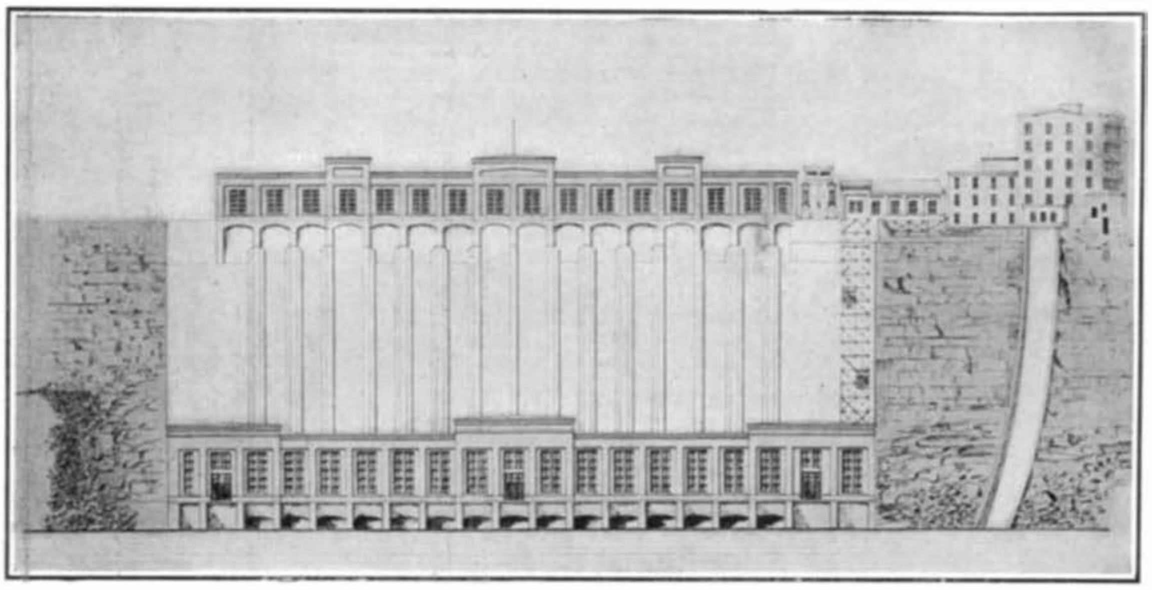
A NEW 130,000-HORSE-POWER PLANT AT NIAGARA FALLS.

BY ORRIN E. DUNLAP.

It is the expectation of the Niagara Falls Hydraulic Power and Manufacturing Company that it will be prepared to deliver electric power from its No. 3 station in February or March next. This station is to be located at the water's edge in the Niagara gorge, a few hundred feet to the north of its present power house. The new station will be the greatest yet built by this company, and it is preparing to place a notable installation in it. The new power house will be 500 feet long, 95 feet wide, and 40 feet high. The design was made by engineers of the company, and guarantees a substantial and imposing structure. It will be built of concrete, with steel frame, the steel to be delivered about December 1. A double cage electric elevator installed at the south end of the building will afford a means of reaching the station from the top of the high bank.

The turbine-generator installation will consist of thirteen units of 10,000 horse-power each, and two exciter units of 1,000 horse-power each. The turbines and generators, which will make 300 revolutions per minute, will be the first of this speed installed in connection with the Niagara power development. There will be a penstock for each turbine. The shafts will be horizontal and placed at right angles to the length of the power house, which will be divided by a central wall, the turbines to be on one side and the generators on the other. The switchboard will be in the generator room on a gallery that will run parallel to the river and overlook the entire interior of the station. Three towers will be built up the face of the cliff between the penstocks, and the supports of the cables for the vertical transmission will be similar to those in use in connection with the transmission from No. 2 station for the past three years. A minimum head of 200 feet will be used for the development.



Elevation of Power House, Penstocks, Facing Wall, and Gate House.

The work which the company has done at the top of the high bank, in preparation for the extension of its power facilities, is the most notable ever undertaken by it. A canal has been built from the old canal basin, which is fed by a canal leading through Niagara Falls from the Niagara River above the Falls, to a new forebay north of the flour mills on the company's lands. This canal extension is 200 feet long, and of a width varying from 50 to 70 feet, while it will carry a depth of water of from 20 to 25 feet. The canal section as well as the entire forebay were excavated from solid rock. A concrete wall has been built along each side of this new connecting canal, while along the cliff side of the forebay a concrete retaining wall 30 feet high, 25 feet wide at the bottom and tapering to 15 feet at the top has been built. In this great retaining wall, at a distance of every 53 feet, there is a three-tooth expansion joint, the sides of the teeth or lugs of which batter one inch to the foot, and are coated with a preparation of asphalt and coal tar to make the joint waterproof. Cracking the great wall at predetermined points will prevent it from cracking promiscuously, while provision is also made for any shrinkage which may occur, and the structure remains water-tight.

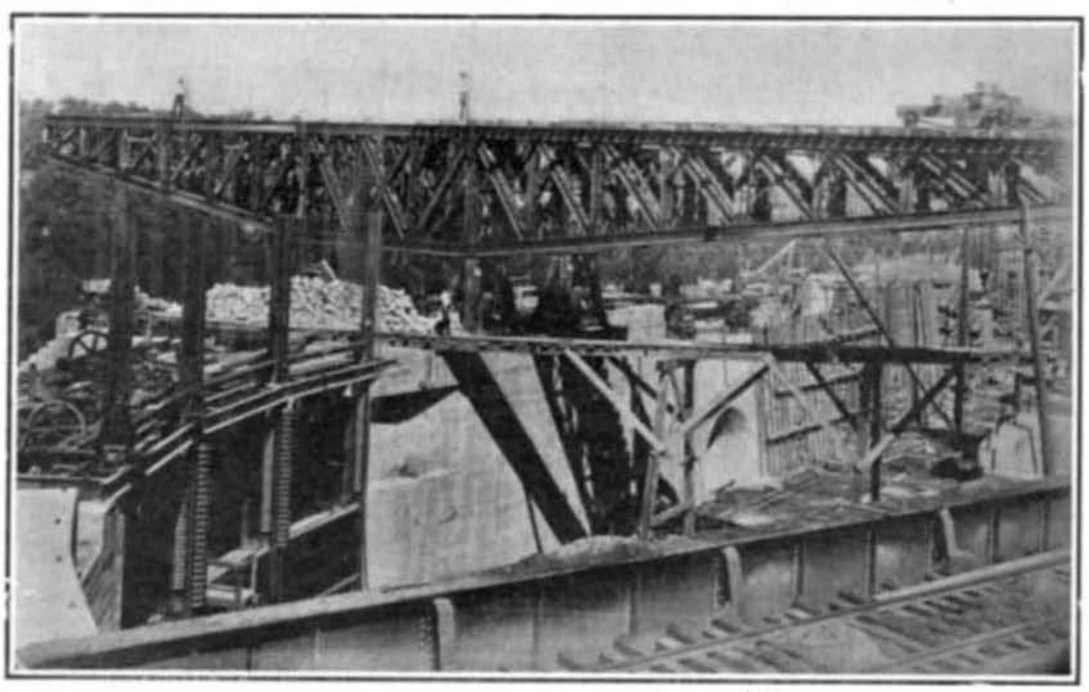
Intakes for the fifteen penstocks which will lead the water down to the power station below have been built right in the retaining wall. Thirteen of the penstocks have a diameter of nine feet, and two are five feet in diameter. The larger penstocks will supply water to the 10,000-horse-power turbines, while th[illegible]er penstocks will furnish a supply of water to [illegible]urbines of the exciter sets. The penstocks have large bell mouths on the water side of the wall. Then come the nine-foot valves, and then the penstock proper. The vent pipe at the top of each penstock is built right into the wall, and a ladder affords access to the rear of the valve when the water is out of the penstock. An innovation worthy of note is that the valve of each penstock will be operated directly from the power house by an individual, specially-designed motor of 20 horse-power, operating suitable mechanism.

The penstocks will have flexible flanges riveted to them in the forebay wall, to prevent water seeping through along them from the forebay. A complete drainage system is provided underneath the bottom of the forebay. It runs the entire length, and consists of pipe varying from three to two feet in diameter. So carefully has the entire work been planned, that in case of injury to the main shut-off valves, the retaining wall is designed so that two steel gates can be quickly slipped into place in front of any of the bell mouths, and the main valve removed for repairs or adjustment.

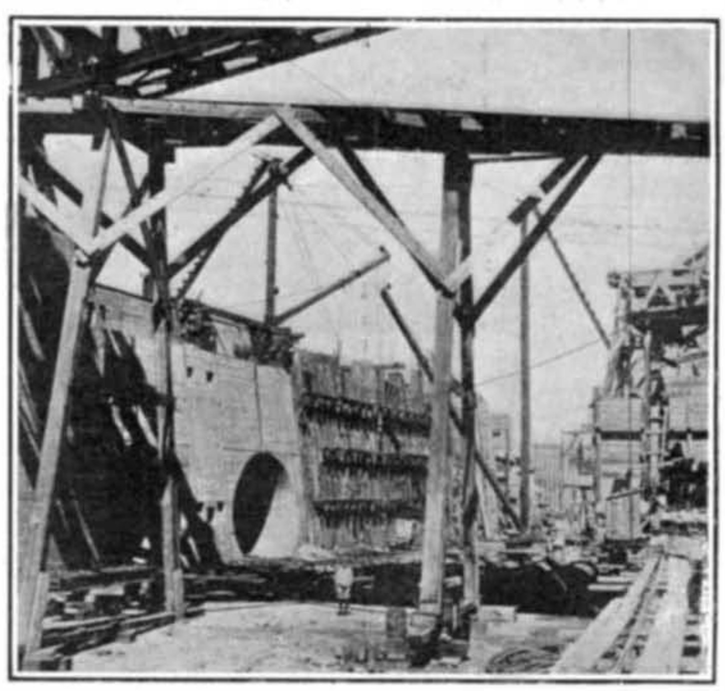
Last year the Niagara Falls Hydraulic Power and Manufacturing Company completed a concrete facing wall on the cliff back of power station No. 2, and it plans to erect a similar wall back of this new power station. It will be even more massive than the facing wall first erected by the company, and the giant penstocks will be built right in it, giving a pilaster effect when viewed from the Canadian side or in the gorge; moreover, between each penstock there will be an arched effect that will be very effective. The concrete sheathing of the penstocks will be part of this wall. Between the old canal basin and the new forebay inlet gates have been installed in the connecting canal. They are three in number, each 16 feet wide and 30 feet high or deep. They will be used only when it is found necessary to remove the water from the forebay. They are operated by heavy gearing driven by electric motors, and it is evident they are for safety purposes. A gate house with steel frame and expanded metal covering will be built over them. The waterway leading from the basin to the forebay is so designed that the water will have a retardation from 4½ feet per second to two feet per second. The entrance to the forebay is protected by a stationary steel boom, which will deflect ice and debris over the ice-run gates. These gates are built into the side of the waterway, and are so designed as to lower and allow water to flow over the top and carry ice away. They are the largest of this type of gate ever built, being 12 feet deep, 16 feet wide, and three in number. They will be operated by motors, and can be instantly adjusted or set to any requirements of ice disposal, at the same time causing the least possible waste of water. An ogee dam, made of solid concrete and sheeted with steel, has been located at the bottom of the ice-run gates. The gates lower back of it, and when the ice comes over the gates, it will strike the dam and be deflected into the ice run proper. This ice run will conduct it over the bank and to the river below without causing a spray cloud to arise and float about, causing ice mountains, which in this locality have been found to be a source of danger to the power houses. A gate house will be erected over the forebay, and cranes will run its full length. There will also be a gate house over the ice-run gates, while a foot bridge will cross the forebay at the south end.

In order that the heavy parts of the machinery to be installed in this new power house may be handled safely and expeditiously, a steel crane runway 200 feet long, and consisting of two pairs of cantilever trusses on which a traveling hoist capable of lifting 50 tons is operated, has been erected. It extends from the railroad tracks on the company's land to a point overhanging the cliff 40 feet, and crosses the forebay. It was built by the Buffalo Structural Company, and will remove material from the cars directly to the station. It is the first crane of the kind erected at Niagara. The chief engineer of the company is John L. Harper, and it is under his supervision that this great work is being built.

The company hopes that by next August it will have its main waterway deepened and widened to its full limits, which means that it will be 100 feet wide in all parts below Port Day, and that it will carry about 18 or 20 feet of water. During the present year great headway has been made. There has always been a narrow section in the vicinity of Third and Niagara Streets where it was impossible to get the city to rebuild bridges; but under an agreement between the city and the power company this work has been going on during the past summer, and the canal has been made 100 feet wide there. A magnificent



The Steel Crane Runway, Ice Gates to the Left.



Scene in Forebay, Showing Mouth of Penstock.

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new concrete bridge is being built to replace an old steel truss affair, and this bridge will be ready for crossing this fall. It is 110 feet long and 200 feet wide, covering the entire intersection of the streets referred to. Above Fourth Street the company's dredges are taking out the final bench of rock to widen the canal, and next spring the Fourth Street bridge will be taken out and a new structure put in. Thus by August next the work that has been under way more than a half century will have been completed.

The company is under contract to furnish the Pittsburg Reduction Company 37,000 electrical horse-power from the new station early next year. The Pittsburg Reduction Company has completed the foundations of a very large new works to the north of the forebay site, between the New York Central tracks and the edge of the high bank.

It will be recalled that at the hearing before Secretary of War Taft in Niagara Falls on July 12 last, the Niagara Falls Hydraulic Power and Manufacturing Company asked permission to divert 6,400 cubic feet of water per second from the upper river. The secretary later gave the company a permit to use 4,000 cubic feet, but it is understood that the additional 2,400 cubic feet will be allowed as soon as the company has this new plant ready for operation.

ARCHDEACON'S AIR-PROPELLED MOTOR BICYCLE.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

M. Ernest Archdeacon, well known in Paris for his experiments with aeroplanes, has lately brought out a curious apparatus in the shape of a propeller-driven motor-cycle. This he constructed in order to make experiments upon different forms of blades and show their efficiency. He claims that the propeller, when well designed and adapted to the apparatus which it is intended to propel, has an efficiency which is to be compared with other forms of mechanical transmission. To show what can be done in this direction he built the present machine, which is certainly original and one of the first of its kind. What is more, it travels at a surprising speed. With a small air-cooled motor revolving the propeller, the latter pulled the bicycle and its rider—a combined weight of 335 pounds—at a speed of very nearly 50 miles an hour in an official trial made on September 12 over a stretch of good road not far from Paris. A number of persons, together with the official timekeeper, were on hand to see the test. The new bicycle, mounted by the champion Anzani, is shown in our engraving.

At the middle of the frame is mounted a Buchet two-cylinder light air-cooled motor, with the cylinders mounted in V-shape on an aluminium crank-box. The motor will give six horse-power. It is located crosswise of the frame. On the shaft is a small pulley, from which a triangular-section belt passes above to a larger pulley. The latter is mounted directly upon the long shaft of the propeller, which runs in two ball-bearings fixed to the frame and a third or outer bearing which is held to the frame by two long rods. On the end of the shaft is fixed the large aluminium propeller, which has perforated blades covered with gold beater's skin. A hand wheel is mounted at the back end of the propeller shaft so as to control the propeller for starting and stopping. A gasoline tank and spark-coil complete the outfit, and the whole is very light, weighing not more than 150 pounds.

Anzani took his place in the saddle and set the motor going, and then brought the propeller up to full speed. Even before reaching the top speed of the propeller the motor-cycle commenced to move, first at five miles, then at ten miles an hour, and soon began to run at a high speed. An official test of the speed was then made by two timekeepers. On a second run Anzani made a fine rush over the ground at full speed, and succeeded in covering a kilometer in 42 2/5 seconds, or at a speed of 49¼ miles an hour.

As to what is the practical use of such an apparatus, M. Archdeacon thinks that it will be of great utility in ascertaining the comparative values of different propellers, so as to find the best form and adjust the blades at the proper angle. These tests can be very quickly carried out, more so perhaps than with most other methods, and one propeller is soon taken off and another one substituted for it. In any case such a combination, which enables a good part of the motor's power to be transmitted to the propeller, is a novelty and may lead to other results of value either in theoretical or practical work. If a machine could be constructed with the propeller located directly on the engine shaft, there would be no loss in speed reduction from the engine to the propeller, and the full engine power would be had at the blades. Then the speed actually obtained compared with the speed which should be made with the horse-power developed by the engine, would give directly the efficiency of the propeller.

Excavating the Power House Site.

How Waste is Turned into Money.

In a discussion of waste utilization it is customary to begin with that shining example of what can be accomplished along these lines—the coal-tar industry. A few years ago the thick, black, viscid liquid which condenses in the pipes during the distillation of gas from coal, was not only waste and useless, but its removal was a positive nuisance and a source of trouble and expense. To-day this tar on further distillation yields a series of products each of which is the basis for a valuable chemical manufacture. Among these products are paraffine, naphtha, benzol, creosote, anthracene, carbolic acid, naphthalene, and pitch. Basic oil of coal tar is the source of the splendid aniline colors, the various hues of which are due to the oxidation of aniline by means of acids or other chemicals. The utilization of some of these products has called into being entirely new industries in the manufacture of dyes, perfumes, medicaments, antiseptics, paving materials, and fuels.

It is undoubtedly true that no branch of science has contributed more to our knowledge of the waste values than chemistry, and a very large number of the great advances have been made along chemical lines. One of the most important of these was Le Blanc's discovery that the treatment of chloride of sodium—common salt—with sulphuric acid gave hydrochloric acid and sulphate of soda. This led to the upbuilding of one of the world's greatest industries of to-day, that of soap making, which formerly had been limited to the soda derived from the sulphuric acid manufacture. Hydrochloric acid, at first a waste, was soon found to be a valuable agent in bleaching. Originally, however, this use was not extensive, and it was necessary to employ a decomposing agent to obtain the chlorine from the acid. This agent was binoxide of manganese; and while the products of the decomposition other than chlorine were at first allowed to go to waste, a complete system of reclamation was soon developed.

The use of furnace slag, in former years not only useless but expensive to remove as well, is becoming more general for various commercial purposes, and the field for further development is excellent. At present, quantities of this material are made into bricks, paving stones, cements, and used as fertilizer. Slag wool, made by blowing steam through a stream of melted slag, is a splendid heat-insulating material. The heat in the slag as it runs from the furnace has also been used in various ways. A good example of metallurgical waste utilization is found in the production of pure tin, good weldable iron, ammoniac, and Prussian blue, from the waste clippings of white iron. The introduction of the gas engine offers excellent means for employing waste blast-furnace gases, though these have previously been made use of in other ways.

Few indeed are the industries which have developed utilization of by-products to such a state of perfection as has the slaughtering industry. It is no exaggeration to say that the animal slaughtered is used from the tip of the horn to the hair at the end of the tail. The quantity and variety of the products from formerly useless portions of the carcasses are almost incredible. Some of these are gelatine, glue, fertilizers, hair, bristles, neat's foot oil, bones, horns, hoofs, glands, and membranes from which are obtained pepsin, thymus, thyroids, pancreatin, parotid substances, capsules, etc.; soap-stock, glycerine, isinglass, albumen, and hides, skins, wool, and intestines.

On This Curious Machine a Speed of 49¼ Miles an Hour Was Made.

Side View of Bicycle, Showing Arrangement of Motor and Propeller-Shaft.

TESTING AN AIR PROPELLER BY USING IT TO DRIVE A MOTOR BICYCLE.