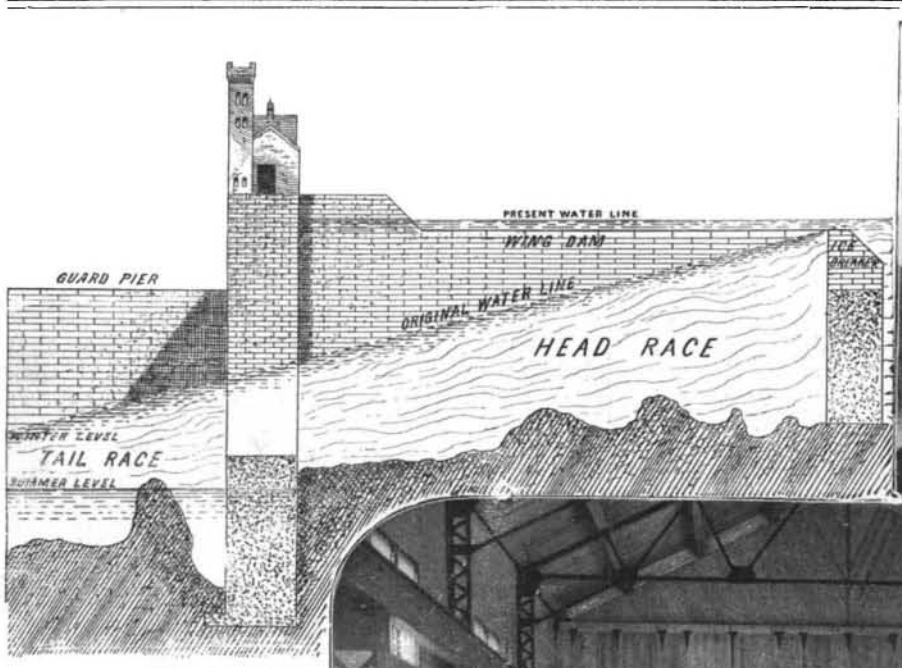
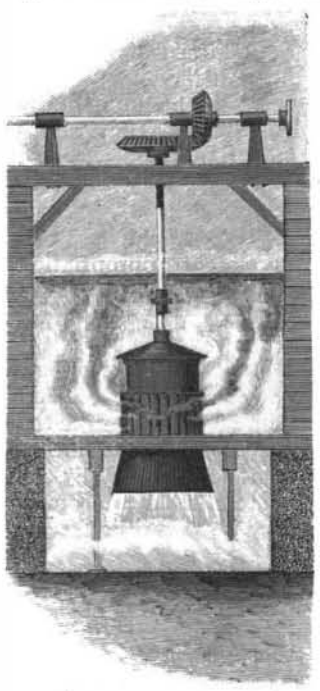
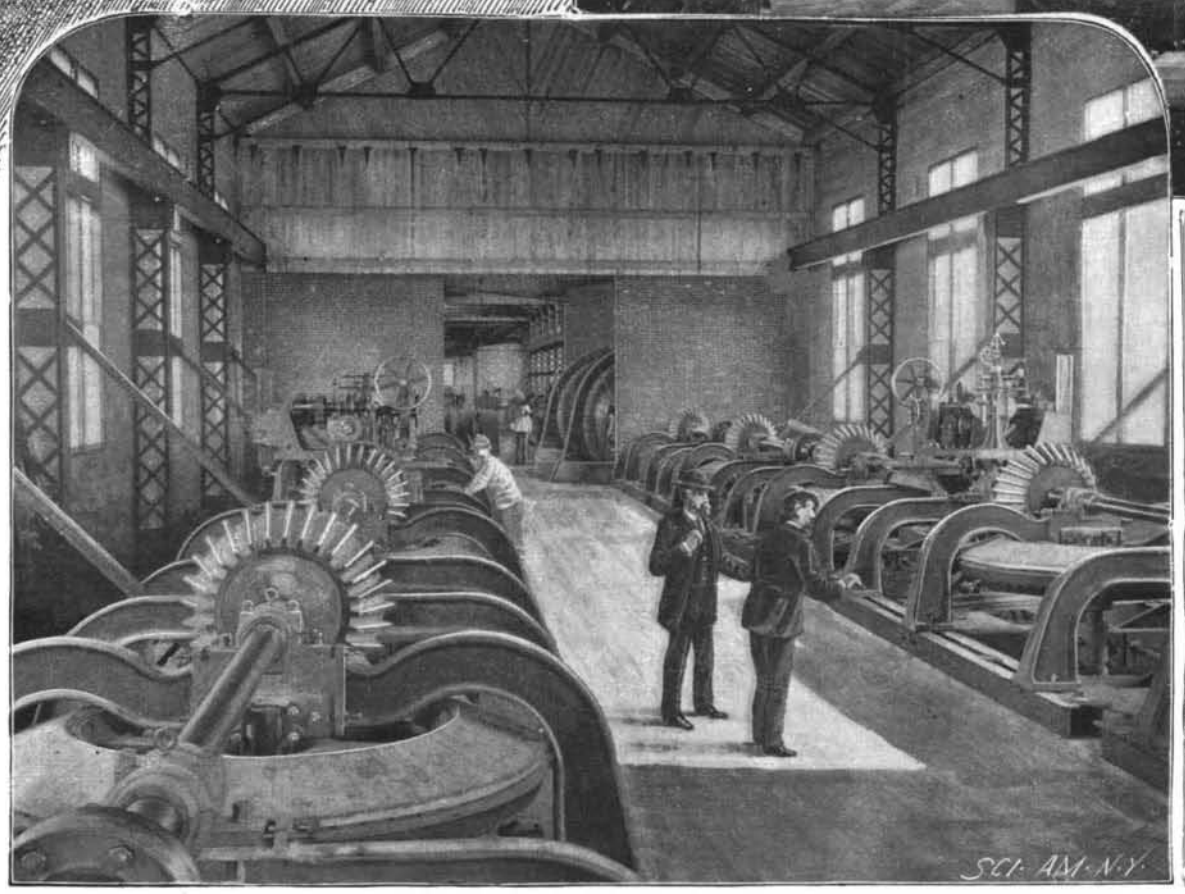


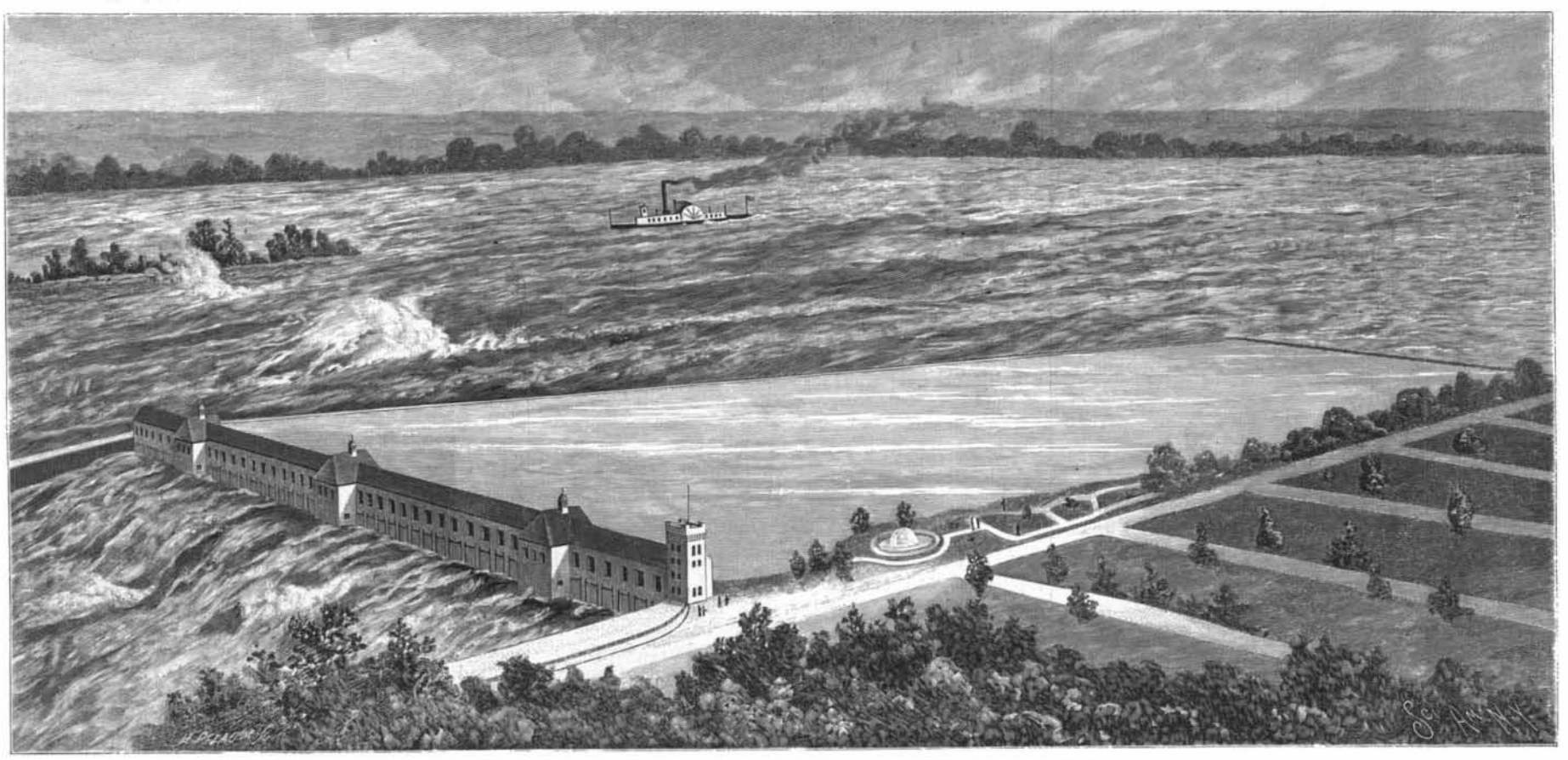


Condensed Profile of the Site.
One of the 300 H. P. Turbines.



INTERIOR VIEW OF POWER HOUSE.

The Power House.
Plan Showing the Site.



BIRD'S EYE VIEW SHOWING LACHINE RAPIDS AND POWER PLANT.

THE LACHINE RAPIDS LIGHT AND POWER PLANT.—[See page 357.]

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