a five-cubic-yard bucket in rock. The boom on No. 1 shovel is 90 ft. long, and the dipper stick 58 ft. The boom on No. 2 shovel is 80 ft. long and the dipper stick 54 ft. Either shovel can load dump-cars which stand on a track the level of which is 62 ft. above the level of the tracks on which the shovel stands. The shovel rests on two tracks (four rails) and is mounted on sixteen wheels. The tracks are 30 ft. centre to centre. The nominal horse-power of each of the two shovels is 715 h.p. upon a half-hour intermittent rating. Each shovel weighs over 400 tons, contains 75 tons of ballast, and has a capacity of 3,000 cubic yards a day when handling earth. At the present time No. 1 shovel is working at the Whirlpool against a face 100 ft. high. It is said to be the largest electrically driven shovel in the world, working against the highest face excavated on work of this character.

There are also five other electrically driven shovels at work, each having a 7/8-yard bucket.

Powerful Construction Equipment

At the Welland River section of the canal, a Lidgerwood cable excavator is at work, fitted with a three-cubic-yard Andreson-Evans clam. The cableway has an 80-ft. head tower and a 60-ft. tail tower, and has a span of 800 ft. The excavated material is being disposed of along the north banks of the river. The width of the Welland River at the water line averages about 300 ft.

The commission has purchased one hundred and fifty 20-yard Western air dump cars, each of 80,000 pounds capacity, six 40-ton steam locomotives and twelve 50-ton electric locomotives. The steam locomotives are switchers purchased from the Pennsylvania Railroad. The electric locomotives were built by the National Steel Car Co., Limited, of Hamilton, Ont., six of them being constructed with General Electric equipment and six with Westinghouse equipment. Two pile-drivers are at work on the river section. There are three 40-ton and two 15-ton Bay City locomotive cranes for general utility work. Drag-line excavators may be purchased at a later date to clean the sloped banks of the overburden which cannot be reached or smoothed down so advantageously by the shovels, or the locomotive cranes may be rigged up for the purpose.

It is estimated in round figures that 9,000,000 cubic yards of earth and 4,000,000 cubic yards of rock must be removed from the excavated section; and from the river section, 2,000,000 cubic yards of material, mostly earth.

Disposal Area at St. David's

At the present time the material which is being excavated from the Whirlpool section is being used to fill the old Whirlpool gulley, but the main dump will be at St. David's. A double-track railway line has been built for the full length of the canal from Montrose to the forebay, and a branch extends to the St. David's dump, two miles away. There will be various other branches of the railroad constructed from time to time as needed. A railway will probably be built from the power house to connect with the Michigan Central at Queenston to bring in the machinery and to take out the material excavated from the power house substructure.

The dump cars drop the material alongside the track and two Jordan spreaders are used to shove it back over the embankment.

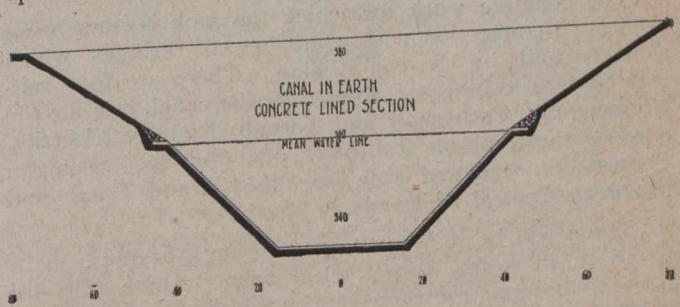
The railroad lines are all electrified, the trolley wires being offset on one side of the track, and carried in clamps devised by the commission's line construction department. These clamps and the hangers which suspend them from the poles, are all made up of standard material, and are so arranged that the temporary use of the material does not injure it. A number of timber trestles are set alongside the temporary tracks and carry the trolley wire for those tracks. These trestles are mounted on four wheels and can be hauled right onto the track and pulled away readily by a steam locomotive when the track is to be moved.

The commission has its own telephone water and electric light systems, and has private, direct telephone communication from the Whirlpool to the head office on University Avenue, Toronto.

Splendidly Equipped Sub-Station

No. 1 sub-station is located at the Whirlpool. The power comes into the station from the Ontario Power Company's plant at 12,000 volts and is stepped down to 4,000 volts by three Canadian General Electric transformers, each of 1,500 k.v.a. capacity. The power is distributed up and down the canal at 4,000 volts. Westinghouse and Maloney transformers step some of the power down from 4,000 to 440 volts for use by the shovels. Three rotary converters, each of 500 kw. capacity, convert some of the power to 600 volts d.c. The station is equipped with most modern appliances in the way of switches and other apparatus, the electrical equipment costing about $110,000.

At this sub-station there are now erected, ready for operation, four Sullivan belt-driven air compressors, each



of 1,000 cubic feet per minute capacity against 125 pounds pressure. They are belt driven from Canadian General Electric 550-volt motors, 180 amperes, 750 r.p.m. As the work progresses, eight or ten more compressors will be installed at this station. All the rock drills, channellers and forges, and much of the other equipment, will be driven by compressed air. The air is piped up and down the canal for three miles in each direction, the mains leading from the sub-station being 10 inches in diameter, reducing to 8 inches and 6 inches. Another sub-station will be built near Montrose and more compressors will likely be installed there.

In the Whirlpool yards is located a large machine shop containing drills, shapers, planers, lathes, forges, trip-hammers and wood-working machines. The commission has built about eighty buildings, including bunk-houses, freight-house, offices, machine shop, store-houses, sub-station, etc. Also a number of buildings are used which were on various parcels of purchased property.

Buildings are Being Gunited

Most of the buildings are of frame construction, but are being gunited on the outside over tar paper and wire mesh, using 1 to 3 mix of cement and sand. Sharp concrete sand is being used and the gunite applied by cement-guns. The sub-station, machine shop and all of the more important buildings have already been fire-proofed and weather-proofed in this manner, and it is