the tops down stream. This rack will keep all heavy ice out, and the swift current will roll it along the sloping rods, and should it be found desirable a steel curtain can be suspended outside the rack and down to 3 or 4 feet below water level, thus shutting out floating fine ice, but it is not expected that frazil ice can be kept out of the forebay, as it comes down the river mixed in the water from top to bottom.

At the north end of the forebay there is a weir with three 16 feet openings, two outside and one inside the forebay room, and a fall of nearly two feet can be utilized in the winter for the purpose of creating a cross current in the forebay, thus tending to draw the floating ice back into the river, but the writer does not believe that the effect of this weir will be felt for any great distance away from the north end of the plant, although by carrying lines of floating booms diagonally across the forebay a large amount of floating

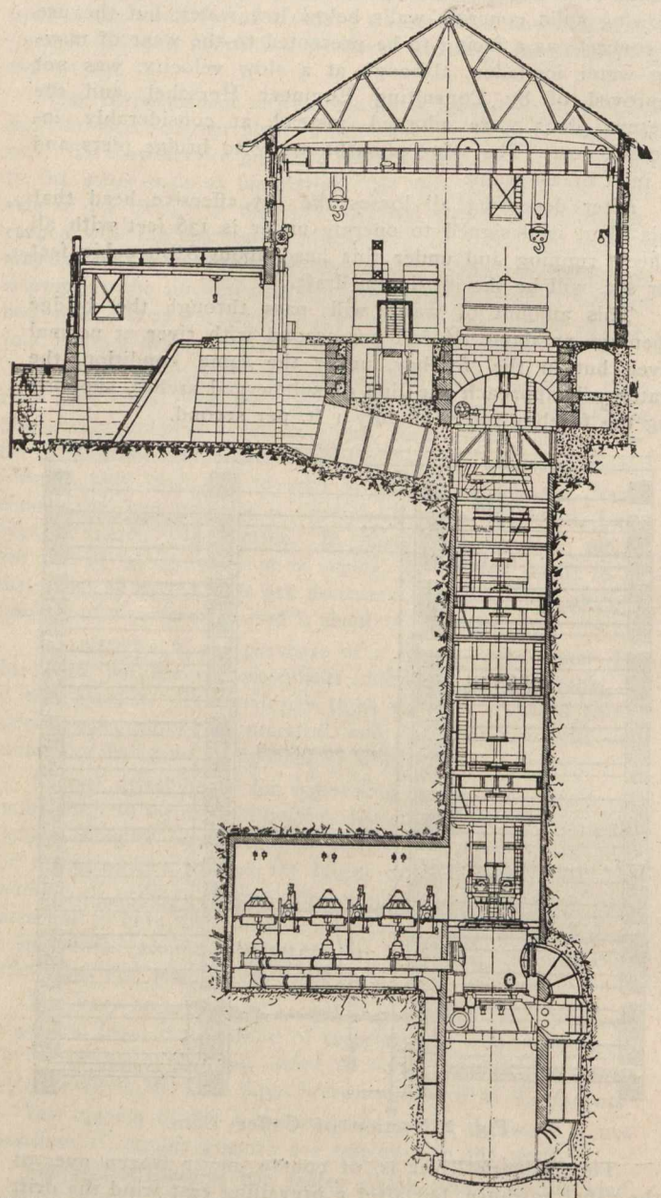


Fig. 3. Cross Section of Power House and Wheelpit, showing machinery installed.

ice can be poled toward the weir and thus passed back to the river; when not in use the weir will be closed by steel lift gates to above the water level of the canal.

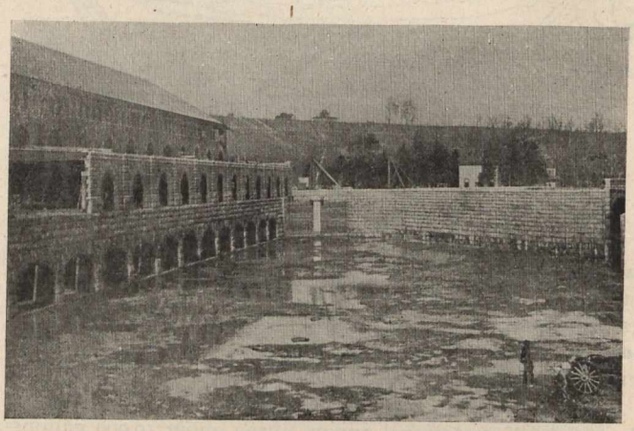
The ice protections thus far mentioned will not keep back frazil ice, but no doubt the slow current in the forebay will allow a large proportion to rise to the surface, while the remainder will pass under the submerged arches into the forebay room, where there is a continuous line of fine ice racks resting at a 30° slope against the main inlet or breast walls.

These racks are carried on a steel framework, and are composed of 3" × ⅜" bars on edge, spaced 1 13-16" centres, built into groups 3' 6" wide, by three tiers high; the bottom tier is 3' 0", the centre 11' 0°, and top 9' 0" high, the centre ones being movable and capable of being raised up to the top, and of being held there by hooks designed for the purpose.

The functions of an enclosed forebay room will vary with the direction of current approaching the power-house, and whereas this direction is parallel to power-house No. 2 of the Niagara Falls Power Company, it is practically at right angles to that of the plant now being described, and therefore all floating and suspended ice adjacent to the submerged arches will, in time, pass under them and enter the forebay room, to be dealt with there by means of a travelling forebay crane, and men using rakes and poles.

However, even in this power-house, an enclosed forebay room is of great value, affording comfortable quarters for men fighting ice in stormy weather, and moderating somewhat the temperature of the ice rack.

In extreme cases the centre sections of the ice rack are raised up, and the accumulations of fine floating ice and frazil are allowed to pass through the wheels, whose large



General View of Power House, Forebay and Canal.

ports will take care of considerable quantities of fairly large ice without any injury to the bronze runners.

The water, after passing the fine ice rack, enters 18 ft. openings in the masonry inlet walls, thence passes through cast iron penstock mouth-pieces which are elliptical (18' × 12') at the outer end and 10 feet in diameter at the inner end where they pass through the main wheelpit walls, and flows into the upper elbows of the main penstocks. During ordinary operation the movement of water is controlled by head gates set in lubricated cast iron grooves in the inlet walls, and operated by lifting screws, a box girder fastened onto the steel columns of the power-house, and a 20-h.p. 125 volt D.C. motor mounted on this girder, and for the purpose of filling the penstocks, so as to release the pressure on the gates, small hand operated wicket gates have been inserted in the main gate bodies.

Outside of these lift gates two sets of stop log grooves have been cut at each inlet, so that in case the lift gates require unwatering stop logs can be inserted.

WHEELPIT.

This pit, which is 570 feet long and 18 feet wide, after lining, was excavated through 15 feet of boulders and gravel, 100 feet of limestone, and 50 feet of shale, the sides being separated, before blasting, by channelling. The channelling machines are self propelling and have a travel of about 12 feet, the cuts being carried down in 6 foot benches, having 6" batter. After blasting and excavating a bench, the channelling was again proceeded with, an off-set of 6" being required for clearance.

For the reception of numerous castings, draft tubes, etc., a great amount of excavation was required in the form of recesses, and in order to do this without unduly shattering the side walls, the whole periphery of each recess was separated, preliminary to blasting, by gadding and broaching, the process being that of a drill body, mounted on a vertical column and truck, and working horizontally; by using small charges of dynamite, these detached masses of rock were then blown out, leaving the adjoining walls usually intact.