ably be necessary to remove this quicksand with a dipper dredge.

As might be expected, the early construction of the railroad bridges is essential to the prosecution of the excavation. The first started is the center one, as shown on the drawing. This bridge will let the southern shovel out, and by the time it is finished there will still be sufficient time to construct the Grand Trunk crossing before the second shovel will be ready to come through with the rock cut.

To build these bridges, holes had to be dug in the ground, and steel sheet piling used for cofferdams. As shown in one of the photographs, the crown of the arch in the first bridge built is below the ground surface. This bridge is for an electric railway road from Niagara Falls to St. Catharines, but the loading specified by the electric railway company was as heavy as that for either of the steam railroad bridges.

CABLEWAY EXCAVATOR AND NEAR VIEW OF GRAB BUCKET ON WELLAND RIVER SECTION

The railroad bridges each contain about 3500 yd. of concrete, each being a single arch. This excludes the wing walls, which will not be placed until the canal excavation has been completed. Because the bridges are built below the original ground surface, the concreting proved easy. It was only necessary to set up a mixer with a loading hopper on the edge of the excavation and spout the concrete directly to place in the forms. The mixer at the first of these bridges was served by a locomotive crane, material being received on a spur from the Grand Trunk Ry. The excavation was carried out with two derricks, the material being dumped around the cofferdam.

As will be seen from the profile, the first rock excavation available was at the lower end. The forebay excavation was begun by shooting out a 10-ft. lift over the entire area, about 1100 holes being fired at once. About one pound of dynamite to the yard, including that used for springing the holes, was used. Each hole was sprung with five or six sticks and loaded with 15 or 20 sticks, the spacing being 7 ft. each way. Several experiments with blasting caps wired up in various ways were tried in an adjacent open field, to make sure that the loaded holes would be fired simultaneously. The firing was done with a high-amperage but low-voltage current thrown with a single switch. As a result of this blast, about 60,000 yd. was broken fine enough to be handled by the railroad shovels.

The crusher plant near the forebay receives material by rail in the 20-yd. dump cars. These discharge direct into a large hopper lined with 2½ x 6-in. steel bars laid flat, and feed a 60 x 84-in. jaw crusher operated by a 250-hp. motor. This crusher reduces the stone to 8-in. size and delivers it to a belt which takes it to the top of the secondary crusher house, where it is fed into three gyratory crushers that reduce it to 2-in. size. From these crushers the material passes through a screen which removes dust and oversize aggregate, and is then carried on a suspended belt conveyor over the storage pile. At the end of the storage pile is the bin structure for the receipt of 1-in. stone to be used for reinforced-concrete work. The 1-in. material is obtained by bypassing the oversize aggregate, after it leaves the screen, into a small auxiliary gyratory crusher, which delivers its product directly into the bin mentioned above.

Under the storage pile is a gallery containing another conveyor for delivering stone to the concrete plant, which it is planned to build as shown in the layout drawing.

The rock-excavation work on the canal itself is carried out in such a way as to produce smooth sides and secure the maximum flow. It is the intention to channel the rock down to the water line in advance of blasting, and to break the rock back below this face so as to allow for a 6-in. lining of concrete throughout the entire flow section. There are 15 duplex channelers cutting to a depth of 20 ft. at one operation on the work, most of them being at present employed around the forebay. The channelers and the tripod drills are operated by compressed air delivered by a 10-in. pipe.

There will be 12 motor-driven compressor units, having a total capacity of 12,000 ft. per minute, on the work. A capacity of 8000 ft. is concentrated at the Whirlpool station in the center of the work now in progress, and the other 4000 ft. is located at Montrose station at the southern end of the line. Six of these machines are now in operation at the first-mentioned station, where one of the main transformer substations for the work is also situated. After-coolers are used on the compressors, and it has not been necessary to employ reheaters, although these may be resorted to in cold weather. At present the loss of pressure in delivery from the central station to the drills in the forebay is about 3 lb. per square inch, the drills taking air at a little more than 100 pounds.